РАЗДЕЛ 2 КОРПОРАТИВНАЯ СОЦИАЛЬНАЯ ОТВЕТСТВЕННОСТЬ

SECTION 2 CORPORATE SOCIAL RESPONSIBILITY

CORPORATE SOCIAL RESPONSIBILITY AND SHAREHOLDER VALUE IMPLICATIONS

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Abstract

The study assesses the implications for shareholder value induced by investing in companies promoting corporate social responsibility (CSR) among members of the Greek CSR Firm Network which consistently pursues CSR strategies. Alternative dynamic volatility models to identify the best fit that adequately describes the risk-return profile of these stocks were estimated, while the EGARCH model which takes into account asymmetric volatility effects was found to be statistically satisfactory in explaining CSR risk and return. The impact of volatility appears to be persistent though varying across Greek CSR companies and shareholder value hence may fluctuate considerably, as CSR stocks may not necessarily present a low risk asset class.

Keywords: corporate social responsibility; socially responsible investments; conditional volatility dynamics; EGARCH models

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Introduction

The present study attempts to reconcile the contradictory views found in a fast growing body of literature, focusing on CSR investments. That is if including CSR investments in a portfolio reduces portfolio volatility and so it results in higher returns compared to a traditional investment approach or if it actually harms the risk-return performance.

The concept of allocation to socially responsible investments by investors entails participation in the equity and thus the indirect support of companies that keenly promote not only their financial, but also their social performance. Private and institutional investors such as pension funds, customarily choose to allocate funds under their management toward socially responsible investments (Merikas, 2003). The recent trends in corporate social responsibility (CSR) strategies and related socially responsible investments (SRI) are moving upwards and at a fast pace. Worldwide socially responsible investments represent approximately 3 trillion dollars with 67% originating from the US, 25% from the UK, 5% from France and the rest from other developed countries, such as Canada and Australia (Merikas, 2003). In the leading US market one out of eight dollars invested was part of a socially responsible portfolio in 1999, and SRI growth rates were twice as high compared to conventional investments. This resulted to SRI increasing to 2.32 trillion dollars in 2001 from 639 billion in 1995 and 40 billion in 1984. Similarly, the number of US socially responsible mutual funds in 2001 reached 181 with approximately $2.01 billion under management (Social Investment Forum, 2003). Of the three major SRI strategies in the US, namely, investment screening, shareholder activism and community investments, it is investment screening that exhibits the strongest growth rates relative to the other SRI strategies (Table 1).

(INSERT TABLE 1 HERE)

The UK market has also seen strong CSR investment trends and SRI funds rose twenty-fold, from $353 million in 1989 to $7.138 million in 2000 (UK Social Investment Forum, 2002). A recent market research study of the investment strategies of 600 British pension funds by the UK Social Investment Forum found that 59% of their managed assets incorporated socially responsible criteria. In Germany, total investments in CSR stocks and funds surged from $366 million in 1998 to $2.9 billion in 2001 or 0.7% of the total market and projections estimate the investment market share in SRI funds to reach 10% by 2010. For the EU overall however, only $17.5 billion was invested in 220 socially responsible funds by the end of 2000, a considerably lower portion of the investment market taken as a whole, but a considerable increase is anticipated in the future (Merikas, 2003).

A corporate social responsibility strategy can produce significant consequences and accordingly, strong signals to the investor in terms of shareholder value, since it affects production costs, revenue, cost of capital, cash flows and earnings and ultimately the company's stock price and market capitalization. It is no surprise therefore that the impact of corporate social responsibility strategies on shareholder value has been attracting increasing attention by the international investment community, because the assessment of the risk-return profile of a CSR investment contributes to the understanding and evaluation of the implications for shareholder value. However, despite the fact that the interaction of these issues ultimately affects the way in which companies operate, the topic remains rather imprecise (Kim & van Dam, 2003). Research evidence is overall inconclusive, with some studies suggesting that stock screening generally harms the risk-return performance taken as a whole by narrowing the available investment universe, while others advocate that including CSR investments in a portfolio can reduce portfolio volatility and thus result in higher returns than a traditional investment approach (Institute of Business Ethics, 2003; Cowe, 2004). The advocates of the Capital Asset Pricing Model (CAPM) for example, maintain that assuming market efficiency, asset allocation to Socially Responsible Investment (SRI) stocks may lead to lower returns in the long-run due to diversification costs, since SRI stocks are only part of the market portfolio (*Markowitz Approach*). On the other hand, the proponents of the *Moskowitz Approach* advocate that SRI portfolios could attain higher returns relative to the overall market since they incorporate important informational signals which cannot be directly conjured and evaluated accordingly by the markets (Kurtz, 1999).

Socially responsible investments are therefore seen increasingly as an investment approach that can add value to other investment approaches such as value, growth, technology or emerging markets. However, no matter what approach is followed, the key issues regarding asset valuation and portfolio management remain. In other words, whether corporate social responsibility can potentially result in higher SRI stock returns relative to the overall market portfolio boosting shareholder value and whether investors value SRI stocks as a low volatility "safe heaven" at nervous market times, investment decisions regarding asset allocation to SRI securities still depend on the risk profile of SRI stock investments. Since strong empirical evidence has indicated that a negative shock to stock returns can potentially generate more volatility than a positive shock of equal magnitude (Pagan & Schwert, 1990; Nelson, 1991; Engle & Ng, 1993), it follows that when stock prices fall due to some bad news and the equity value of the firm decreases resulting to higher debt-to-equity-ratios, the weight attached to debt in the capital structure from an investor's point of view increases making the firm appear riskier. This increase in leverage will lead equity holders who bear the residual risk of the firm to anticipate higher expected future return volatility (Black, 1976; Christie, 1982). Therefore, understanding the mechanism of volatility dynamics behind different SRI stock reactions to market volatility can produce important implications for shareholder value, especially since the stock price behavior of companies embracing CSR strategies has not been uniform across all CSR companies and/or sectors (Cowe, 2004).

Finally, the majority of past studies on CSR issues has focused mainly on developed markets, predominantly the US and the UK. In contrast, this study concentrates on the implications of the CSR impact on stock behavior in a small recently upgraded European stock market, namely Greece, with a carefully selected and sectorally well diversified sample of companies. These companies are established members of the "*Hellenic (Greek) Network for Corporate Social Responsibility Network*" well reputed to consistently promote CSR strategies, and leaders in their business fields with their blue chip equities traded in the Athens Stock Exchange.

This study attempts to fill some of the literature gaps in the very important topic of time-varying volatility implications for CSR stock returns and to contribute a range of innovative theoretical and managerial implications especially for non-US or UK settings. The empirical findings are expected to shed some light on the feedback effect of CSR volatility on shareholder value, because misconceived models of stock volatility may lead to incorrect and/or invalid conclusions about stock return dynamics.

The structure of the paper is as follows: The first section critically evaluates the available literature on the issue and sheds light on the contradictory findings.

The second section of this paper develops the model and its theoretical underpinnings for measuring CSR Stock Return Volatility. The third section presents and discusses the empirical findings and the last part of the paper concludes with the analysis of the contribution of the Greek case on the existing body of literature.

Corporate Social Responsibility and SRI Performance

Past empirical research investigating the performance of CSR investments has been mainly focused on SRI mutual funds with mostly ambiguous and contradictory conclusions. The majority of socially responsible investments, predominantly in the US and UK, has been channeled via specialized SRI mutual funds which, as mentioned earlier, exhibit upward growth trends as alternative investment vehicles. Hamilton *et al.* (1993) and Statman (2000) compared the SRI fund performance against conventional funds, the S&P500, and the Domini Social Indices (DSI) but did not find any statistically significant difference in their returns. Goldreyer and Diltz (1999) used an extensive sample of equity, bond and balanced mutual funds and found that social equity screening did not affect investment returns in SRI funds in any systematic way. Diltz (1995), Russo and Fouts (1998) and King and Lenox (2000) confirmed that a positive correlation between excess returns and environmentally responsible corporate behavior. However, Di Bartolomeo (1996) and Kurtz (1999) postulated that any excess returns of SRI funds are related to a higher implicit risk. Luther *et al.* (1992) compared the performance of fifteen UK SRI funds against FTSE Indices and reported weak SRI excess returns. In contrast, Gregory *et al.* (1997) did not find any statistically significant impact between UK SRI and non-SRI mutual funds. At the portfolio level, Woodall (1986) investigated fourty categories of CSR criteria and concluded limited return losses, whereas Kahn *et al.* (1997) and Guerard (1997) found that social stock screening can lead to higher returns. At the company level, Klassen and McLaughlin (1996), Gunthorpe (1997) and Hall and Rieck (1998) reported a positive impact of good corporate environmental announcements and company stock returns, and a negative impact for bad ones. Feldman *et al.* (1997) estimated a 5 percent potential stock return increase in companies that improve their environmental policies and Waddock and Graves (1997) concluded that there is a positive correlation among management quality, employment policies and shareholder value (Merikas, 2003).

Additional comparative risk and return studies in CSR investments reported that no exceptional differences exist between SRI and non-SRI mutual fund returns. The Ethical Investment Research Service for instance, examined the performance of five CSR stock indices relative to a conventional market index, namely, the FTSE-All Share Index (EIRIS, 1999). The five CSR indices included were: Charities' Avoidance Index; Environmental Damage Avoidance Index; Responders' Index; Ethical Balanced Index; and, Environmental Management Index. For the study period between December 1990 and May 1999 three out of the five indices exhibited higher returns compared to the FTSE-All Share Index. The Environmental Damage Avoidance Index performed best at 1.61% above the FTSE-All Share Index, whereas the Environmental Management Index performed relatively lower. It was concluded that the CSR indices and the FTSE index returns were similar, whereas volatility in three out of the five CSR indices was lower demonstrating that a CSR investment can support risk diversification and portfolio hedging. Another study over a three year period between December 1998 and December 2001 by the Sustainable Investment Research International Group was conducted on nineteen mutual funds that apply social stock screening strategies with assets in excess of $75 million. They then compared their risk and return profiles with their respective conventional peer fund group benchmarks (SIRI, 2003). Each of these nineteen funds which had assets in excess of $75 million, exhibited a slightly higher risk level relative to their benchmark and eleven CSR funds indicated a standard deviation higher than 50 percent of their benchmark. Ten of these mutual funds produced returns higher than 50 percent of their conventional peer group benchmark and four performed better than 25 percent of their benchmark. Considering risk and return together, six CSR funds showed higher returns and lower standard deviations relative to 50 percent of their benchmark, whereas for seven CSR funds risk was comparatively higher and return lower. Their conclusion was that CSR mutual funds can potentially produce a return performance competitive to conventional mutual funds, but that return may be associated with a relatively higher level of risk (Merikas, 2003).

The Greek market follows the major CSR trends seen in the rest of Europe where CSR investments remain at a particularly low level (Merikas, 2003). However, the establishment of the "*Hellenic Network for Corporate Social Responsibility*" underlines the increasing domestic corporate interest in the subject. This Greek CSR Network is based in Athens and was originally formed in June 2000 by thirteen companies and three business institutions as a non-profit organization. It is run by a board from seven member companies and is the Greek national partner of the European CSR Network, established in 1996. Its mission is to promote the "meaning of CSR" to both Greek businesses and Greek society with its ultimate goal a balance between corporate profitability and sustainable economic development. The Network collects data and records and publicizes the best practices in corporate social responsibility in order to raise public and company awareness of corporate social responsibility and provides a forum for networking and collaboration among companies and organizations at all levels for the exchange and spread of information (HNCSR, 2004). Recently, the Greek CSR Network has also been promoting the concept of social responsibility among small and medium-sized enterprises with conferences, presentations, and through CSR awards, and participated in two projects under the European Union initiative EQUAL that promotes equal employment opportunities especially for immigrants and people with disabilities. Today, the Greek CSR Network has grown into 56 companies and business institutions (Table 2).

INSERT TABLE 2 HERE

Measuring CSR Stock Return Volatility

In order to investigate the time-varying volatility implications of the Greek CSR Network stock returns and shed some light on the feedback effect of this volatility on shareholder value, alternative symmetric GARCH and asymmetric EGARCH models are estimated and their validity is statistically tested in order to determine whether they can adequately describe the CSR stock variance dynamics (Engle, 1982; Bollerslev, 1986; Nelson, 1991; Bollerslev *et al.*, 1992; Rabemananjara & Zakoian, 1993; Bera & Higgins, 1995). A conventional conditional mean specification, as a stationary AR(1) process can be:

$$r_{it} = \alpha_0 + b\, r_{it-1} + \varepsilon_{it}, \qquad |b| < 1 \qquad (1)$$

Where: r_{it} = The continuously compounded rate of return on i CSR stock over a single period from time $t-1$ to t;

ε_{it} = The unexpected return at time t (error term)

and ε_{it} is given by $\varepsilon_{it} = \eta_{it}\sqrt{h_{it}}$ and η_{it} is an independently and identically distributed process (i.i.d.). A typical GARCH conditional variance specification, h_{it}, is:

$$h_{it} = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon^2_{it-i} + \sum_{j=1}^{q} \beta_j h_{it-j} \qquad (2)$$

Where: h_{it} = The conditional variance function;
$\omega > 0,\ \alpha_1,\ ...,\ \alpha_p > 0,\ \beta_1,\ ...,\ \beta_q > 0$ = constant parameters;
ε^2_{it-1} = The ARCH effect; and,
h_{it-j} = The GARCH effect.

In a GARCH(p,q) model, the size of the parameters α and β (reaction and persistence coefficients respectively), determines the short run dynamics of the resulting i stock return volatility. The α reaction coefficient measures the extent to which volatility shocks today feed through into next period's volatility, and large α reaction coefficients mean that volatility reacts quite strongly to market movements. The β persistence coefficient expresses whether volatility is persistent and large β persistence coefficients indicate that volatility shocks take a long time to fade away. Finally, the ($\alpha_i + \beta_j$) term measures the rate at which this effect dies out over time. In case α (reaction coefficient) is relatively high and β (persistence coefficient) is relatively low then volatility tends to be more "spiky".

Empirical research in equity market volatility has indicated significant asymmetric and leverage effects (Alexander, 2001). The EGARCH model allows for asymmetric or leverage effects, whereas negative and positive shocks can have different impact on volatility. Conditional volatility is modeled as:

$$h_t = \exp\left[\omega + \alpha\ g_{1,t} + \beta \log(h_{t-1}) + \gamma\, g_{2,t}\right] \qquad (3)$$

$$g_{1,t} = \left[\ \left|\frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}\right| - \sqrt{2/\pi}\ \right], \quad g_{2,t} = \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}$$

The impact of negative shocks causing volatility to rise more than positive shocks of the same magnitude is depicted with γ coefficient; γ typically enters the EGARCH model with a negative sign and indicates that bad news ($\varepsilon_{it} < 0$) generate more volatility than good news.

Empirical Findings

The study of time-varying volatility effects on CSR stock returns is based on a sample of eight Greek companies founding members of the Greek CSR Network. As mentioned earlier, these companies have a strong reputation of actively promoting CSR strategies. The sample has been carefully selected, so that the companies represented encompass a diversity of corporate characteristics and activities, are market leaders in a range of important business sectors bearing value as well as growth features, have medium to large market capitalization value, represent both private and public sectors, and finally have their equities traded in the Athens Stock Exchange (ASE). This group of companies covers approximately 25% of the total ASE market capitalization, and since this sample represents such a significant stock market share the empirical findings may have implications for the ASE market as a whole. The companies included in the sample are: Hellenic Telecom Organization (OTE, telecoms); Titan Cement (TIT, cement); EFG Eurobank-Ergasias (EFG, bank); Commercial Bank of Greece (EMP, bank); Coca-Cola Hellas (COC, beverages); Delta Dairies (DEL, food & beverages); Intracom (INC, telecom equipment, technology); and, Silver and Barite Ores Mining (SLB, mining) (Table 3). The sample data covered a 5-year period from April 1999 to April 2004 and consists of weekly ASE closing values of the sample CSR company stock prices. The data were then transformed to continuously compounded returns, calculated as follows:

$$r_{it} = \log (P_{it} / P_{it-1}) \qquad (4)$$

Where: P_{it} = The value of i CSR stock price at time t; and,

i = OTE, TIT, EFG, EMP, COC, DEL, INC and SLB, respectively.

INSERT TABLE 3 HERE

The empirical findings regarding the CSR stock return volatility are summarized in Tables 4 - 9 and Figures 1 - 3. The stock price path of the CSR stock sample indicates highly volatile periods at times with some sharp price swings not always justifiable by the underlying fundamentals, as exhibited in Figure 1. This means that the CSR stock market behavior may not have always been rational with significant implications for investors' expectations on asset risk and return valuation (Bekaert & Harvey, 1997). A closer examination of the CSR stock price and return plots suggest that volatility displays the clustering phenomenon associated with GARCH processes (Figure 2). For comparison purposes Figures 1 and 2 also include the ASE General Index (log) stock price and return plots.

INSERT FIGURES 1 & 2 HERE

Preliminary statistical analysis of the descriptive CSR (log) stock prices and returns presented in Table 4 supports this conclusion. In most cases, positive skewness (long right tail) and kurtosis were observed, whereas significant values of the Jarque-Bera test support deviation from normality.

INSERT TABLE 4 HERE

Evidence of ARCH is shown by 12-order Ljung-Box statistics in some of the CSR stock return and squared return series. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests for unit roots in levels and first differences indicated non-stationarity of the (log) stock price series, as the presence of a unit root was not rejected. The conditional mean i CSR stock return was modeled and tested as an autoregressive structure of the following form:

$$r_{it} = \mu + \sum_{i=1}^{j} b_j x_{jt} + \varepsilon_{it} \qquad (5)$$

Where: r_{it} = Weekly i CSR stock return;

μ = A constant;

x_{jt} = Lagged dependent variable(s), and,

ε_{it} = The unexpected return of i CSR stock at time t, as a collective measure of news on the i CSR stock.

An $AR(2)$ model specification was found to adequately explain the data generating process for the CRS conditional mean returns. Alternative $AR_{(1)}$ models for the conditional mean were preliminary estimated to test the best fit of the data, including functional forms such as: $r_{it} = b\, r_{it-1} + \varepsilon_{it}$; $r_{it} = b\, r_{it-1} + a\, \varepsilon_{it-1} + \varepsilon_{it}$; $r_{it} = a\, \varepsilon_{it-1} + \varepsilon_{it}$; $r_{it} = a_1\, \varepsilon_{it-1} + a_2\, \varepsilon_{it-2} + \varepsilon_{it}$. Tests were also conducted to check for the absence of a higher order autocorrelation up to 12 lags (Breusch-Godfrey test), as well of autoregressive conditional heteroskedasticity (ARCH-LM test) in the mean residuals (Table 5).

INSERT TABLE 5 HERE

The empirical findings support the application of generalized autoregressive conditional heteroskedasticity models to study the conditional variance of the CSR stock returns. The estimation results from the GARCH and EGARCH models are presented in Tables 6 and 7, respectively. The method of quasi-maximum likelihood (QML) covariances and robust standard errors was used in modeling the conditional variance (Bollerslev & Wooldridge, 1992). The estimated coefficients ω, α, β, and γ ($\gamma < 0$) were found statistically significant at the 5% level in most cases, and the critical value of $\chi^2_{(12)}$ was 21.026 at the 5% significance level. The broad interpretation of the conditional variance coefficients relates to an investor/shareholder that predicts this period's variance by developing a weighted average of the long term average represented by the constant term ω, the forecasted variance from last period represented by the GARCH term β, and the information about volatility observed in the previous period represented by the ARCH term α, while γ represents asymmetric reactions. If the asset return were to be unexpectedly large either upwards or downwards, then the investor/shareholder will increase the estimate of the variance for the next period. This is consistent with the volatility clustering of stock market returns where large changes in returns are likely to be followed by further additional large changes.

INSERT TABLES 6 & 7 HERE

The magnitude of the estimated conditional variance in both GARCH and EGARCH models suggests a volatile CSR stock behavior over the sample period. The coefficients of the lagged conditional variance β denote a diversified impact between past CSR volatilities which carry on into the next period. Stationarity of the GARCH (p,q) process imposes non-negativity conditions on the α_i and β_j coefficients (Bollerslev, 1986; Greene, 2000), such as $\alpha_i > 0$; $\beta_j > 0$; and, $0 < \sum_{i=1}^{q} \alpha_i + \sum_{j=1}^{p} \beta_j < 1$. In case the sum of the ARCH and GARCH terms is greater than 1, then volatility shocks appear to be quite persistent. In contrast, if this sum is equal to 1, then the model is said to be an (Integrated) IGARCH model (Engle & Bollerslev, 1986). For a number of the CSR stocks under study an IGARCH formulation can be relevant, as $(\alpha_i + \beta_j)$ was found to be around unity. In some cases, the pace of convergence to the long-run volatility estimate of the EGARCH model was found to be particularly slow and in few cases variance non-stationarity may be apparent, as the combined effect of $(\alpha_i + \beta_j)$ exceeded unity. These findings seem to indicate varied but nevertheless persistent volatility shocks in most CSR cases.

Testing for the possible impact of asymmetric implications and the presence of a "leverage effect" requires the corresponding term γ in the EGARCH model to be typically negative and statistically significant. The estimated γ coefficients for the CSR stocks suggest that negative shocks imply a higher "next period" conditional variance than positive shocks of the same sign. Asymmetric effects were detected for some of the CSR firms under study, such as, Titan Cement (TIT), Eurobank (EFG), and Intracom (INC).

Financial research indicates that the EGARCH model appears to have considerable advantages, even in the case when leverage effects are not robust (Taylor, 1994; Lumsdaine, 1995). These results are depicted in the CSR conditional EGARCH volatility variance plots in Figure 3 and are in accordance with the pattern already observed in the CSR stock returns of Figure 2.

INSERT FIGURE 3 HERE

Overall, the CSR stocks were found to exhibit a diversified asymmetric volatility behavior. Inspection of the EGARCH volatility plots of Figure 3 indicate that the CSR companies most reactive to volatility appear to be Coca-Cola (COC), Commercial Bank (EMP) and Intracom (INC), whereas the volatility behavior of Titan (TIT), Eurobank (EFG), Delta Dairies (DEL) and Silver and Barite Mines (SLB) follows a more "spiky" pattern. The behavior of Hellenic Telecom Organization (OTE) stock returns exhibits a pattern of its own, as its volatility movements are found to stretch only within certain limits.

The EGARCH class of models was found to adequately describe the volatility behavior of the CSR stocks under study. Testing for the null hypothesis of absence of further autoregressive conditional heteroskedasticity effects (up to 12th-order) in the EGARCH standardized residual innovations ($z_{it} = \varepsilon_{it}/\sqrt{h_{it}}$) and the squared standardized residual innovations (z^2_{it}), the relevant Ljung-Box statistics point toward acceptance of the null hypothesis for all the CSR models, as Table 7 indicates. The CSR stock returns are nearly normally distributed when normalized (divided) by their conditional variance, as depicted by standardized residuals skewness and kurtosis statistics. As an additional diagnostic check for the adequacy of the conditional variance model parameterization (Pagan and Sabau, 1992; Henry, 1998), a moment type specification test was estimated in the following form:

$$\varepsilon^{*2}_{it} = \varphi_0 + \varphi_1 h^{*}_{it} + n_{it} \tag{6}$$

Where: ε^{*2}_{it} = The ARCH effect on the i CSR stock return or the squared unexpected return at time t, as a collective measure of news on the i CSR stock;
h^{*}_{it} = The conditional variances from the reported models;
φ_0 = A (regression) constant term;
φ_1 = The coefficient impact factor of i CSR stock's conditional variance h^{*}_{it}; and,
n_{it} = The residual (error) term.

The null hypothesis that was tested with Equation (6) was that the EGARCH model is a correct specification for i CSR stock return volatility. Under the null hypothesis, the moment condition $E(\varepsilon^2_{it} \mid X_{t-1}) = h_{it}$ implies that $\varphi_0 = 0$ and $\varphi_1 = 1$. Thus, according to the estimation results of Equation (6), the null hypothesis is accepted for all CSR stocks under study (Table 8). Hence, the EGARCH model does indeed adequately explain the dependencies of the first and second moments that are present in the CSR stock returns.

INSERT TABLE 8 HERE

The relationship between the i unexpected return at time $t-1$ (ε_{it-1}) and the conditional variance (h_{it}) describes the ''news impact curve'' assuming information is held constant at time $t-2$ and earlier, and, as mentioned before, it can be considered as a collective measure of news on the i CSR stock return (Engle & Ng, 1993). The shape and location of the ''news impact curve'' will differ depending upon the volatility model employed, because the ''news impact curve'' of the GARCH(1,1) model is symmetric and centered at $\varepsilon_{it-1} = 0$, whereas that of the EGARCH(1,1) model is asymmetric and has a steeper slope for $\varepsilon_{it-1} < 0$, provided that $\gamma < 0$.

Three ''news impact'' tests were conducted in order to examine whether modeling conditional volatility of the i CSR stock returns should take into account potential asymmetries and also whether it is possible to predict the squared standardized residual innovations z^2_{it} using some variables observed in the past but not included in the model. Assuming that N_{it-1} is a dummy variable that takes the value of one if ε_{it-1} is negative and zero if ε_{it-1} is positive, then the value of i CSR stock price at time $t-1$ is $P_{it-1} = 1 - N_{it-1}$. In the "*sign bias*" test, the squared standardized residual innovations term z^2_{it} is regressed on a constant and on N_{it-1}. If the coefficient on N_{it-1} is significant, then positive and negative shocks affect future volatility differently than the prediction of the model. The "*negative size bias*" test examines whether the magnitude of negative shocks causes the bias to predict volatility. The test examines the significance of $N_{it-1}\ \varepsilon_{it-1}$ in the regression of z^2_{it} on a constant and on $N_{it-1}\ \varepsilon_{it-1}$. The ''*positive size bias*'' test examined the significance of $P_{it-1}\ \varepsilon_{it-1}$ in the regression with z^2_{it} on a constant and on $P_{it-1}\ \varepsilon_{it-1}$. A joint test for ''*size and sign bias*'', based on a $\chi^2_{(3)}$ statistic, is obtained as follows:

$$z^2_{it} = \varphi_0 + \varphi_1\ N_{it-1} + \varphi_2\ N_{it-1}\ \varepsilon_{it-1} + \varphi_3\ P_{it-1}\ \varepsilon_{it-1} + \eta_{it} \quad (7)$$

If the EGARCH model employed to study CSR stock return volatilities is appropriately specified, then the restriction $\varphi_1 = \varphi_2 = \varphi_3 = 0$ should be valid. The tests of these restrictions from Equation (7) indicated that the asymmetric EGARCH model appears to be data consistent and appropriate indeed for studying CSR volatility (Table 9).

INSERT TABLE 9 HERE

Conclusions

This study investigated the implications of corporate social responsibility (CSR) strategies and the corresponding stock behavior of related socially responsible investments (SRI) for shareholder value on a carefully selected sample of Greek CSR companies. As mentioned earlier, this group of listed companies participates in the recently established Greek CSR Network which has the documented reputation of consistently pursuing the promotion of CSR strategies. The assessment of the impact of conditional volatility on CSR stock returns of this group has important implications for asset valuation, portfolio allocation and hedging strategies. Alternative symmetric GARCH and asymmetric EGARCH volatility models were specified and statistically tested in order to identify the best fit that can adequately explain and depict CSR volatility dynamics and assess their effects on CSR shareholder value. The EGARCH model which takes into account asymmetries in unanticipated shocks was found to be a statistically satisfactory representation of the CSR stock volatility. Additionally, a range of test statistics including the sign bias, the negative size bias, and the positive size bias tests indicated that the EGARCH model is appropriate in describing the volatility dynamics of CSR stock returns.

The impact of CSR volatility was found to be persistent, since once volatility increases, its impact is likely to remain high over several periods. Variance stationarity was detected in some CSR cases, as the combined ARCH and GARCH effect was found at unity. However, the impact of volatility on CSR stock returns has not been uniform across all CSR companies in the sample. This may indicate that sectoral and/or company-specific fundamental issues can also be important to shareholders when they decide to allocate funds to CSR stocks. Overall however, the empirical findings support the fact that asset allocation to CSR stocks may not necessarily present a low risk, safe shelter investment opportunity, as CSR returns can exhibit persistent volatility over time. The EGARCH model of the CSR volatility was tested for the presence of a leverage effect and asymmetric implications. The leverage effect was found to be negative and statistically significant in some CSR cases, indicating that a negative shock is anticipated to potentially cause volatility to increase more than a positive shock of the same magnitude. Despite certain limitations, the EGARCH model appears to have considerable advantages even in the case when leverage effects may not be robust.

Some empirical evidence has indicated that the specification of the volatility model will depend on the current market regime (Hamilton & Susmel, 1994), because intra-day data may be more relevant to model short-term volatility, as normal GARCH models cannot capture the full extent of excess kurtosis (Terasvirta, 1996). The persistence in volatility however, has been found lower when measured on intra-day data (Muller *et al.*, 1997; Galbraith & Zinde-Walsh, 2000). The implementation of different investment strategies of heterogeneous agents may also have certain implications for volatility (Andersen & Bollerslev, 1996).

It has also been argued that the asymmetric nature of the volatility response to return shocks could reflect the existence of a time-varying risk premium (French, *et al.*, 1987; Braun, *et al.*, 1995; Pagan, 1996). In that case, apart from the leverage effects, it would also be relevant to assess the potential volatility feedback effects (Kroner and Ng, 1998). In order for the time-varying risk premium to explain company-specific volatility asymmetry, covariances with the market portfolio should respond positively to increases in market volatility (Bekaert & Wu, 2000). When the conditional covariance between market and stock returns are more responsive to negative rather than to positive market shocks, the volatility feedback effect can be particularly strong. The implications due to covariance asymmetries remain a topic for further research, and multivariate GARCH models, such as the VECH, CCORR, FARCH and BEKK models have been proposed to study time-varying covariance asymmetries (Alexander, 2001). Finally, it would also be useful for further research to have some quantitative estimates of potential volatility shocks induced by factors related specifically to CSR strategies. The assessment of possible volatility feedback effects on CSR stock returns, apart from leverage effect, can enrich current empirical evidence. However, in contrast to conventional stock market indices, stock indices that relate specifically to CSR companies have not been widely developed as of yet. The development of CSR stock index benchmarks could become a very valuable tool for CSR asset valuation and the appraisal of SRI shareholder decisions.

References

1. Alexander, C., 2001. *Market models: A guide to financial data analysis* (J. Wiley and Sons, New York).
2. Andersen, T.G. and T. Bollerslev, 1996. *DM-dollar volatility: Intraday activity patterns, macroeconomic announcements and longer run dependencies,* Working Paper No. 217, Kellog Graduate School of Management, Northwestern University.
3. Bekaert, G and C.R. Harvey, 1997. Emerging equity market volatility, *Journal of Financial Economics* 43, 29-77.
4. Bekaert, G. and G. Wu, 2000. Asymmetric volatility and risk in equity markets, *Review of Financial Studies* 13, 1-42.
5. Bera, A.K. and M.L. Higgins, 1995. On ARCH models: properties, estimation and testing, in: L. Oxley, D.A.R. George, C.J. Roberts and S. Sayer (eds.) *Surveys in Econometrics* (Blackwell, Oxford) 215-272.
6. Black, F., 1976. Studies in price volatility changes, *Proceedings of the 1976 Meeting of the Business and Economics Statistics Section,* American Statistical Association, 177-181.
7. Bollerslev, T., 1986. Generalised autoregressive conditional heteroskedasticity, *Journal of Econometrics* 31, 307-327.
8. Bollerslev, T., R.Y. Chou and K.F. Kroner, 1992. Arch modeling in finance: A review of the theory and empirical evidence, *Journal of Econometrics* 52, 5-59.
9. Bollerslev, T. and J.M. Wooldridge, 1992. Quasi-maximum likelihood estimation and inference in dynamic models with time-varying covariances, *Econometric Reviews* 11, 143-172.
10. Braun, P.A., D. Nelson and A. Sunier, 1995. Good news, bad news, volatility and beta, *Journal of Finance* 50, 1575-1603.
11. Christie, A., 1982. The stochastic behaviour of common stock variance: Value, leverage and interest rate effects, *Journal of Financial Economics* 10, 407-432.
12. Cowe, R., 2004. *Risk, return and responsibility*, Report, Association of British Insurers, www.abi.org.uk.
13. Di Bartolomeo, D., 1996. *Explaining and controlling the returns on socially screened US equity portfolios,* Presentation, New York Society of Security Analysts.
14. Diltz, J.D., 1995. The private cost of socially responsible investing, *Applied Financial Economics* 5, 69-77.
15. Ethical Investment Research Service, 1999. *The financial performance of ethical investments*, www.eiris.org
16. Engle, R.F., 1982. Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation, *Econometrica* 50, 987-1006.
17. Engle, R.F and T. Bollerslev, 1986. Modeling the persistence of the conditional variances, *Econometric Reviews* 5, 1-50.
18. Engle, R.F. and M. Chowdury, 1992. Implied ARCH models from option prices, *Journal of Econometrics* 52, 289-311.
19. Engle, R. and V. Ng, 1993. Measuring and testing the impact of news on volatility, *Journal of Finance* 48, 1749-1778.
20. Feldman, S., P. Soyka and P. Ameer, 1997. Does improving a firm's environmental management system and environmental performance result in a higher stock price?, *Journal of Investing* 6, 53-62.
21. French, K.R., G.W. Schwert and M. Rothschild, 1987. Expected stock returns and volatility, *Journal of Financial Economics* 19, 3-29.
22. Galbraith, J.W. and V. Zinde-Walsh, 2000. *Properties of estimates of daily GARCH parameters based on intra-day observations*, Working Paper, McGill University.
23. Goldreyer, E.F. and J.D. Diltz, 1999. The performance of socially responsible mutual funds: Incorporating sociopolitical information in portfolio selection, *Managerial Finance* 25, 23-36.
24. Greene, W.H., 2000. *Econometric Analysis* (Prentice Hall, New Jersey).
25. Gregory, A., J. Matatko and R. Luther, 1997. Ethical unit trust financial performance: Small company effects and fund size effects, *Journal of Business Finance and Accounting* 24, 705-725.
26. Guerard, J.B., 1997. Is there a cost to being socially responsible in investing? It costs nothing to be good, *Journal of Forecasting* 16, 475-493.
27. Gunthorpe, D.L., 1997. Business ethics: A quantitative analysis of the impact of unethical behaviour by publicly traded corporations, *Journal of Business Ethics* 16, 537-543.
28. Hall, P.L. and R. Rieck, 1998. The effect of positive corporate social actions on shareholder wealth, *Journal of Financial and Strategic Decisions* 11, 83-88.
29. Hamilton, J.D. and R. Susmel, 1994. Autoregressive conditional heteroscedasticity and changes in regime, *Journal of Econometrics* 64, 307-333.
30. Hamilton, S., H. Jo, and M. Statman, 1993. Doing well while doing good? The investment performance of socially responsible mutual funds, *Financial Analysts Journal* 49, 62-66.
31. Harvey, A.C., E. Ruiz and N. Shepherd, 1994. Multivariate stochastic variance models, *Review of Economic Studies* 61, 247-264.
32. Hellenic Network for Corporate Social Responsibility, 2004. *Organization, Mission, Activity, Members*, www.csrhellas.gr
33. Henry, O., 1998. Modelling the asymmetry of stock market volatility, Applied *Financial Economics* 8, 145-153.
34. Institute of Business Ethics, 2003. *Does business ethics pay?* Webley and more, Report, www.ibe.org.uk
35. Kahn, R.N., C. Lekander and T. Leimkuhler, 1997. Just say no? The investment implications of tobacco divestiture, *Journal of Investing* 6, 62-75.
36. Kim, R. and E. van Dam, 2003. *The added value of corporate social responsibility*, Working Paper, Triple Value Strategy Consulting, NIDO.
37. King, A. and M. Lenox, 2000. *Exploring the locus of profitable pollution reduction*, Working Paper, www.sristudies.org

38. Klassen, R.D. and C.P. McLaughlin, 1996. The impact of environmental management on firm performance, *Management Science* 42, 1199-1214.
39. Kroner, K.F. and V. Ng, 1998. Modeling asymmetric comovements in asset returns, *Review of Financial Studies* 11, 817-844.
40. Kurtz, L., 1999. *A review of studies of socially responsible investing: Markowitz vs Moskovitz,* www.sristudies.org
41. Lumsdaine, R.L., 1995. Finite sample properties of the maximum likelihood estimation in GARCH(1,1) and IGARCH(1,1) models: A Monte Carlo investigation, *Journal of Business Economics and Statistics* 13, 1-10.
42. Luther, R., J. Matatko and D. Corner, 1992. The investment performance of UK 'ethical' trusts, Accounting, *Auditing and Accountability Journal* 5, 57-70.
43. Merikas, A., 2003. *A study of the opportunities to establish Greek mutual funds specialized in 'corporate social responsibility'*, Special Report, Greek Capital Market Commission.
44. Muller, U.A., M. Dacoragna, R.D. Dave, R. Olsen, O.V. Pictet and J.E. Von Weizsacker, 1997. Volatilities of different time resolutions: Analyzing the dynamics of market components, *Journal of Empirical Finance* 4, 213-239.
45. Nelson, D.B., 1990. Stationarity and persistence in the GARCH(1,1) model, *Econometric Theory* 6, 318-334.
46. Nelson, D.B., 1991. Conditional heteroskedasticity in asset returns: A new approach, *Econometrica* 59, 347-70.
47. Pagan, A., 1996. The econometrics of financial markets, *Journal of Empirical Finance* 3, 15-102.
48. Pagan, A. and H. Sabau, 1992. Consistency tests for heteroskedasticity and risk models, *Estudios Economico* 7, 3-30.
49. Pagan, A. and G. Schwert, 1990. Alternative models for common stock volatility, *Journal of Econometrics* 45, 267-290.
50. Rabemananjara, R. and J. Zakoian, 1993. Threshold ARCH models and asymmetries in volatility, *Journal of Applied Econometrics* 8, 31-49.
51. Russo, M.V. and P.A. Fouts, 1997. A resource-based perspective on corporate environmental performance and profitability, *Academy of Management Journal* 40, 534-559.
52. Social Investment Forum, 2003. *Report on responsible investing trends in the United States,* www.socialinvest.org.
53. Statman, M., 2000. Socially responsible mutual funds, *Financial Analysts Journal* 56, 30-39.
54. Sustainable Investment Research International Group, 2003. *Latest trends in European, green, social and ethical funds*, Report, www.sirigroup.org
55. Taylor, S.J., 1994. Modeling stochastic volatility: A review and comparative study, *Mathematical Finance* 4, 183-204.
56. Terasvirta, T., 1996. *Two stylized facts and the GARCH(1,1) model*, Working Paper No 06, Stockholm School of Economics.
57. UK Social Investment Forum, 2002. *International evidence on ethical mutual fund performance and investment style* (Bauer, R., K. Koedijk and R. Otten), Working Paper, Maastricht University, www.uksif.org.
58. Waddock S.A. and S.B Graves, 1997. Finding the link between stakeholder relations and quality of management, *Journal of Investing* 6, 20-24.
59. Woodall, A., 1986. The cost of imposing an ethical constraint on an investment portfolio, www.sristudies.org

Appendices

Table 1. US Investment Strategies for Socially Responsible Investments (SRI)*

Investment Strategy	1997 (1)	1999 (2)	2001 (3)	Δ (%) (2)/(1)	Δ (%) (3)/(2)	Δ(%) (3)/(1)
Investment Screening	529	1,497	2,010	183%	35%	280%
Shareholder Activism	736	922	897	25%	-3%	22%
Community Investments	4	5,4	7,6	35%	41%	90%
Investment Screening and Shareholder Activism**	(84)	(265)	(592)	215%	123%	605%
Total Investments	1,185	2,159	2,323	82%	7%	96%

* In US$ billion.
** In order to avoid double-counting, funds that employ both investment screening and shareholder activism strategies were subtracted from total investments.

Table 2. The Greek CSR Network

BP Hellas S.A.	Hellenic Airspace Industry S.A.
Shell Hellas S.A.	Toyota Hellas S.A.
IBM Hellas S.A.	FAGE Dairy Industry S.A.
Nestle Hellas S.A.	Q-Plan S.A.
Philip Morris Hellas S.A.	Agricultural Industries A. Michailidis S.A.
Janssen-Cilag Pharmaceutical SACI	Leaf Tobacco A. Michailides S.A.
Procter & Gamble Hellas Ltd.	Ziridis Schools S.A.
Johnson & Johnson S.A.	Clotefi S.A.
C & C International S.A.	TUV Hellas S.A.
TVX Hellas S.A.	Dimiourgiki S.A.
Vodafone-Panafon S.A.*	Cocomat S.A.
Novartis Hellas S.A.	Amacon Management Consultants S.A.
Hellenic Telecom Organization S.A.*	Interbeton S.A.
EFG Eurobank Ergasias S.A.*	PriceWaterhouseCoopers S.A.
Titan Cement Co. S.A.*	Manpower Team S.A.
Coca-Cola Hellas S.A.*	Reputation Management S.A.

Coca-Cola HBC S.A.*	EQI Engineering and Quality Consultants International S.A.
Delta Holding S.A.*	Alpha-Mentor Consultants Ltd.
Silver & Barite Ores Mining Co. S.A.*	TradeLink Reputation Management S.A.
Intracom S.A.*	Bureau Veritas S.A.
Bank of Cyprus S.A.*	Epikinonia Business Communications Network
Heracles General Cement Co. S.A.*	Federation of Greek Industries
Chipita International S.A.*	Athens Chamber of Commerce and Industry
Motor Oil S.A.*	Hellenic Organization of Standardization S.A.
Klonatex Group S.A.*	Hellenic Association of Pharmaceutical Companies
Fanco S.A.*	Federation of Industries of Northern Greece
FHL H.Kyriakidis S.A.*	Institute of Social Innovation Ltd.
Atlantic S.A.*	Hellenic Organization of Small and Medium Enterprises & Handicraft

* Listed in the ASE;
(Source: Hellenic CSR Network, www.csrhellas.gr)

Table 3. Stock Sample of the Greek CSR Network

	OTE	TIT	EFG	EMP	COC	DEL	INC	SLB
Stocks outstanding	504,054,199	38,181,932	315,484,837	85,931,676	236,925,277	29,096,511	130,826,005	30,151,190
Market capitalization*	6,281	1,414	5,628	1,808	5,373	170	652	200
% of total market capitalization	6.89%	1.55%	6.18%	1.98%	5.90%	0.19%	0.71%	0.22%
Liquidity**	891,007	46,358	156,268	104,201	167,972	30,768	184,385	21,411
p / e_{2003}	14.49	12.08	20.31	23.73	52.11	7.33	18.31	7.72
p / bv_{2003}	1.73	3.40	3.06	1.54	2.53	1.26	0.81	1.29
2003 Dividend yield %	5.68	2.62	3.40	2.32	0.93	-	8.03	-
Sector	Telecoms	Cement	Bank	Bank	Beverages	Food & Beverages	Telecom. Equipment	Mining

OTE: Hellenic Telecom Organization; TIT: Titan Cement; EFG: EFG Eurobank Ergasias; EMP: Commercial Bank of Greece; COC: Coca-Cola Hellas; DEL: Delta Dairies; INC: Intracom; SLB: Silver and Barite Ores Mining
* In mln. Euros.
** Average daily volume as of July 23, 2004.
(Source: Athens Stock Exchange; Sigma Securities)

Table 4. CSR Stock Return Descriptive Statistics

	OTE	TIT	EFG	EMP	COC	DEL	INC	SLB
Mean	-0.0024	-0.001	-0.0028	-0.0036	-0.0010	-0.0023	-0.0064	-0.0021
Median	-0.0049	-0.0028	-0.0060	-0.0061	-0.0020	-0.0088	-0.0079	-0.0028
Maximum	0.1573	0.1907	0.2662	0.2640	0.1929	0.2712	0.1931	0.2392
Minimum	-0.1191	-0.1654	-0.1762	-0.2013	-0.1319	-0.2536	-0.3375	-0.3269
Standard Deviation	0.0466	0.0448	0.0474	0.0589	0.0458	0.0620	0.0656	0.0554
Skewness	0.3816	0.5474	0.7192	0.4243	0.4597	0.6863	-0.2461	-0.2950
Kurtosis	3.7948	5.5226	7.9539	5.7822	5.1380	6.7045	5.8941	10.6310
Jarque-Bera	13.1524	81.9252	288.2749	91.6262	58.6792	169.0784	93.3635	635.9620
Probability	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$Q_{(12)}$*	10.324	30.519	18.907	20.551	20.452	22.099	15.300	13.633
P-values	(0.588)	(0.002)	(0.091)	(0.057)	(0.059)	(0.036)	(0.225)	(0.325)
$Q^2_{(12)}$*	10.222	41.045	23.018	3.181	9.797	64.860	6.062	20.825
P-values	(0.597)	(0.000)	(0.028)	(0.994)	(0.634)	(0.000)	(0.913)	(0.053)

*$Q_{(12)}$ and $Q^2_{(12)}$ Ljung-Box test for stock returns and squared stock returns (12-lags).

Table 5. Diagnostic Testing

	OTE	TIT	EFG	EMP	COC	DEL	INC	SLB
Breusch-Godfrey$_{(12)}$*	9.867	25.298	20.462	22.091	18.789	22.018	15.638	23.963
P-values	(0.627)	(0.013)	(0.058)	(0.036)	(0.093)	(0.037)	(0.208)	(0.020)
ARCH$_{(12)}$*	10.891	27.977	19.468	15.161	15.852	33.133	14.543	21.026
P-values	(0.538)	(0.039)	(0.077)	(0.999)	(0.893)	(0.0009)	(0.933)	(0.050)
ADF$_{(0)}$**	-0.978	-1.730	-2.163	-0.917	-2.545	-0.841	-0.110	-0.776
ADF$_{(1)}$	-7.433	-7.427	-6.839	-6.499	-7.318	-5.940	-6.790	-7.564
PP$_{(0)}$**	-0.967	-2.165	-1.929	-0.749	-2.492	-0.808	-0.069	-0.733
PP$_{(1)}$	-15.874	-18.358	-17.256	-13.975	-17.068	-15.242	-14.106	-14.211

* Mean return residuals at 5% significance level
** (Log) stock prices at 4 lags: ADF: Augmented Dickey Fuller;
PP: Phillips-Perron tests;
ADF$_{(0)}$ / PP$_{(0)}$: level-tests;
ADF$_{(1)}$ / PP$_{(1)}$: first difference-tests;
(Critical values ADF / PP: -3.457 (1%); -2.873 (5%); -2.573 (10%))

Table 6. The GARCH Model

	OTE	TIT	EFG	EMP	COC	DEL	INC	SLB
Ω	0.0068	0.0003	0.0002	0.0004	0.0007	0.0009	0.0003	0.0008
Robust *Z*-statistics	(3.292)	(1.043)	(0.588)	(0.667)	(1.090)	(1.179)	(2.879)	(3.211)
A	0.0093	0.0691	0.0075	0.0289	0.0657	0.1218	0.0359	0.7496
Robust *Z*-statistics	(7.897)	(2.132)	(0.437)	(1.487)	(2.043)	(2.730)	(4.093)	(2.001)
B	0.7800	0.9012	0.9920	1.0144	0.8921	0.8458	0.9652	0.2015
Robust *Z*-statistics	(9.613)	(1.853)	(2.469)	(2.821)	(1.534)	(1.566)	(6.464)	(1.341)
L.L.	430.663	472.251	433.258	377.831	439.726	389.440	346.482	407.908
Q$_{(12)}$	6.049	9.982	15.364	18.010	10.481	14.280	11.261	14.981
P-Values	(0.914)	(0.618)	(0.222)	(0.115)	(0.574)	(0.283)	(0.507)	(0.242)
$Q^2_{(12)}$	10.681	3.809	13.538	7.280	2.789	7.0695	7.288	4.134
P-Values	(0.556)	(0.987)	(0.331)	(0.839)	(0.997)	(0.853)	(0.836)	(0.981)

ω: constant
α: ARCH effect
β: GARCH effect
L.L: Log Likelihood
Q$_{(12)}$: Ljung-Box test, standardized residuals;
$Q^2_{(12)}$: Ljung-Box test, squared standardized residuals
$\chi^2_{(12)}$: 21.026 (5% significance level)

Table 7. The EGARCH Model

	OTE	TIT	EFG	EMP	COC	DEL	INC	SLB
Ω	0.2984	0.0366	0.4276	0.7416	0.3314	-0.3102	0.3784	0.2615
Robust *Z*-statistics	(1.877)	(0.926)	(1.767)	(1.234)	(1.314)	(1.992)	(1.741)	(2.700)
A	0.1541	0.0790	0.1921	0.0959	0.1183	0.2324	0.1360	0.8872
Robust *Z*-statistics	(1.407)	(2.523)	(1.714)	(0.581)	(2.174)	(3.018)	(1.334)	(3.047)
B	0.4982	0.9071	0.3290	0.2883	0.9623	0.9783	0.3334	0.6748
Robust *Z*-statistics	(1.921)	(3.311)	(0.812)	(0.270)	(2.635)	(4.113)	(0.852)	(4.555)
Γ	-0.1397	-0.1004	-0.2493	-0.0073	-0.078	-0.0199	-0.2163	-0.1856
Robust *Z*-statistics	(-1.439)	(-3.300)	(-2.011)	(-0.074)	(-1.482)	(-0.340)	(-1.972)	(-1.090)
L.L.	430.771	486.773	428.936	369.724	444.399	388.818	345.532	412.698
Sk	0.337	-0.045	0.767	0.500	0.372	0.360	-0.151	0.316
Ku	3.583	3.590	7.748	5.990	4.994	3.746	5.378	5.773
Q$_{(12)}$	4.316	13.223	15.250	17.868	10.651	13.651	7.867	21.196
P-Values	(0.977)	(0.353)	(0.228)	(0.120)	(0.559)	(0.324)	(0.795)	(0.048)
$Q^2_{(12)}$	8.737	27.670	14.844	2.706	3.165	6.690	6.454	4.807
P-Values	(0.725)	(0.006)	(0.250)	(0.997)	(0.994)	(0.877)	(0.891)	(0.964)

ω: constant; α: ARCH effect; β: GARCH effect; γ: asymmetric / leverage effect
L.L.: Log Likelihood
Sk: standardized residuals skewness;
Ku: standardized residuals kurtosis;
Q$_{(12)}$: Ljung-Box test, standardized residuals;
$Q^2_{(12)}$: Ljung-Box test, squared standardized residuals

Table 8
Moment Specification Test

	OTE	TIT	EFG	EMP	COC	DEL	INC	SLB
φ_o	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.001
HCTR	(0.024)	(0.285)	(0.712)	(0.046)	(1.027)	(0.763)	(2.111)	(4.114)
φ_1	1.017	1.043	0.763	1.075	0.757	0.857	0.379	0.264
HCTR	(1.988)	(2.380)	(2.815)	(1.675)	(3.288)	(2.801)	(1.221)	(8.059)

HTCR: Heteroscedasticity consistent t-ratios

Table 9
News Impact Curve

	OTE	TIT	EFG	EMP	COC	DEL	INC	SLB
Sign Bias	0.330	0.012	0.476	0.172	0.423	0.357	0.222	-0.284
Negative Size Bias	-1.858	-4.756	-0.138	-3.226	-1.760	-4.509	-2.068	-2.359
Positive Size Bias	1.054	2.937	0.308	-2.552	2.548	-0.404	-1.852	6.502
Joint Test $\chi^2_{(3)}$*	3.567	2.083	2.652	4.615	3.903	4.628	3.733	3.916

*Critical value $\chi^2_{(3)}$: 7.814 (5% significance level)

Figure 1
CSR (log) Stock Prices

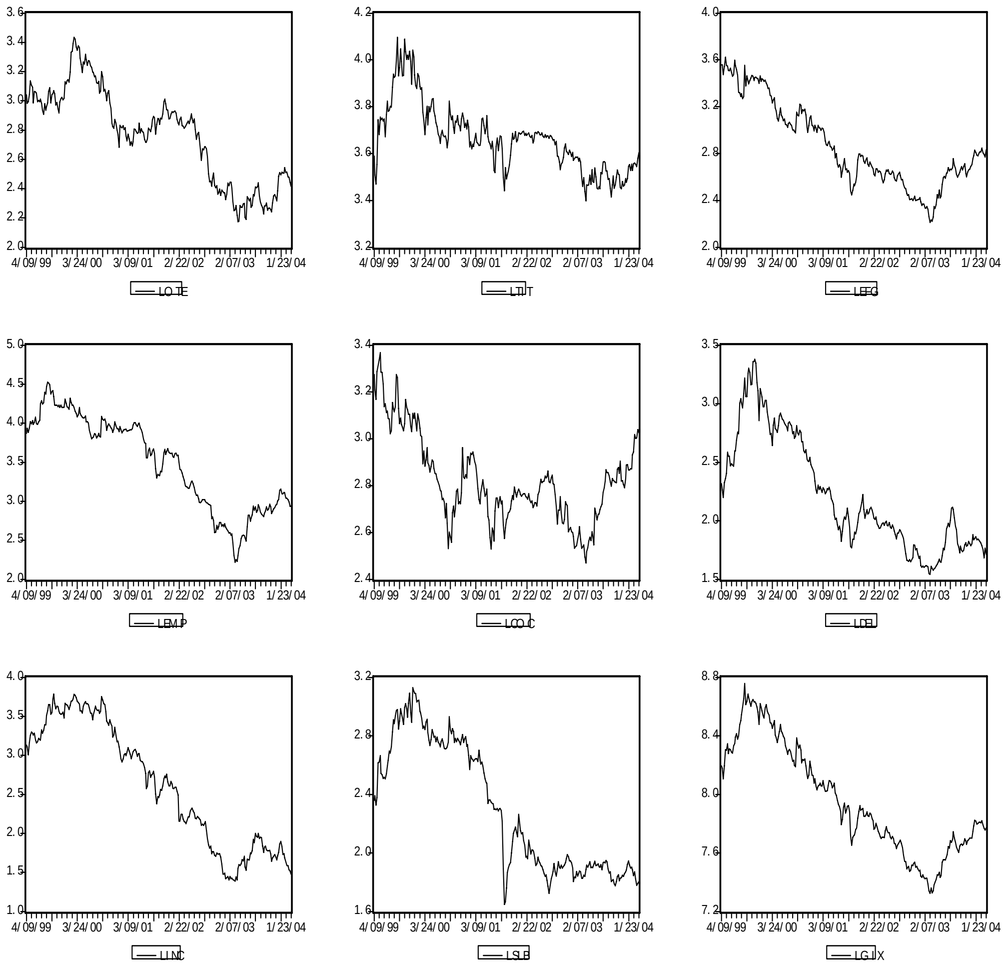

Figure 2. CSR Stock Returns

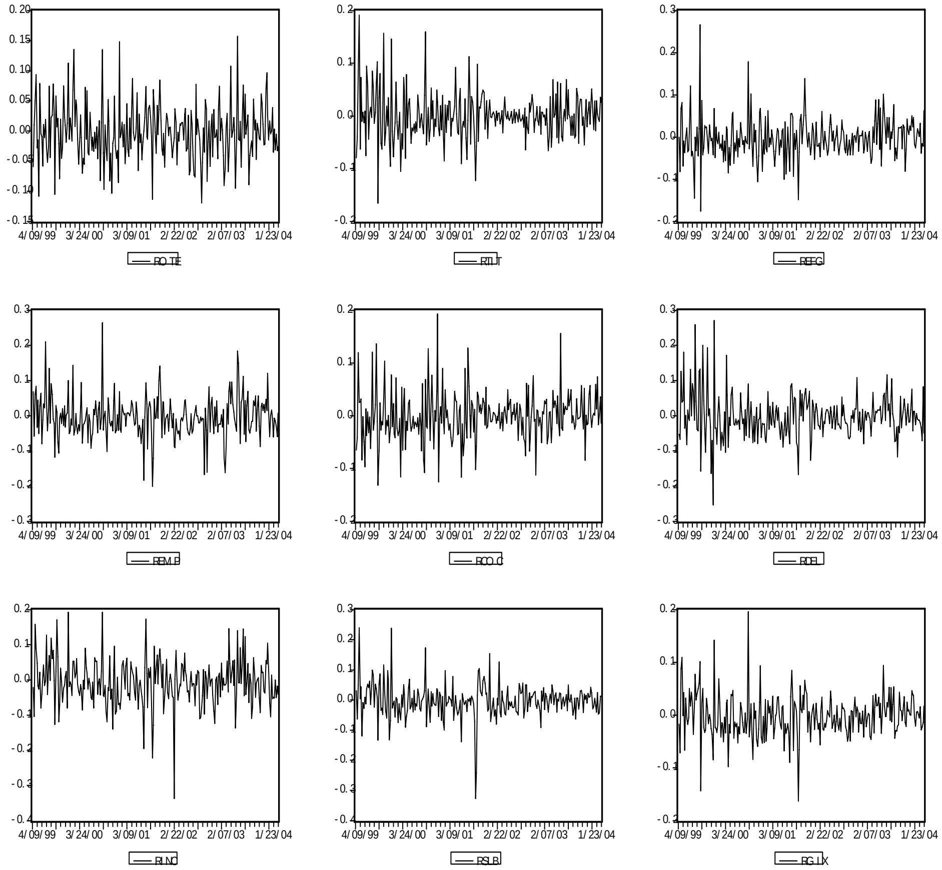

Figure 3. EGARCH CSR Conditional Volatilities