Corporate Social Responsibility and Value at Risk: Petrochemical Companies listed on Tehran Stock Exchange

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ABSTRACT

It seems that paying attention to social responsibility by companies can lead to a better stakeholder's view toward the company, thereby increasing their loyalty and trust. Having the ability to obtain more financial resources in times of crisis, due to the greater loyalty of investors, will result in reducing the company risk. In contrast, being overconfident about the loyalty of individuals to the company can lead to keeping a short-term debt structure, thereby increasing the risk of obtaining financial resources. Recently, the negative impacts of petrochemical companies on the environment have made social and environmental groups focus more on this industry, and this focus has pushed companies into involving in more social activities. Considering the potential impact of CSR on the company's risk, this study examines the relationship between corporate social responsibility and value at risk in petrochemical industry using a sample of 27 companies listed on the Tehran Stock Exchange during the 2010-2017 period. Eviews 10 is used for computing and analyzing the data, and the generalized auto regressive conditional heteroskedasticity (GARCH) model is employed to estimate value at risk. The results indicate a negative and statistically significant relationship between corporate social responsibilities and company value at risk.

1. Introduction

In recent decades, companies have moved toward globalization and are seeking to attract more and more trans-regional markets. Along with the increase in the number of multinational corporations, requests for taking responsibility of the impacts that companies can have on their surrounding community have been raised.

The recent Volkswagen Group's scandal in 2015, which left the company losing one third of its market capital, highlights the growing interest of policymakers, investors, and social activists in corporate social responsibilities (CSR), and nowadays, CSR has become one of the basic and strategic priorities of the companies (Jenkins, 2005; Benlemlih & Girerd-Potin, 2017; Knudsen, 2017).

Society is paying more attention to CSR, and this case has become one of the hot topics of literature. Many studies have focused on the impacts that CSR can have on companies, and its relationship with risk is one of the important cases researchers study (Orlitzky and Benjamin, 2001; Godfrey et al., 2009; Oikonomou et al., 2010; Benlemlih and Girerd-Potin, 2017).

Theoretically, companies that involve in CSR activities with higher standards for reasons such as balancing stakeholders interests, reducing information asymmetry, and having more reputation will have less risk in times of crisis (Mishra and Modi, 2013; Lahrech, 2011; Godfrey et al., 2005).

The agency view of CSR argues that a high CSR performance is possibly associated with a high level of managerial entrenchment (Arouri and Pijourlet, 2015). A high CSR involving may mitigate the tension between managers and non-financial stakeholders and may decrease opportunistic behaviors in firms (Jones, 1995). Hence, managers can reduce stakeholder's uncertainty through this

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[1] Generalized Auto Regressive Conditional Heteroskedasticity

method.

Most investors are more likely to investigate social responsibility companies, and the loyalty of customers to these companies can reduce their risk. Stronger customers loyalty to companies means that these companies have a steady demand (less sensitive to their stock prices), and their profit is less sensitive to entire economic changes. Hence, it can be said that social responsible companies will have less risk (Scherer and Palazzo, 2012).

Total risk is divided into two parts: systematic and idiosyncratic risk. Systematic risk (market risk) is the uncertainty inherent in the entire market and can be affected by factors such as economic and political developments, business cycles, inflation, and unemployment, which affects the price of all stocks in the market. On the other hand, idiosyncratic risk (unsystematic risk) is the uncertainty that comes with the company or industry itself and includes factors such as the entry of new rivals into the market, change of management, and product return, which can be eliminated by purchasing market portfolio (Cheung, 2016).

Although systematic and unsystematic risk are the main criteria to measure risk, portfolio managers, banks, and risk managers use other measures such as Value at risk to determine the risk. Value at risk (VaR) as one of the downside risk indicators is a criterion for measuring the maximum potential loss of a portfolio which was presented in 1994 by Weather Stone. Value at risk measures the risk quantitatively and is currently considered as one of the key tools in risk management discussions. By definition, value at risk is the worst expected losses that an asset portfolio may suffer over a specific period of time and with a given level of confidence (Llacay and Peffer, 2017).

Given the importance and increasing use of VaR as one of the criteria for measuring the risk (Mohamed, 2005), this criterion and its relation with CSR has not much been considered in the literature.

Petrochemical industry, as the connector of the oil industry (with high price fluctuations) to other industries, has always faced a growing flow of risk, and its negative impacts on the environment have made the social and environmental groups focus more on this industry; thus, this has pushed these companies into involving in more social activities. Involving in CSR in the petrochemical industry can be very influential; these effects include the role of oil pollutants and environmental hazards of the industry and greenhouse gas emissions, which have a profound impact on climate change and global warming. Moreover, most financial transactions of the petrochemical industry are often foreign trades in Iran, and due to the fluctuations in the price of oil, the possibility of international sanctions, and the dependence of the petrochemical industry on this mineral, the risk of investment in this industry will increase (Bolu and Jahan-Ara, 2017). Considering the potential impact of these activities on the company risk and the availability of the industries information in Iran, this study examines the relationship between corporate social responsibility and value at risk in petrochemical industry for companies listed on the Tehran Stock Exchange.

Below, literature review and hypotheses development; results; discussion and conclusion; and references of the article are presented.

2. Literature review and hypotheses development

Stakeholder theory states that managers must balance the interests of stakeholders, employees, customers, and society in order to guarantee the survival of the organization (Mishra & Modi, 2013). However, the goals of an organization may depend more on the interests of a certain stakeholder. CSR can reduce the risk of losing support of one or more stakeholders. In addition, CSR commitment can increase the reputation of the organization and cause greater customer loyalty towards the company in case of a negative event (Viviani, Revelli and Fall, 2015).

In fact, according to Fabrizi et al. (2014), there are two opposite motivations for managers to involve in CSR policies. The agency view of CSR commitment suggests that these activities should be used by managers to increase their personal interests. For instance, managers may involve in CSR to increase their power in the company (Jiraporn and Chintrakarn, 2013). Managers may also engage in CSR activities to reduce the impact of internal control (Fabrizi et al., 2014). On the contrary, the conflict-of-interest perspective clearly suggests that CSR activities should be a tool for managers to resolve conflicts with stakeholders, thereby increasing shareholder's wealth (Jiraporn and Chintrakarn, 2013).

Involving in some types of CSR activities can lead to a form of goodwill or moral capital (Godfrey et al., 2009) that protects many of the firm's intangible assets by providing an insurance-like protection for shareholders against the future risks.

Value at risk is one of the criteria used to estimate company's financial risk and aims to measure the maximum probable loss of a portfolio in a certain period. For example, if a portfolio's VaR risk is 1 million $, with the probability of 95%, it means that the possibility of that portfolio's daily loss being more than 1 million $ is 5 percent. Due to the important role of risk management and the pervasive use of VaR since 1996, many parametric, non-parametric ,and semi-parametric methods have been devised for its estimation, and

one of the most important and useful models to estimate VaR is the GARCH model.

Llacay and Peffer (2017) in their research indicated that VaR has an impact on the firm's market stability and market capitalization. In addition, past studies about CSR have shown the effect of these factors on the financial risk (Benlemlih and Girerd-Potin, 2017; Jo and Na, 2012) and social capital (Jha and Cox, 2015) of the companies. Kytle and Ruggie (2005) state that high-quality relationship with stakeholders can have a positive impact on risk management by reducing the uncertainty of company's stock on the market, which creates controls to minimize or eliminate distortions, losses, or damage to business operations and reduces the effect of a negative event in business.

According to the mentioned studies, it can be expected that corporate social responsibility and company risk have a type of relationship with each other. Hence, in the following section, some studies in this regard will be investigated.

Chollet and Sandwidi (2017) studied the relationship between risk and corporate social responsibility using the global data of 23,194 firms-years during the period of 2003 to 2012. The results of this study showed that good social and governmental behavior can reduce corporate risk.

Llacay and Peffer (2017) investigated the impact of value at risk on market stability. Their research suggests that market should be more prone to suffer VaR cycles when investors use a short-term horizon to calculate asset volatility or a not-too-extreme value for their risk threshold.

Cheung (2016) examined the relationship between CSR and cash holdings using a sample of 2364 companies. The results of this work showed that the positive effect of CSR on cash holdings via the systematic risk channel is robust, while via the idiosyncratic risk and corporate governance are not.

Viviani, Revelli, and Fall (2015) added that CSR activities can ease the negative measures of stakeholders in case of a negative event. This can lead to the avoidance of punitive actions by stakeholders, which might otherwise lead to decisions which can have a negative impact on companies.

Orhan and Koksal (2012) conducted a research on VaR using GARCH and ARCH model. In their study, samples of Brazil, Turkey, Germany, and the United States stock markets were used. The results showed that the GARCH and ARCH model had the best performance in measuring value at risk.

Jo and Na (2012) developed and tested two competing hypotheses of risk reduction and window dressing. Employing an extensive U.S. sample during the 1991–2010 period from controversial industry firms such as alcohol, tobacco, gambling, and others, they found that CSR engagement inversely affected firm risk after controlling various firm characteristics.

According to above studies, it can be resulted that companies more participating in CSR activities can increase the trust and loyalty of society towards themselves and consequently reduce firm risk. In particular, accepting CSR and being aware of environmental and social issues can increase company ability to control and reduce company risks. CSR commitment can also have an impact on reducing the risk of different penalties such as sanctions by consumers, damaging to company brand, and losing reputation. Regarding the literature review the research hypothesis is CSR commitment by petrochemical companies having relationship with their value at risk (VaR).

3. Methodology

The data of the research were extracted from 27 petrochemical companies listed on the Tehran Stock Exchange during 2010-2017. Due to the difference in the number of active days of each share to the shares of other companies and owing to the risk estimation for each company, the daily stock prices of each company are separately collected and analyzed. After collecting data for each company, we can predict the mean and standard conditional deviations using the mean equation and variance of the optimal model for the logarithmic return series of petrochemical companies. Finally, VaR is estimated using means and standard deviations for that time at a 95% probability level, and VaR can be estimated by having the distribution of returns. After estimating daily VaR of each share, the annual average of each share is calculated and valued as the VaR of company for that year.

According to the research hypothesis, the research model is presented by:

$$VAR_{it} = \alpha_{0} + \alpha_1 CSR_{it} + \alpha_2 CFA_{it} + \alpha_3 DVPA_{it} + \alpha_4 SIZE_{it} + \alpha_5 LEV_{it} + \alpha_6 SG_{it} + \alpha_7 MTB_{it} + \alpha_8 NWC_{it} + \alpha_9 RETA_{it} + \varepsilon_{it} \quad (1)$$

The work of Viviani et al. (2015) is used to from the above model.

4. Dependent Variable: Value at Risk (VaR)

In order to calculate VaR, there is not any explicit, absolute, and optimal model. Using different methods of calculating VaR depends on the simplicity in executing the model and the validity of its results. This substitution relationship creates inherent constraints in risk management. In this study, GARCH model is used for estimating VaR; GARCH is a mechanism that uses past variances and errors to explain the current variance. The GARCH model is capable of describing many of actual characteristics of financial time series, including higher than normal kurtosis.

To calculate the VaR of a financial asset during the horizons of time (for example, one day), its amount is typically expressed as a left or right distribution. Therefore, based on the information available at the time (t), the (Ψt) symbol as VaR of the purchase time (left side of distribution function) during the time horizon t + 1 with the confidence level P is modeled as follows:

$$Pr[r_{T+1} \le VaR^{p}_{T+1} \mid \psi_T] = 1 - p \quad (2)$$

In other words, we have P percent confidence that, over next N days, we will not certainly suffer losses more than VaR value.

Assuming that the average return on financial assets is zero, the dynamics of financial asset or portfolio returns are modeled as reads:

$$r_t = \sigma_t \varepsilon_t, \quad t = 1, \ldots, T \quad (3)$$

That (σ) is the square root of the conditional variance (volatilities) of returns at time T, and epsilons (ε) are distributions and independents with the mean of zero, variance of one, and (f) distribution functions. On the other hand, the empirical cumulative distribution of assets returns is showed by (G). Hence, the VaR is equal to:

$$VaR^{p}_{T+1} = \sigma_{T+1} F^{-1}_{1-p} = G^{-1}_{1-p} \quad (4)$$

where, σT+1 is the square root of conditional variance at time T+1; function F^{-1}_{1-p} with a 1-p quadrant is the distribution function of standard returns of (εt), and G^{-1}_{1-p} with a 1-p quadrant is the empirical distribution of returns.

One of the parametric methods for computing VaR is the GARCH model. An important feature of some economic and financial time series is that they have cluster variability, which means big changes make large changes, and small changes make small changes. In other words, the current level of variability has a positive relationship with its past values. Assuming to have no structural changes in the process of variance, conditional variance under the GARCH model is defined by:

$$\sigma^2_t = \omega + \alpha . r^2_{t-1} + \beta . \sigma^2_{t-1} \quad (5)$$

It is assumed that β+α< 1 for the positivity of the variance.

Considering the following relationship, the value of σ_t^2 depends on time T and the values of ω, α, and β:

$$\sigma^2_T = \frac{\omega}{1-\alpha-\beta} + \alpha \sum_{j=0}^{\infty} \beta^j \left(r^2_{T-j-1} - \frac{\omega}{1-\alpha-\beta}\right) \quad (6)$$

Then, VaR is obtained using the GARCH model in the following steps:

Step 1: Using the MLE method, the parameters of the GARCH model (β،α،ω) can be estimated, and the series of variances σ_t^2 and $\epsilon \hat{=} rt / \sigma_t^2$ can be calculated using the following equation:

$$\hat{\sigma}^2_t = \hat{\omega} + \hat{\alpha} . r^2_{t-1} + \hat{\beta} . \hat{\sigma}^2_{t-1} \quad (7)$$

By placing the MLE estimates in Equation (5), the following relation is obtained:

$$\hat{\sigma}^2_T = \frac{\hat{\omega}}{1-\hat{\alpha}-\hat{\beta}} + \hat{\alpha} \sum_{j=0}^{T-2} \hat{\beta}^j \left(r^2_{T-j-1} - \frac{\hat{\omega}}{1-\hat{\alpha}-\hat{\beta}}\right) \quad (8)$$

The equation of predicting σ^2_{t+1} and σ^2_{t+1} is given by:

$$\hat{\sigma}^2_t = \hat{\omega} + \hat{\alpha} . r^2_{t-1} + \hat{\beta} . \hat{\sigma}^2_{t-1} \quad (9)$$

Step 2: Values of F^{-1}_{1-p} and F^{-1}_{1-p} are estimated.

Step 3: The GARCH estimated amounts of VaR is calculated using the following equation (Christoffersen and Gonçalves, 2004).

$$G - VaR^{p}_{T+1} = \hat{\sigma}_{T+1} \hat{F}^{-1}_{1-p} \quad (10)$$

5. Independent Variable: CSR

For calculating CSR as the independent variable of the research, the checklist of Hassas et al. (2013) is used. This checklist contains 67 indicators based on identifying the components and indicators of CSR in Iran. These indicators are presented in social, environmental, and economic dimensions, and each of dimensions has a series of components. Board of directors' report is used to measure and analyze CSR commitment in companies. To calculate CSR, if one of the indicators is disclosed by the company, its score is one, otherwise the given score is zero; the level of CSR commitment of each company is then calculated using the following equation:

$$CSR = \frac{Number\ of\ items\ disclosed}{Total\ number\ of\ diclosable\ items} \quad (11)$$

6. Control Variables

Cfa_{it}: Cash flow to assets ratio which is equal to the operating cash flow to the book value of assets.

$Dvpa_{it}$: Dividends to assets ratio that equals dividends to the book value of assets.

$Size_{it}$: Size of the company, which is equal to the logarithm of the total assets.

Lev_{it}: Financial leverage, which is equal to debts to total assets ratio.

Sg_{it}: Sales Growth, which equals the difference between the sales of the current and previous years divided by the sales of previous year.

Mtb_{it}: Ratio of market value to the book value of equity,

which is equal to (Stock price × Shares outstanding + assets - shareholders' equity) divided by total assets.
Nwc_{it}: Net working capital to the book value of assets ratio, which equals (working capital - cash holdings - short-term investments) divided by total assets.
$Reta_{it}$: Retained earnings to total equity.

7. Results

7.1. Descriptive Statistics Result

The result of descriptive statistics related to variables used in this research is summarized in Table 1.

The average amount of CSR in the results is 20, which, contrary to previous researches such as the works of Cheung (2016) and Arouri and Pijourlet (2015), indicates that CSR is not considered as an important factor in the target society of the research. In addition, the average amount of VAR is 42 which can be considered a high rate for this variable compared to the results reported elsewhere (Viviani, Revelli, and Fall, 2015).

7.2. Multicollinearity Test

The results of the multicollinearity test shows that the VIF value of all the variables is less than 10, and tolerance statistic is more than 0.2; thus, it can be concluded that there is no multicollinearity between the independent variables, and the results of the regression model are reliable (Gujarati and Porter, 2009). The results of this test are tabulated in Table 2.

7.3. Fixed Effects and Hausman Tests

According to Table 3, in both tests the probability is less than 5%, so the fixed effect method should be used in the regression model.

Regarding the tests conducted, the robust regression has been used in the model.

7.4. Panel Data Results

According to Table 4, the probability of the F statistic, which indicates the significance of the total regression, is 0, indicating that the model (at a confidence level of 99%) is significant. Adjusted R-squared is 0.38, indicating that approximately 38% of the variations of the dependent variable can be explained by the model variables. A Durbin-Watson statistic value of 2.30, which lies in the range of 1.5 to 2.5, indicates that a lack of correlation in the model is accepted.

Coefficient of CSR variable is -20961.63, and the results of T-statistic and the probability of this variable indicate the significance of this coefficient at an error level of 5%. These findings show a negative and statistically significant relationship between CSR and company VaR risk. Moreover, among control variables, SG and MTB have a negative and significant relationship, but RETA has a positive and significant relationship with the VaR.

8. Discussion and Conclusion

This study examines the relationship between corporate social responsibilities and value at risk in petrochemical companies listed on the Tehran Stock Exchange. Though there has been many studies investigating the effects of participating and reporting corporate social responsibilities on numerous factors, its relationship with value at risk has not much been considered in the literature. In fact, although previous researches on relationship between financial risk (systematic and idiosyncratic) and CSR is worthwhile, managers tend to measure risk by using different methods such as VaR model. Therefore, the study of the relationship between CSR and VaR seems to be a very important.

Table 1- Descriptive Statistics

Variable	Observation	Mean	Medium	Maximum	Minimum	Standard Deviation
VAR	216	428270.9	57324.43	11372069	0.735425	0.1399058
CSR	216	20.31239	20.89552	32.83582	10.44776	6.305267
CFA	216	0.179187	0.150464	0.691905	-0.18406	0.172608
DVPA	216	0.000132	0.00004	0.002141	0.000000	0.000253
SIZE	216	6.961732	6.991962	8.509889	4.727330	0.579813
LEV	216	0.560725	0.570688	0.987059	0.038807	0.221630
SG	216	0.197120	0.094004	1.322922	-0.462008	0.359305
MTB	216	1.849873	1.597159	4.943690	0.104046	1.002539
NWC	216	-0.035985	0.016665	0.485478	-0.781087	0.263594
RETA	216	0.416002	0.496049	0.920706	-0.587819	0.349130

Investigating the relationship between these two variables can help companies decide on the amount of investme nt on their CSR activities and reduce the risk of being active in the capital market.

Nowadays, consumers show a more positive response towards establishments exhibiting higher levels of social responsibility and consider it as an important factor in their decision making. Paying attention to CSR activities can create a positive view in society towards the companies, thereby increasing stakeholders' loyalty and trust. These companies can be more resilient in times of economic crises, and in case of a need for resources such as cash, they have better condition than their rivals, which will ultimately reduce the company risk.

Theoretically, companies that involve in CSR activities with higher standards, for different reasons such as balancing stakeholders interests, reducing information asymmetry, and having more reputation, will have less risk in times of crisis (Mishra and Modi, 2013; Lahrech, 2011; Godfrey et al., 2005). The results of the research model showed that there is a negative and significant relationship between CSR and VaR, which confirms the theoretical foundations of the research and is similar to the past studies reported elsewhere (Cheung, 2016; Arouri and Pijourlet, 2015; Parsa et al., 2014; Mishra and Modi, 2013). Most of the past studies show that the risk of the company can be reduced by involving in more CSR activities.

According to the results and information obtained during the research, some suggestions are given by the authors:

It is suggested that companies should take CSR activities as an important factor in achieving their goals and should be more responsible towards CSR to increase their reputation and encourage people for investing in their companies. By reducing their risk, companies can expect greater loyalty from their customers in unfavorable economic conditions; as a result, if they need resources such as cash, they can achieve them more easily.

Most petrochemical companies in Iran are dependent on the government, and the negative effects of this industry on the environment have made the social and environmental groups focus more on this industry, which has pushed these companies into involving in more social activities. Therefore, it is suggested that these companies should reduce the number of their governmental, environmental, and social fines and penalties by taking part in more CSR activities.

Corporate social responsibility is almost a new concept in the third world countries, and further studies in this concept such as a study about its relationship with financial transparency, audit quality, and other factors can lead to reducing environmental hazards in the world as well as being a growth factor for companies deciding to invest in it.

Table 2- Multicollinearity Test Results

Variable	Tolerance	VIF
C	2.84	
CSR	4.49	1.26
CFA	6.65	1.53
DVPA	2.59	1.62
SIZE	5.42	1.42
LEV	5.41	1.96
SG	1.30	1.14
MTB	2.34	1.27
NWC	3.94	2.02
RETA	2.22	2.01

Table 3- Fixed Effects and Hausman Results

Test	Statistic	Degree ofFreedom (d.f.)	Probability
Fixed Effects	2.236	-26.118	0.0019
Hausman	12.045	9	0.0296

Table 4- Panel data results

Variable	Coefficient	Standard Error	t-Statistic	Probability	Relationship
C	319287.9	428667.2	0.744839	0.4579	-
CSR	-20961.63	4022.276	-5.211384	0.0000	negative and significant
CFA	-17526.06	110799.5	-0.158178	0.8746	-
DVPA	-30020807	36709774	-0.817788	0.4151	-
SIZE	88310.77	64775.74	1.363331	0.1754	-
LEV	-145459.8	120450.9	-1.207628	0.2296	-
SG	-181135	43239.52	-4.189107	0.0001	negative and significant
MTB	-49109.27	24191.27	-2.030041	0.0446	negative and significant
NWC	-70931.87	101831.9	-0.696559	0.4874	-
RETA	341214.9	50397.44	6.77048	0.0000	positive and significant
	R-squared	Adjusted R-squared	F-statistic	Probability	Durbin-Watson
statistics	0.524295	0.383196	3.715792	0.0000	2.300717

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