

# “An analysis of United States on Dow Jones Sustainability Index”

<b>AUTHORS</b>	Grigoris Giannarakis Xanthi Partalidou Eleni Zafeiriou Nikolaos Sariannidis
<b>ARTICLE INFO</b>	Grigoris Giannarakis, Xanthi Partalidou, Eleni Zafeiriou and Nikolaos Sariannidis (2016). An analysis of United States on Dow Jones Sustainability Index. <i>Investment Management and Financial Innovations</i> , 13(3-2), 353-361. doi: <a href="https://doi.org/10.21511/imfi.13(3-2).2016.07">10.21511/imfi.13(3-2).2016.07</a>
<b>DOI</b>	<a href="http://dx.doi.org/10.21511/imfi.13(3-2).2016.07">http://dx.doi.org/10.21511/imfi.13(3-2).2016.07</a>
<b>RELEASED ON</b>	Monday, 10 October 2016
<b>JOURNAL</b>	"Investment Management and Financial Innovations"
<b>FOUNDER</b>	LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

0



NUMBER OF FIGURES

0



NUMBER OF TABLES

0

© The author(s) 2020. This publication is an open access article.

Grigoris Giannarakis (Greece), Xanthi Partalidou (Greece), Eleni Zafeiriou (Greece), Nikolaos Sariannidis (Greece)

## An analysis of United States on Dow Jones Sustainability Index

### Abstract

This paper examines the effect of various economic and financial indicators on the Dow Jones Sustainability Index (DJSI) returns. In particular, four explanatory variables are employed, namely United States (US) 10 Year bond value, gold price, Trade Weighted U.S. Dollar Index and Consumer Sentiment Index calculated by Michigan University. A generalized autoregressive conditional heteroskedasticity (GARCH) model is applied over DJSI United States which incorporates socially responsible companies for the period August, 1999 to May, 2016 using monthly data. The empirical results indicate that the consumer sentiment and the bond market exert positive impact on the DJSI US, whereas the gold and currency market affects it negatively. In addition, the structural analysis of DJSI US returns volatility showed that the US trade balance has a stabilizing effect on the conditional variance of the DJSI US return series.

**JEL Classification:** G1, F2, Q40, M21.

**Keywords:** Dow Jones Sustainability Index, bond value, gold, exchange rate, consumer sentiment.

### Introduction

A significant number of studies has been devoted to investigate the relationship between stock returns and a range economic indicators and variables across different stock markets (e.g., Chen et al., 1986; Cheung and Ng, 1998; Aroui and Nguyen, 2010; Atanasov, 2016). For instance, Chen et al. (1986) incorporated a number of the US macroeconomic variables as proxies for the systematic risk factors that determine the stock returns. The results reveal that several of these macroeconomic variables, industrial production, changes in risk premium, and twist in the yield curve, to be significant in explaining expected stock returns. Samitas and Kenourgios (2007) employed four European countries so as to investigate whether long and short-run stock returns are affected by current and future domestic and international macroeconomic variables. Based on Arbitrage Pricing Theory, Rjoub et al. (2009) tested if interest rate, industrial production, risk premium, inflation, market return, and consumption and oil prices can explain stock returns of Istanbul Stock Exchange for the period 1953-1984.

Based on Arbitrage Pricing Theory which supports that stock returns are related to a number of unknown macroeconomic determinants (Chen et al., 1986), this study considers a modern approach of

business operations by incorporating companies that both integrate and implement socially responsible initiatives. For this reason, US companies listed on Dow Jones Sustainability Index (DJSI) are considered in order to detect socially responsible companies as its analysis is based on corporate economic, environmental and social performance. Investments on this type of companies, which attract the interest of investors, are known as Socially Responsible Investments (SRI). In particular, since 1995, the overall SRI assets in the US was increased ten times reaching \$6.57 trillion in 2014 (Social Investment Forum Foundation, 2014).

In total, four explanatory variables were selected, namely, bond value, gold price, Trade Weighted US Dollar Index (TWUSDI) and consumer sentiment (CSI) in order to ascertain whether they affect the stock returns of companies listed on DJSI. With regard to the bond value as a proxy for interest rate, interest rate risk is a significant economic factor affecting the value of common stocks (Joseph and Vezos, 2006). The impact of the interest rate on stock returns has received a great deal of attention in the literature. Prior empirical studies revealed evidence of negative relationship between interest rate and stock returns. For instance, Dinenis and Staikouras (1998) took into account the UK stock market and showed that the negative effect of interest rate is stronger on stock returns when a three monthly Treasury bill rate is considered for a period of 1989-1995. By using a wavelet approach, Moya-Martínez et al. (2015), analyzing the period 1993-2012, illustrated that, when interest rate falls, the Spanish companies are benefited. Nasseh and Straus (2000) investigated the role of interest rate on stock prices of six European economies France, Germany, Italy, Netherlands, Switzerland and the UK for the period 1962-1995. Regarding long-term interest rates affected negatively stock prices,

---

© Grigoris Giannarakis, Xanthi Partalidou, Eleni Zafeiriou, Nikolaos Sariannidis, 2016.

Grigoris Giannarakis, Adjunct Lecturer, Technological Educational Institution of Western Macedonia, Department of Business Administration, Grevena, Greece.

Xanthi Partalidou, Ph.D. Candidate, Democritus University of Thrace, Department of Agricultural Development, Orestiada, Greece.

Eleni Zafeiriou, Professor, Democritus University of Thrace, Department of Agricultural Development, Orestiada, Greece.

Nikolaos Sariannidis, Associate Professor, Technological Educational Institution of Western Macedonia, Department of Accounting and Finance, Kozani, Greece.

consistent with the discount factor explanation, while short-term interest rates are illustrated positively related to stock prices. Focused on the US stock market, Huang et al. (2016) revealed that stock markets responded negatively to real interest rate. However, the development of derivative markets and corporate bond markets has decreased the effect of interest rate fluctuations on equity return (Czaja et al., 2010; Korkeamäki, 2011). The interest rate was selected as determinant of stock index returns because it is a crucial variable both for firms and investors as it can affect loan interest and principal payments formulating the future cash flow of firms (Hyde, 2007).

As far as gold variable is concerned, it is considered as a commodity and a monetary asset (Gokmenoglu and Fazlollahi, 2015). Gold employed in the proposed model, because it provides portfolio diversification offering to portfolio managers to mitigate price deterioration (Jaffe, 1989; Sherman, 1982) and it is considered as a hedge and a safe haven during market crash in the US (Nguyen et al., 2016). In the case of extreme negative market shocks, gold can be a stabilizing factor for the financial system by reducing losses (Baur and McDermott, 2010). However, Raza et al. (2016) revealed that gold prices have a different impact on stock market prices. Gold prices affect positively the stock market prices of large emerging BRICS economies, while gold prices have a negative impact on the stock markets of Mexico, Malaysia, Thailand, Chile and Indonesia.

Regarding CSI, it can be affected both by economic and psychological factors such as political tensions or wars (Katona, 1975; Acemoglu and Scott, 1994). CSI is a vital indicator, because, under certain circumstances, it can be a notable predictor of consumption (Mueller, 1963; Dees and Brinca, 2013), while it is used as a proxy for individual investor sentiment (e.g., Fisher and Statman, 2003; Schmeling, 2009). Similarly, Carroll et al. (1994) and Bram and Ludvigson (1998) indicated improvements in CSI underpins the consumption growth in the short-term period. In the US field, Fisher and Statman (2003) implied that consumer confidence can predict the stock market; in particular, there is a positive and statistically significant relationship between S&P 500 Index returns and changes in CSI. In addition, Jansen and Nahuis (2003) focused on 11 European countries for the period 1986-2001 and indicated that stock returns and changes in CSI are positively correlated for nine countries, except for Germany. Based on S&P 500, Chen (2011) found that the lack of confidence, indeed, has an asymmetric effect on

stock returns. To sum up, Oprea and Brad (2014) distinguished three types of sentiment-stock return relationships. The positive changes in investor sentiment and stock returns indicates that the stock prices tend to be overvalued (undervalued) in case of bullish (bearish) market, especially when the excessive optimism (pessimism) of investors is unjustified by fundamentals. The negative relationship between the two relationships is explained by the fact that prices tend to revert to their fundamental values after gradual corrections, while the third type of relationship of the two variables is not very clear in the sense that the investor acts regardless the use of fundamental data.

Finally, Trade Weighted US Dollar Index to Major Currencies is used as a proxy for the US dollar purchasing value. By employing trade-weight exchange rate of the dollar, Aggarwal (1981) examined the US stock market and found that changes in exchange rate affect profits or losses of multinational firms inducing changes on their stock prices. Soenen and Hennigan (1988) illustrated negative interaction of the US dollar effective exchange rate and US stock market index during. In addition, Ibrahim and Aziz (2003) indicated that there is a negative association between stock returns and the domestic currency value of Malaysia implying that when domestic currency depreciates, the stock prices will also drop. However, Bahmani-Oskooee and Sohrabian (1992) developed Granger concept of causality and cointegration technique and revealed that there is bidirectional causality between stock prices and exchange rate of the dollar, at least in the short-run. Furthermore, it is shown that there is no long-run relationship between two stock prices and exchange rate. Finally, Joseph (2002) stated that when the exchange rate changes, both imports and exports change too. Thus, on the one hand, depreciation will affect positively (negatively) firms exports increasing (decreasing) their stock prices. On the other hand, appreciation will affect negatively (positively) firms export (import) firms decreasing (increasing) their stock prices (Tsai, 2012).

Furthermore, the effect of trade balance on the volatility of stock returns of socially responsible companies is examined. Trade balance defines a difference between the monetary value of a nation's exports and imports over a certain period (Sheffrin, 2003). Prior studies have attempted to determine how trade balance affects stock index; however, the results are contradictory. For instance, Kwon and Shin (1999) revealed that the trade balance affects positively the Korean stock index. However, Antonakakis et al. (2016) stated that trade balance can affect stock prices as inflation can be raised,

because trade balance leading the monetary authority to increase the interest rate, thus, in turn, is likely to affect stock prices negatively. In addition, focused on India market, Bhattacharya and Mukherjee (2003) found a negative relationship between trade balance and stock exchange prices.

The growth and development of SRI in the US triggered the interest to identify the main determinants of socially responsible stock index. In particular, this paper aims at developing an integrated framework to identify the determinants that affect the stock returns of companies which integrate socially responsible initiatives in their business operations. For the purpose of the study, DJSI United States (DJSI US) is employed as a proxy for companies that integrate socially responsible initiatives in their operation in the U.S. DJSI has not been used adequately in empirical studies in relation to its determinants. However, the credibility of DJSI cannot be disputed by a number of studies (e.g., Chih et al., 2010; Searcy and Elkhawas, 2012; Peillex and Ureche-Rangau, 2016). The results of the study are important to investors that intend to invest in companies that develop socially responsible initiatives in their business operation. Furthermore, investors are able to compare the results with those of conventional indexes in order to ascertain the differences and similarities between the two types of stock indexes.

The rest of the paper is organized as follows: section 1 describes the methodology used in this study along with the data employed in section 2. Section 3 presents the main empirical results followed by concluding remarks in final section.

## 1. Methodology

Various methodologies and econometric techniques have been developed to take into account the special distributional characteristics which have been observed in the financial time series returns. Mandelbrot (1963), examining various time series on commodity returns and interest rates, claimed that price returns can be described by a stable Paretian distribution with a characteristic exponent less than two. Consequently, he suggested that financial returns are more appropriately described by a non-normal<sup>1</sup> stable distribution with fat tails and an infinite variance. By using the stocks of the Dow Jones Industrial Average, Fama (1963, 1965) confirmed Mandelbrot's (1963) hypothesis, as he concluded that the distribution of the returns tends

to be leptokurtic with fat tails compared with the normal distribution. Although fat tails have been well accepted for daily returns, many researchers argued that also monthly returns generally appear to exhibit leptokurtosis, but in weaker form than do daily or intra-daily returns (Richardson and Smith, 1993; Affleck-Graves and McDonald, 1989; Taylor, 2005; Schrimpf, 2010). Another feature of financial returns is the volatility clustering, which appears when there is a tendency that large changes in stock returns prices will follow large changes, and small changes will follow small changes (Kyle, 1985). Also, Akgiray (1989) found that daily and squared daily return series show significant autocorrelation, which means that volatility is persistent over time. Moreover, Schwert (1990) claimed that the investor's perception about the persistence of current movement in share prices will also influence the future movements of the share price. The autoregressive conditional heteroskedasticity (ARCH) model developed by Engle (1982), and extended by Bollerslev (1986) and Nelson (1991), allow the fat tails and impose an autoregressive structure on the conditional variance, thus, it is capable of capturing not only the volatility persistence of return series over time, but also the volatility clustering as well.

The estimation of GARCH model involves the joint estimation of a mean and a conditional variance equation. The GARCH (1,1) model is stated as follows:

the mean equation:

$$Y_t = X_t' b + u_t, \quad (1)$$

where  $X_t$  is a vector of exogenous variables. The conditional variance equation:

$$\sigma_t^2 = c_0 + c_1 u_{t-1}^2 + c_2 \sigma_{t-1}^2. \quad (2)$$

The conditional variance equation is a function of three terms:

$c_0$  : a constant term.

$c_1 u_{t-1}^2$  (the ARCH term): news about volatility from the previous period, measured as the lag of the squared residual  $u_{t-1}^2$  from the mean equation.

$c_2 \sigma_{t-1}^2$  (the GARCH term): last period's forecast variance as a function of the past residuals  $u_{t-2}, u_{t-3}, \dots$

$c_1 + c_2 < 1$ : It should be noted that this constrain allows the process to remain stationary, with the upper limit  $c_1 + c_2 = 1$  which represents an integrated process.

<sup>1</sup> The characteristic component of a distribution should be equal to two in order to be characterized normal.

## 2. Data

For the purpose of the study, monthly observations of DJSI US, US 10 Year Bond's value, Gold price, TWUSDI and CSI were carried out. Regarding the DJSI US, RobecoSAM and Dow Jones Indices they are corporate to formulate the DJSI family offering global, regional and country benchmarks. The socially responsible performance is based on four main sources; a specific company questionnaire, company documentation, media and stakeholder analyses and direct contact with companies. At least 50% of the questionnaire concerns specific industry characteristics covering risks and opportunities on economic, environmental and social aspects that are particularly relevant to companies within the industry that operate. The assessment questionnaire incorporates both quantitative and qualitative answers by adopting predefined multiple choice questions in order to ensure the objectivity of the final score. Finally, the formula of the socially responsible performance is based on three aspects: number of points received, question weight (within the criterion) and criterion weight (within questionnaire) (DJSI, 2016a). The DJSI US is a sub-index of DJSI North America incorporating 125 companies. The DJSI US represents the top 20% of the largest 600 US companies in the DJSI North America based on socially responsible terms (DJSI, 2016b). As far as CSI is concerned, it is based on surveys of consumers collecting data on consumer's attitudes and expectations summarized in the consumer sentiment, in order to determine the changes in consumers' willingness to buy and to predict their subsequent discretionary expenditures. This Index is comprised of measures of attitudes toward personal finances, general business conditions, and market conditions or prices. The US 10 Year bond value measures the generic government 10-year yield for US issues of treasuries. Moreover, gold price is quoted as US

Dollar per Troy Ounce. The Trade Weighted U.S. Dollar Index to Major Currencies is a weighted average of the foreign exchange value of the U.S. dollar against a subset of the broad index currencies that circulate widely outside the country of issue. Major currency index includes the Euro Area, Canada, Japan, United Kingdom, Switzerland, Australia, and Sweden. Finally, the international trade of US balance measures the difference between the movement of merchandise trade leaving a country (exports) and entering a country (imports). This measure tracks the value of the merchandise trade balance. The data of closing prices for the DJSI US are collected from the official web site of Dow Jones Sustainability Indexes<sup>2</sup>. Data regarding CSI, US 10 Year bond value, Gold prices and Trade Balance (TRDB) have been obtained from the Bloomberg online platform. Data for TWUSDI have been obtained from Federal Reserve Bank of St. Louis<sup>3</sup>. The sample period covers 31<sup>st</sup> August, 1999 to 31<sup>st</sup> May 2016. Monthly continuously compounded returns for the selected data are calculated as  $R_t = 100 * \log(p_t/p_{t-1})$ , where  $R_t$  and  $p_t$  are the monthly returns and prices, respectively.

## 4. Empirical findings

Table 1 presents the summary statistics for DJSIUS, BOND, CSI, TWUSDI, GOLD, and TRDB series. Specifically, no conclusion about the overall sign of the skewness can be reached as some series show positive skewness and some negative. Also, as expected, the returns series seem to have a leptokurtic distribution. Moreover, by using the Jarque-Bera statistics with a significance level of one and five percent it showed that the assumption of normality was rejected in each of the time series. Finally, the augmented Dickey-Fuller (ADF) test, allowing for both an intercept and a time trend, showed that the sample series had been produced by stationary series.

Table 1. Sample statistics

	DJSIUS	BOND	CSI	TWUSDI	GOLD	TRDB
Mean	0.0022	-0.00584	-0.0005	-0.0004	0.0078	0.0061
Median	0.0098	0	-0.0033	0.0006	0.0066	0.0066
Maximum	0.1185	0.24988	0.1276	0.0647	0.1557	0.3287
Minimum	-0.2199	-0.30289	-0.1992	-0.0478	-0.1850	-0.2662
Std. dev.	0.0508	0.08412	0.0538	0.0173	0.0505	0.0794
Skewness	-0.7263	-0.21422	-0.3637	0.0847	-0.1222	-0.1265
Kurtosis	4.4571	4.73923	3.7658	3.5296	3.6869	4.7981
Jarque-Bera	35.45	26.87	9.34	2.59	4.45	27.61
Observations	201	201	201	201	201	201
Augmented Dickey-Fuller (ADF)	-12.41	-13.93	-11.93	-10.03	-11.97	-12.58

Table 2 shows the sample autocorrelation function (ACF) and partial autocorrelation function (PACF) for daily returns and squared daily returns of the DJSIUS series. It can be observed that the Ljung – Box statistics, although they provide no evidence of autocorrelation on monthly returns, present strong evidence of autocorrelations in the squared daily

returns, indicating conditional heteroskedasticity (Bollerslev, 1987).

<sup>2</sup> DJSI US data: <http://www.sustainability-indices.com/index-values/>.

<sup>3</sup> Federal Reserve Bank of St. Louis: <https://fred.stlouisfed.org/series/TWEXMMTH>.

Table 2. Test for serial dependence in first and second moments of DJSIUS series

Returns				Squared returns			
Lags	Autocorrelation	Partial correlation	LB(n)	Lags	Autocorrelation	Partial correlation	LB(n)
1	0.059	0.059	0.7103	1	0.228	0.228	10.631
2	-0.049	-0.053	1.21	2	0.097	0.047	12.541
3	0.095	0.102	3.0833	3	0.144	0.119	16.811
4	0.064	0.05	3.9434	4	0.225	0.177	27.269
5	0.081	0.086	5.3209	5	0.211	0.129	36.496
6	-0.078	-0.094	6.5846	6	0.137	0.051	40.448
12	0.036	0.057	10.812	12	0.064	0.059	44.888
24	0.075	0.05	26.854	24	-0.007	-0.076	55.784
36	-0.017	-0.003	35.679	36	0.014	0.019	64.032

Notes: LB(n) are the n-lag Ljung-Box statistics for  $DJSIUS_t$  and  $DJSIUS_t^2$ , respectively. LB(n) follows chi-square distribution with  $n$  degree of freedom; the sample period contains 201 monthly returns.

Table 3 represents the correlation of the used variables in the model. The correlation coefficients between the different independent variables are low indicating that there is no tendency in the examined model to present a multicollinearity problem.

Table 3. Correlation matrix

	DJSIUS	BOND	CSI	GOLD	TWUSDI	TRDB
DJSIUS	1	0.306	0.177	-0.005	-0.253	-0.014
BOND	0.306	1	0.081	-0.212	-0.029	-0.038
CSI	0.177	0.081	1	0.012	0.045	0.062
GOLD	-0.005	-0.212	0.012	1	-0.275	0.022
TWUSDI	-0.253	-0.029	0.045	-0.275	1	0.038
TRDB	-0.014	-0.038	0.062	0.022	0.038	1

In summary, it seems that the DJSIUS return series is best described by an unconditional leptokurtic distribution and possesses significant conditional heteroskedasticity. This renders the ARCH models a very good choice for modelling the DJSIUS return series. The preliminary statistical results and the application of the LR test on the  $GARCH(p,q)$  model demonstrate the final specification for the estimation of the mean and volatility for the DJSIUS series. The specification is:

mean equation:

$$DJSIUS_t = b_1 + b_2 BOND_t + b_3 CSI_t + b_4 TWUSDI_t + b_5 GOLD_{t-1} + u_t \tag{3}$$

Variance equation:

$$\sigma_t^2 = c_0 + c_1 u_{t-1}^2 + c_2 \sigma_{t-1}^2 + c_3 TRDB_t \tag{4}$$

$u_t \sim GED(0, \sigma_t^2)$ .

Some diagnostic tests were performed to establish goodness of fit and appropriateness of the model. First, it was examined whether the standardized residuals and squared standardized residuals of the estimated model were free from serial correlation. As we can see from Table 4, the LB(n) statistics for standardized residuals are not statistically significant and the LB(n) statistics for standardized squared residuals show no ARCH remaining structure. Furthermore, the coefficient estimation  $\nu = 1.47$  for tail thickness regulator with 0.239 standard error, confirms the adoption of the GED assumption. Specifically, the assumption of normal distribution is rejected, a fact that verifies the theory for thick tails in the stock returns. An LR test of the restriction  $\nu = 2$  (for  $\nu = 2$  the GED distribution is essentially the normal distribution) against the unrestricted models and it clearly supports this conclusion.

Table 4. Diagnostics on standardized and squared standardized residuals

Residuals				Squared residuals			
Lags	Autocorrelation	Partial correlation	LB(n)	Lags	Autocorrelation	Partial correlation	LB(n)
1	-0.066	-0.066	0.8793	1	-0.004	-0.004	0.0025
2	-0.057	-0.061	1.5366	2	0.047	0.047	0.4583
3	0.089	0.081	3.1478	3	0.013	0.013	0.4925
4	0.016	0.024	3.1992	4	-0.022	-0.024	0.5932
5	0.093	0.107	4.9965	5	0.036	0.035	0.8677
6	-0.018	-0.01	5.064	6	0.037	0.039	1.1476

Table 4 (cont.). Diagnostics on standardized and squared standardized residuals

Residuals				Squared residuals			
Lags	Autocorrelation	Partial correlation	LB(n)	Lags	Autocorrelation	Partial correlation	LB(n)
12	-0.041	-0.041	9.9418	12	-0.011	-0.009	3.3983
24	0.105	0.077	25.317	24	0.009	-0.004	8.6045
36	0.04	0.075	33.336	36	-0.032	-0.014	18.567

Notes: LB(n) are the n-lag Ljung-Box statistics for the residual series. LB(n) follows chi-square variable with *n* degree of freedom; the series of residual contains 200 elements.

Results presented in Table 5 show that the mean return of the DJSIUS series had statistically significant higher return at the 1% level when the returns of ten years bond have increased and when the interest rates have reduced. The relationship between interest rates and stock prices is negative, a fact that is attributed to many reasons with the most important one the impact of interest rates in the present values of stocks, as it is calculated through the cash flow discounting model. Also, the coefficient of CSI is statistically significant at 1% level (p value = 0.074) suggested the vital gravity of the consumer’s sentiment on the mean return of the DJSIUS variable. Also, the sign, the magnitude and the statistical significance of the Dollar Index coefficient (-0.64) imply the important role of the dollar exchange rate in the U.S. stock market. Finally, the coefficient of the Gold, used as a proxy for the economic-political uncertainties, indicates the crucial role of economic expectations for well-balanced global growth.

In Table 6 the results for the variance equation are presented. The value of the  $c_2$  coefficient (0.796), which reflects the influence of  $\sigma_{t-1}^2$ , i.e. the older information (residuals  $u_{t-2}, u_{t-3}, \dots$ ), is much higher than the value of the  $c_1$  coefficient (0.139), which correlates the price variation of the present month to the price variation of the previous month. Consequently, the volatility shocks (information) are slowly assimilated to the particular market. The sum of the  $c_1 + c_2 = 0.139 + 0.796 = 0.93$  is lower than one, but high, a fact that indicates the presence of volatility clustering. Also, the statistical significance of the  $c_3$  indicates that the positive increase of trade balance exerts negatively and, therefore, has a beneficial effect on the conditional volatility of the DJSIUS return series. Possible explanation of this stabilizing effect is that the trade balance of the U.S. economy is associated with the reduced economic uncertainty.

Table 5. Mean equations

$$DJSIUS_t = b_1 + b_2 BOND_t + b_3 CSI_t + b_4 TWUSDI_t + b_5 GOLD_{t-1} + u_t.$$

$b_1$	$b_2$	$b_3$	$b_4$	$b_5$
0.007573*	0.136261*	0.110249*	-0.63878*	-0.15792*
(0.002158)	(0.026322)	(0.041175)	(0.126387)	(0.043664)

Notes: standards errors are shown in parentheses. \* indicates statistical significance at the 1% level.

Table 6. Variance equations

$$\sigma_t^2 = c_0 + c_1 u_{t-1}^2 + c_2 \sigma_{t-1}^2 + c_3 TRDB_t$$

$c_0$	$c_1$	$c_2$	$c_3$
1.04E-04**	0.138954**	0.795666*	-0.0036*
(5.25E-05)	(0.064641)	(0.075834)	(0.001006)

Notes: standards errors are shown in parentheses. \* indicates statistical significance at the 1% level. \*\* indicates statistical significance at the 5% level.

### Conclusions

Socially responsible investors intend to incorporate social expectations in their investment decisions. The present study examined the relationship of the social responsibility index and its determinants. As prior empirical studies have incorporate conventional stock indexes, this study intends to fill the gap incorporating socially responsible index. For this reason, DJSI US is selected as a proxy for socially responsible stock index so as to examine its determinants.

The aim of this study is to examine the role of economic and financial factors in the formation of conditional mean and variance returns of DJSI US series using a GJR-GARCH model. Specifically, we have examined the influence of the US 10 Year Bond’s value, the Michigan CSI, the TWUSDI, the Gold and the US Trade Balance on the DJSI US. The Bond market, which, in turn, is affected by the direction of interest rates having an inverse relationship, is positively correlated with the stock market. Thus, variations in the federal funds rate

affect not only the behavior of consumers, but also the response of the investors. Besides, the price of share prices is valued by the sum of the discounted future cash flows, hence the returns of stocks increase when the interest rate decreases and conversely.

Regarding the impact of the consumer's sentiment on the DJSI returns, the results could be justified by the following reasons. First of all, the consumer's sentiment is considered a leading economic indicator, and it has historically been good predictor of consumer spending, as the publication of consumer survey data exerts a psychological effect on the market through the so-called "publication effect". Secondly, some consumers are also investors and when they are confident about the economy they are also confident about the stock market as well. Thirdly, many companies adjust their production schedules according to the tendency of consumer sentiment publications. To an extent, it can be a self-fulfilling statistic. If falling consumer spending is predicted, companies will cut back on production and hiring, a fact that makes consumers to become even more nervous. In the same spirit, this phenomenon works in reverse, if the forecast predicts that the consumer's spending will rise, companies will increase production and hiring, thereby implementing the prediction, which, in turn, has as a result the improvement of investor psychology for the market.

Concerning gold, which acts as a safe haven and reflects the market uncertainty, the correlation with the DJSI is negative. When the gold prices tend to perform well is a signal that the market conditions

may be worsening affecting investors and portfolio managers to adjust their portfolios by selling shares, a fact that works also vice versa.

In respect to the influence of exchange rates, although the strong dollar reflects the health of the US economy, the results of our model indicates a negative relationship, a fact that can be explained in several ways. Firstly, DJSI is composed of large US firms which operate overseas and are paid in a foreign currency, hence, when these companies convert their foreign earnings to dollar, the earnings worth less (translation effect). Secondly, a strong dollar makes US goods more expensive overseas risking the reduction of foreign consumers, who may turn away from American brands.

Finally, the structural analysis of volatility showed that the volatility of DJSI returns is persistent with the impact of old news on conditional volatility to be higher than that of the current news. Finally, the results suggest that the impact of the increase of US trade balance on the conditional variance of the DJSI was stabilizing. This can be explained by the fact that the US trade balance affects the confidence of investors, as it determines the health of the US economy and its relationship with the rest of the world.

The identification of the forces that affect socially responsible indexes is important to investors in order to enhance and elaborate their investment decisions to companies that take into account societal expectations. Further, investors have the opportunity to compare the results to those ones that concern convention stock indexes.

## References

1. Acemoglu, D. and Scott, A. (1994). Consumer Confidence and Rational Expectations: Are Agents' Beliefs Consistent with the Theory? *The Economic Journal*, 104(422), pp. 1-19.
2. Affleck-Graves, J. and McDonald, B. (1989). Nonnormalities and tests of asset pricing theories, *Journal of Finance*, 44 (4), pp. 889-908.
3. Aggarwal, R. (1981). Exchange rates and stock prices: A study of the US capital markets under floating exchange rates, *Journal of Financial Research*, 12, pp. 7-12.
4. Akgiray, V. (1989). Conditional heteroskedasticity in time series of stock returns: evidence and forecasts, *Journal of Business*, 62, pp. 55-80.
5. Antonakakis, N., Gupta, R. and Tiwari, A.K. (2015). Time-Varying Correlations between Trade Balance and Stock Prices in the United States over the Period 1792 to 2013, *Working Paper*, IFHE University.
6. Arouri, M. and Nguyen, D.K. (2010). Oil prices, stock markets and portfolio investment: evidence from sector analysis in Europe over the last decade, *Energy Policy*, 38 (8), pp. 4528-4539.
7. Atanasov, V. (2016). Conditional interest rate risk and the cross-section of excess stock returns, *Review of Financial Economics*, Article in Press.
8. Bahmani-Oskooee, M. and Sohrabian, A. (1992). Stock prices and the effective exchange rate of the dollar, *Applied Economics*, 24 (4), pp. 459-464
9. Baur, D.G. and McDermott, T.K. (2010). Is gold a safe haven? International evidence, *Journal of Banking & Finance*, 34 (8), pp. 1886-1898.
10. Bhattacharya, B. and Mukherjee, J. (2003). Causal Relationship between Stock Market and Exchange Rate. Foreign Exchange Reserves and Value of Trade Balance: A Case Study for India, The 5th Annual Conference on Money and Finance in the Indian Economy on January 2003.
11. Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity, *Journal of Econometrics*, 31(3), pp. 307-327.

12. Bollerslev, T. (1987). A conditional heteroscedastic time series model for speculative prices and rate of return, *The Review of Economics and Statistics*, 69 (3), pp. 542-547.
13. Bram, J. and Ludvigson, S. (1998). Does Consumer Confidence Forecast Household Expenditure? A Sentiment Index Horse Race, *Federal Reserve Bank of New York Economic Policy Review*, 4, pp. 59-78.
14. Carroll, C.D., Fuhrer, J.C. and Wilcox, D.W. (1994). Does Consumer Sentiment Forecast Household Spending? If So, Why? *American Economic Review*, 84, pp. 1397-1408.
15. Chen, N., Roll, R. and Ross, S. (1986). Economic forces and the stock market, *Journal of Business*, 59 (3), pp. 383-403.
16. Chen, N., Roll, R. and Ross, S. A. (1986). Economic forces and the stock market, *Journal of Business*, 59, pp. 383-403.
17. Chen, S.S. (2011). Lack of consumer confidence and stock returns, *Journal of Empirical Finance*, 18, pp. 225-236.
18. Cheung, Y.W. and Ng, L.K (1998). International evidence on the stock market and aggregate economic activity, *Journal of Empirical Finance*, 5 (3), pp. 281-296.
19. Chih, H.-L., Chih, H.-H. and Chen, T.-Y. (2010). On the determinants of corporate social responsibility: International evidence on the financial industry, *Journal of Business Ethics*, 93 (1), pp. 115-135.
20. Czaja, M., Scholz, H. and Wilkens, M. (2010). Interest rate risk rewards in stock returns of financial corporations: evidence from Germany, *European Financial Management*, 16 (1), pp. 124-154.
21. Dees, S. and Brinca, P.S. (2013). Consumer confidence as a predictor of consumption spending: Evidence for the United States and the Euro area, *International Economics*, 134, pp. 1-14.
22. Dinenis, E. and Staikouras, S.K. (1998). Interest rate changes and common stock returns of financial institutions: evidence from the UK, *The European Journal of Finance*, 4 (2), pp. 113-127.
23. Dow Jones Sustainability Index (2016a). *Dow Jones Sustainability Indices Methodology*. Available at: <http://eu.spindices.com/indices/equity/dow-jones-sustainability-world-index>.
24. Dow Jones Sustainability Index (2016b). *Dow Jones Sustainability United States Index Fact Sheet 2016*. Available at: [http://djindexes.com/mdsidx/downloads/fact\\_info/Dow\\_Jones\\_Sustainability\\_United\\_States\\_Index\\_Fact\\_Sheet.pdf](http://djindexes.com/mdsidx/downloads/fact_info/Dow_Jones_Sustainability_United_States_Index_Fact_Sheet.pdf).
25. Engle, R.F. (1982). Autoregressive conditional Heteroscedasticity with estimates of the variance of United Kingdom inflation, *Econometrica*, 50, pp. 987-1007.
26. Fama, E. (1963). Mandelbrot and the stable paretian distribution, *The Journal of Business*, 36 (4), pp. 420-429.
27. Fisher, K.L. and Statman, M. (2003). Consumer confidence and stock returns, *Journal of Portfolio Management*, 30 (1), pp. 115-127.
28. Gokmenoglu, K.K. and Fazlollahi, N. (2015). The Interactions among Gold, Oil, and Stock Market: Evidence from S&P500, *Procedia Economics and Finance*, 25, pp. 478-488.
29. Huang, W., Mollick, A.V. and Nguyen, K.H. (2016). U.S. stock markets and the role of real interest rates, *The Quarterly Review of Economics and Finance*, 59, pp. 231-242.
30. Hyde, S. (2007). The response of industry stock returns to market, exchange rate and interest rate risks, *Managerial Finance*, 33 (9), pp. 693-709.
31. Ibrahim, M.H. and Aziz, H. (2003). Macroeconomic variables and the Malaysian equity market: A view through rolling subsamples, *Journal of Economic Studies*, 30 (1), pp. 6-27.
32. Jaffe, J. (1989). Gold and gold stocks as investments for institutional portfolios, *Financial Analysts Journal*, 45, pp. 53-59.
33. Jansen, W.J. and Nahuis, N.J. (2003). The stock market and consumer confidence: European evidence, *Economics Letters*, 79, pp. 89-98.
34. Joseph, N.A. and Vezos, P. (2006). The Sensitivity of US Bank's Stock Returns to Interest Rate and Exchange Rate Changes, *Managerial Finance*, 32 (2), pp. 182-199.
35. Joseph, N.L. (2002). Modelling the impacts of interest rate and exchange rate changes on UK stock returns, *Derivatives Use, Trading & Regulation*, 7 (4), pp. 306-323.
36. Katona, G. (1975). *Psychological Economics*. New York: Elsevier Scientific Publishing Company.
37. Korkeamäki, T. (2011). Interest rate sensitivity of the European stock markets before and after the Euro introduction, *Journal of International Financial Markets, Institutions and Money*, 21 (5), pp. 811-831.
38. Kwon, C.S. and Shin, T.S. (1999). Cointegration and causality between macroeconomic variables and stock market returns, *Global Finance Journal*, 10 (1), pp. 71-81.
39. Kyle, S. (1985). Continuous Auctions and Insider Trading, *Econometrica*, 53 6, pp. 1315-1335.
40. Mandelbrot, B. (1963). The variation of certain speculative prices, *The Journal of Business*, 40 (4), pp. 393-413.
41. Moya-Martínez, P., Ferrer-Lapeña, R. and Escribano-Sotos, F. (2015). Interest rate changes and stock returns in Spain: A wavelet analysis, *BRQ Business Research Quarterly*, 18 (2), pp. 95-110.
42. Mueller, E. (1963). Ten years of consumer attitude surveys: Their forecasting record, *Journal of the American Statistical Association*, 58, pp. 899-917.
43. Nasseh, A. and Strauss, J. (2000). Stock prices and domestic and international macroeconomic activity: a cointegration approach, *The Quarterly Review of Economics and Finance*, 40 (2), pp. 229-245.
44. Nelson, D.B. (1991). Conditional heteroskedasticity in asset returns: a new approach, *Econometrica*, 59 (2), pp. 347-370.
45. Nguyen, C., Bhatti, M.I., Komorníková, M. and Komorník, J. (2016). Gold price and stock markets nexus under mixed-copulas, *Economic Modelling*, 58, pp. 283-292.

46. Oprea, D.S. and Brad, L. (2014). Investor Sentiment and Stock Returns: Evidence from Romania, *International Journal of Academic Research in Accounting, Finance and Management Sciences*, 4 (2), pp. 19-25.
47. Peillex, J. and Ureche-Rangau, L. (2016). Identifying the Determinants of the Decision to Create Socially Responsible Funds: An Empirical Investigation, *Journal of Business Ethics*, 136 (1), pp. 101-117.
48. Raza, N., Shahzad, S.J.H., Tiwari, A.K. and Shahbaz, M. (2016). Asymmetric impact of gold, oil prices and their volatilities on stock prices of emerging markets, *Resources Policy*, 49, pp. 290-301.
49. Richardson, M. and Smith, T. (1993). A Test for Multivariate Normality in Stock Returns, *Journal of Business*, 66 (2), pp. 295-321.
50. Rjoub, H., Türsoy, T. and Günsel, N. (2009). The effects of macroeconomic factors on stock returns: Istanbul stock market, *Studies in Economics and Finance*, 26 (1), pp. 36-45.
51. Samitas, A. and Kenourgios, D. (2007). Macroeconomic Factors' Influence on 'New' European Countries' Stock Returns: The Case of Four Transition Economies, *International Journal of Financial Services Management*, 2 (1-2), pp. 34-49.
52. Schmeling, M. (2009). Investor sentiment and stock returns: Some international evidence, *Journal of Empirical Finance*, 16 (3), pp. 394-408.
53. Schrimpf, A. (2010). International stock return predictability under model uncertainty, *Journal of International Money and Finance*, 29 (7), pp. 1256-1282.
54. Schwert, G.W. (1990). Stock Market Volatility, *Financial Analysts Journal*, 46 (3), pp. 23-34.
55. Searcy, C. and Elkhawas, D. (2012). Corporate sustainability ratings: An investigation into how corporations use the Dow Jones Sustainability Index, *Journal of Cleaner Production*, 35, pp. 79-92.
56. Sheffrin, S.M. (2003). *Economics: Principles in action*. Upper Saddle River, New Jersey 07458: Pearson Prentice Hall. p. 462.
57. Sherman, E. (1982). Gold: a conservative, prudent diversifier, *Journal of Portfolio Management*, 8 (3), pp. 21-27.
58. Social Investment Forum Foundation (2014). *REPORT ON US Sustainable, Responsible and Impact Investing Trends 2014*. SIF, Washington, DC.
59. Soenen, L.A. and Hennigar, E.S. (1988). An analysis of exchange rate and stock prices – The U.S. experience between 1980 and 1986, *Akron Business and Economic Review*, 19, pp. 7-16.
60. Taylor, S.J. (2005). *Asset Price Dynamics, Volatility, and Prediction*. Princeton, NJ: Princeton University Press.
61. Tsai, I.C. (2012). The relationship between stock price index and exchange rate in Asian markets: A quantile regression approach, *Journal of International Financial Markets, Institutions & Money*, 22, pp. 609-621.