THE DRIVERS OF SOCIAL RESPONSIBLE STOCK INDEX: THE CASE OF DOW JONES SUSTAINABILITY INDEX WORLD

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Abstract

This study intends to investigate the main drivers of socially responsible stock index returns. For this reason, Dow Jones Sustainability Index World (DJSIW) is employed to identify companies that incorporate socially responsible initiatives in their business operations. As far as explanatory drivers of DJSIW returns are concerned, four variables are considered namely, gold prices, dollar US value to major currencies, interest rate and air pollution, while oil prices is examined in relation to volatility of DJSIW returns. Furthermore, a GARCH method was applied to investigate the relationship between explanatory variables and DJSIW returns for the period August, 1999 to 31 May, 2016 using monthly data. It is revealed that all explanatory variables have a negative effect on DJSIW. In addition, the increase of oil prices has a stabilizing effect on volatility of DJSIW returns. The results are important to explain the investor's behaviour to socially responsible stock index returns.

Keywords: Dow Jones Sustainability Index, Carbon Dioxide, Interest Rate, Crude Oil, Gold
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1. INTRODUCTION

Over the past decade, Socially Responsible Investment (SRI) has attracted the interest of financial research around the world (Auer and Schuhmacher, 2016). SRI is defined as an investment process that considers both social and environmental concerns into investment decision (Renneboog et al., 2008). Thus, investors and funds are able to identify companies that incorporate socially responsible initiatives in their business operations combing both the financial objectives and social concerns. Globally, a number of SRI indexes has been developed such as Dow Jones Sustainability Index in US, FTSE4Good in UK and JSE SRI Index in South Africa. Global SRI assets has increased dramatically during the last years, rising from $13.3 trillion in 2012 to $21.4 trillion at the beginning of 2014 (Global Sustainable Investment Alliance, 2105).

Unlike to prior studies, this study intends to investigate the main drivers of socially responsible stock index returns. For the purpose of this study, the Dow Jones Sustainability index World (DSJIW) is employed so as to identify socially responsible companies as its analysis is based on economic, environmental and social criteria. Therefore, four explanatory drivers are used to explain the DSJIW stock returns, namely interest rate, gold, trade weighted US dollar index (TWUSDI) and air pollution.

First of all, interest rate variable is selected because it is ranked in the second most relevant financial risk factor after market risk among 392 US CFOs (Graham and Harvey, 2001). In general, interest rate influences stock prices in two main ways. Firstly, changes in interest rate have a direct effect on the discount rate used in standard equity valuation models and, secondly, interest rate affects the firm's financing cost which in turn reduce future cash flows of the firm leading to lower discounted cash flows for shareholders (Hyde, 2007; Bernanke and Kuttner, 2015; Ferrer et., 2016). A bulk of empirical studies have revealed the negative effect of interest rate on stock returns. For instance, Elyasiani and Mansur (1998) applied GARCH-M methodology and found that the long-term interest rate has a negative effect on the stock returns. Moreover, Kasman et al. (2011) focused on Turkish market and found that interest rate has a negative and significant impact on the conditional bank stock return. Reilly et al. (2007) showed a significant negative relation of interest rate risk in different industries. Furthermore, during periods of lower stock market uncertainty, Stivers and Sun (2002) investigated the behaviour of stock market returns and Treasury bonds returns as proxy of interest rate for the period 1988 to 2000. The results revealed that stock and bond returns seem to move substantially together. Based on wavelet analysis, Moya-Martínez et al. (2015) examined the relationship between 10-year government bond yields and the Spanish stock market taking into account the time horizon aspect. The results indicated that Spanish industries are affected by interest rate sensitivity; however, the effect of interest rate vary across industries and depends on the time horizon. However, during period of high stock market uncertainty the two variables seem to to bear little relation or even a negative relation. However, the effect of interest rate on stock returns is decreased because derivative markets and corporate bond markets mitigate interest rate risk (Czaja et al., 2009; Korkeamäki, 2011).

As far as gold is concerned, Baur and Lucey (2010) used GARCH model for the period 1995-2005 and found that Gold is a safe haven for stocks for a relatively short-term period as gold is a hedge for stocks. Investors tend to buy gold on days of extreme negative returns and sell when confidence

is regained. Similar results were found by Baur and McDermott (2010) when they lie period the period 1979-2009. It is indicated that gold is a hedge and safe haven mostly for developed country stock markets but not for emerging stock markets. Similarly, Baur and McDermott (2016) indicated that gold was considered as strong safe haven in the aftermath of September 11, 2001 and the Lehman bankruptcy in September 2008. However, Raza et al. (2016) used nonlinear ARDL approach for the period 2008-2015 and showed that gold prices have a positive impact on stock market prices of large emerging BRICS economies and a negative impact on the stock markets of Mexico, Malaysia, Thailand, Chile and Indonesia. In this study, it is intended to examine whether gold can be a safe haven of socially responsible stock index return or not.

Furthermore, air pollution is employed in order to ascertain whether air condition can affect the behavior of socially responsible stock market investors. A number of studies examined the effect of environmental condition in relation to stock returns (e.g. Kang et al., 2010; Lu and Chou, 2012; Yoon and Kang, 2009). However, the effect of environmental pollution, specifically air pollution, in stock returns has not been investigated substantially. Lepori et al. (2016) pointed out two main channels via air pollution may affect trading decisions. Firstly, people in a negative (positive) mood tend to be more pessimistic (optimistic) which leads them to keep distance from (take more) risk. The second channel concerns a medical approach which supports that the rise of air pollution may increase the cortisol level in bodies. Higher levels of cortisol in body is considered a factor that prevents individual to take risks. Prior empirical studies revealed a negative effect of air pollution on stock returns. For instance, Levy and Yagil (2011) investigated the effect of air pollution in the US stock market indexes for the period 1997-2007. Air Quality Index composed by the US Federal Environmental Protection Agency was used as a proxy for air pollution. The results revealed that air pollution is negatively related to stock returns and illustrated that air pollution may affect them even if they are located far from the polluted area. In addition, Li and Peng (2016) analyze the effect of air pollution on Chinese stock return for the period 2005-2014. It is found that contemporaneous negative and a two-day lagged positive relationship exists between air pollution levels and stock returns. Finally, Lepori et al. (2016) showed that a rise in air pollution was estimated to have a negative marginal effect on both the direction and size of equity returns across United States, Canada, Ireland, Spain, UK, France, Germany, China, and Australia. In this study carbon dioxide (CO2) is used as a proxy for air pollution because it is considered as a main driver behind global warming and climate change (Sadorsky, 2009). The fourth explanatory driver of socially responsible stock index returns concerns TWUSDI as a proxy for the US dollar purchasing value. In general, exchange rates are considered as a major source of uncertainty for multinational firms (Jorion, 1990). Prior empirical studies are extensive and generally inconclusive. For instance, Aggarwal (1981) illustrated that US stock prices and the trade-weighted dollar are positively correlated for the period 1974-1978 illustrating that the US stock market prices are correlated with the external value of US dollar. Whilst, Soenen and Hennigar (1988) found a significantly negative impact of the dollar value on the stock price during 1980–1986. Bahmani-Oskooee and Sohrabian (1992) bidirectional causality between stock prices measured by S&P 500 index and the effective exchange rate of the dollar in the short-run. However, based on cointegration analysis, no long-run relationship between S&P's 500 composite stock price and the effective exchange rate of the dollar was found. Jorion (1990) took into account US multinational firms to examine if the value of the US dollar affect stock returns. The results indicated that the co-movement between stock returns and the exchange rate of the dollar to major currencies is found to be positively is associated with the percentage of foreign operations of US multinationals firms. Hughen and Beyer (2015) considered a sample of US stock returns for the period 1973-2013 in order to examine the effect of foreign exchange fluctuations on domestic stock prices. TWUSDI is used as a proxy for exchange rate and Thomson Reuters Global Equity Indices were employed to measure stock returns. The results illustrated that equity returns are positively associated with periods when the dollar was appreciated.

Finally, another variable of oil prices is examined in relation to volatility of DJSIW returns. In general, the effect of oil prices on stock index return is well documented in the literature review (e.g. Ciner, 2001; Park and Ratti, 2008). Oil is employed in the study because it is considered an important determinant in explaining stock price movements (Papapetrou, 2001) and higher level of oil prices put future profits at risk (Hammoudeh et al., 2010). Despite this, relatively little work has been made regarding the effect of oil prices on volatility of stock index returns. For instance, Hammoudeh et al. (2004) found that the oil prices have strong impact on the oil sectors' volatility for the period 1995-2001. Later, Hammoudeh et al. (2010) intend to examine the role of oil prices on stock return volatilities across 26 sectors in the US for the period 1989-2006. Based on GARCH approach analysis, the results revealed that in the upward regime increases in oil prices reduce the return volatility of most of the sectors, whilst in downward regime the decrease of oil price reduces volatility for all sectors not as strongly as in the case of the upward regime. Narayan and Sharma (2014) took into account listed companies on New York Stock Exchange for the period 2000-2008 dividing the sample of 540 firms into 14 sectors in order to address the relationship between oil and stock returns. A rise in the oil price generally reduces stock return volatility; however, banking firm's volatility increases. Consistent with the aforesaid, it is expected that oil prices affect socially responsible stock index returns.

As the concept of Corporate Social Responsibility (CSR) has triggered the interest of academics and business bodies, it is crucial to point out the wide range of determinants that may affect CSR performance. For instance, Ioannou and Serafeim (2012) used a sample of firms from 43 countries taking into account seven year data and found out that the political system, the labor and education system, and the cultural system are considered crucial determinants that impact CSP performance. Additionally, a number of studies have investigated the relationship between CSR performance and financial performance suggesting contradictory results (Griffin and Mahon, 1997; Roman et al., 1999). During the last two decades, analysts have changed their assessment for

companies that integrate socially responsible initiatives in their business operations from pessimistic to optimistic (Ioannou and Serafeim, 2015). Finally, a number of different determinants may affect different aspects of CSR such as sector in which companies operate (Sturdivant and Ginter, 1977; Azapagic and Perdan, 2000), size of companies (Cowen et al., 1987; Graafland et al., 2003), labor system (Baldini et al., 2016) and ownership identity (Tagesson et al., 2009).

The main contribution of our paper is that socially responsible stock index return is incorporated in order to examine the main driver of it. In addition, the investigation of CO2 as a proxy of air pollution on stock returns is relatively new. It is intended to ascertain if air pollution affects human's mood and decision investment making in relation to socially responsible stock index. A third contribution of the study is that it considers a global socially responsible stock index so as to examine the investors' behavior in relation to large in size companies that operate in different countries. Understanding the mechanism that determines socially responsible stock index returns is crucial knowledge for a variety of parties, such as corporate financial managers, portfolio managers and policy makers with a variety of implications. A GARCH model is used over DJSI World (DJSIW) which incorporates the world's leading companies in terms of economic, environmental and social criteria for the period 31 August, 1999 to 31 May, 2016 using monthly data.

The structure of the paper is organized as follows: Section 2 describes the methodology approach used in order to examine the drivers of socially responsible stock index returns along with the data used. Section 3 illustrated the main empirical results followed by discussion and the conclusion in Section 4.

2. METHODOLOGY CONSIDERATIONS AND DATA

The generalized autoregressive conditional heteroskedasticity models (GARCH) have been widely used in financial and econometric modeling since the 1980s. These models are characterized by their ability to capture volatility clustering in time-series data.

The simplest GARCH model specification is the GARCH (1, 1) model, which is stated as follow:

The mean equation:

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

where, X_t is a vector of exogenous variables;

$u_t = \sigma_t Z_t$ stands for the residual returns follow a GARCH process, where Z_t are independent and identically distributed random variables (iid) with zero mean and variance 1, and σ_t^2 is the conditional variance.

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. Where r_t = return of the asset at time t.

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 $u_{t-2}, u_{t-3}, \ldots$;

$c_1 + c_2 < 1$: 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.

This study intends to incorporate in its proposed model the socially responsible stock index returns. Undoubtedly, one of the most well-known socially responsible indexes is provided by Dow Jones called Dow Jones Sustainability Index. It provides an objective tool to investors offering global, regional and country benchmarks to manage their investment portfolios by measuring the performance of the world's leading companies in terms of economic, environmental and social criteria. In particular, in this study companies that develop operations relative to alcohol, tobacco, gambling, armaments, cluster bombs, firearms, landmines, adult entertainment, nuclear weapons, nuclear power generation and nuclear power sales are excluded (Dow Jones Sustainability Indices Methodology[1]). An important specification of DJSI is that both general and industry specific risks and opportunities are incorporated in its assessment methodology. Furthermore, the proportion of general and industrial specific criteria and their relative weights depend on the specific characteristics of industries. Each company achieve at the end of the methodological procedure a total sustainability score base of the follow formula (CSA Guide - RobecoSAM's Corporate Sustainability Assessment Methodology[2]):

Total Sustainability Score = Σ (Number of Question points received x Question Weight x Criterion Weight)

Total returns of DJSIW are retrieved by the official site of DJSI[3]. As far as TWUSDI is concerned, it is a weighted average of the foreign exchange value of the US 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. The US 10 Year Bond's value as a proxy of interest rate measures the generic government 10-year yield for US issues of treasuries. Regarding gold price, it is quoted as US Dollar per Troy Ounce. Data for TWUSDI, Bond's value and gold have been obtained from the Bloomberg online platform. CO2 is employed as a proxy for air pollution while its data were retrieved by National Oceanic and Atmospheric Administration of US Department of Commerce[4]. It should be mentioned that higher level of CO2 means higher level of air pollution. Finally, West Texas Intermediate is selected as a benchmark in oil pricing available by U.S. Energy Information Administration[5]. The sample period covers 31 August, 1999 to 31 May, 2016.

[1]Dow Jones Sustainability Indices Methodology available at: http://djindexes.com/mdsidx/downloads/meth_info/methodology-dj-sustainability-indices.pdf (accessed on 10 August, 2016)
[2]CSA Guide-RobecoSAM's Corporate Sustainability Assessment Methodology: http://www.sustainability-indices.com/images/corporate- sustai nability-assessment-methodology-guidebook.pdf (accessed on 10 August, 2016)
[3]Data for DJSI available at: http://www.sustainability-indices.com/index-values/ (accessed on 10 August, 2016)
[4]Data for CO2 available at: ftp://aftp.cmdl.noaa.gov/products/trends/co2/ co2_mm_mlo.txt (accessed on 10 August, 2016)
[5] Crude oil prices - WTI - Cushing, Oklahoma available at: https://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm (accessed on 10 August, 2016)

3. RESULTS

Table 1 presents the summary statistics for DJSIW, BOND, CO2, TWUSDI, GOLD, and OIL series. Specifically, no conclusion about the overall sign of the skewness can be concluded 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

	DJSI	*GOLD*	*BOND*	*TWUSDI*	*CO2*	*OIL*
Mean	0.002203	0.0078	-0.00584	-0.0004	0.0005	0.0039
Median	0.009766	0.0066	0	0.0006	0.0015	0.0153
Maximum	0.118495	0.1557	0.249877	0.0647	0.0064	0.2139
Minimum	-0.21986	-0.1850	-0.302891	-0.0478	-0.0065	-0.332
Std. Dev.	0.050836	0.0505	0.08412	0.0173	0.0033	0.0898
Skewness	-0.726279	-0.1222	-0.214215	0.0847	-0.5787	-0.842
Kurtosis	4.457066	3.6869	4.739226	3.5296	1.9794	4.416
Jarque-Bera	35.45109	4.45	26.87085	2.5894	19.944	40.517
Observations	201	201	201	201	201	201
Augmented Dickey-Fuller (ADF)	-12.41	-11.97	-13.93	-10.03	-4.22	-10.40

Table 2 shows the sample autocorrelation function (ACF) and partial autocorrelation function (PACF) for daily returns and squared daily returns of the DJSI series. It can be observed that the Ljung – Box statistics although provide no evidence of autocorrelation on monthly returns, present strong evidence of autocorrelations in the squared daily returns, indicating conditional heteroskedasticity (Bollerslev, 1987).

Table 2. Test for serial dependence in First and Second Moments of DJSI series

Returns				*Squared Returns*			
Lags	*Autocorrelation*	*Partial Correlation*	*LB(n)*	*Lags*	*Autocorrelation*	*Partial Correlation*	*LB(n)*
1	0.124	0.124	3.1277	1	0.276	0.276	15.542
2	-0.033	-0.049	3.347	2	0.093	0.018	17.298
3	0.131	0.144	6.9005	3	0.136	0.115	21.098
4	0.086	0.05	8.4286	4	0.185	0.13	28.222
5	0.036	0.033	8.7012	5	0.079	-0.011	29.508
6	-0.026	-0.048	8.8418	6	0.146	0.12	33.945
12	0.021	0.07	13.746	12	-0.005	0.004	41.604
24	0.053	0.04	23.9	24	-0.004	-0.02	46.274
36	-0.039	0.004	34.466	36	0.063	0.024	50.914

Notes: LB (n) are the n-lag Ljung-Box statistics for $DJSIW_t$ and $DJSIW_t^2$ 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 is low indicating that there is no tendency in the examined model to present a multicollinearity problem.

Table 3. Correlation Matrix

	DJSIW	*GOLD*	*BOND*	*TWUSDI*	*CO2*	*OIL*
DJSIW	1	-0.073	0.292	-0.356	-0.027	0.234
GOLD	-0.073	1	-0.015	-0.287	-0.0346	0.122
BOND	0.292	-0.015	1	-0.029	0.0194	0.266
TWUSDI	-0.356	-0.287	-0.029	1	0.0009	-0.381
CO2	-0.027	-0.035	0.019	0.00086	1	0.201
OIL	0.234	0.122	0.266	-0.381	0.201	1

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

Mean equation:

$$DJSIW_t = b_1 + b_2 GOLD_{t-1} + b_3 BOND_t + b_4 TWUSDI_4 + b_5 CO2_{t-2} + u_t \quad (3)$$

Variance equation:

$$\sigma_t^2 = c_0 + c_1 u_{t-1}^2 + c_2 \sigma_{t-1}^2 + c_3 OIL_t \quad u_t \sim \text{GED}(0, \sigma_t^2), \tag{4}$$

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 v=0.91 for tail thickness regulator with 0.186 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. In LR test of the restriction v=2 (for v=2 the GED distribution is essentially the normal distribution) against the unrestricted models 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	-0.043	-0.043	0.3692	1	0.057	0.057	0.6461
2	-0.046	-0.048	0.7967	2	0.045	0.042	1.0589
3	0.09	0.086	2.4333	3	0.136	0.132	4.8477
4	0.092	0.098	4.1618	4	0.078	0.064	6.106
5	0.06	0.078	4.91	5	0.076	0.061	7.3103
6	0.013	0.02	4.9424	6	0.058	0.031	8.0057
12	0.005	-0.013	9.5667	12	0.063	0.014	16.654
24	0.125	0.143	24.021	24	0.027	0.055	21.354
36	-0.03	0.006	30.048	36	-0.068	-0.051	28.712

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 gold prices are statistically significant at 1% level (p-value = -0.17) suggesting that increase of gold prices leads to higher levels of DJSIW returns. In addition, results show that the mean return of the DJSIW series had statistically significant higher return at the 1% level when the returns of ten years bond have increased. Thus, it is confirmed the inverse relationship between socially responsible stock index returns and interest rate. Moreover, the dollar value to major currencies has a statistically negative effect on DJSIW returns at 1% level. Finally, air pollution exerts a statistically negative contribution to DJSIW at 1% level suggesting that when the air pollution is worsen investors tend to sell equities reveling the effect of pollution on human mood and decision investment making process.

In Table 6 the results for the variance equation are presented. The value of the c_2 coefficient (0.576), which reflects the influence of σ_{t-1}^2, i.e. the older information (residuals u_{t-2}, u_{t-3}, …), 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 $c_1 + c_2 = 0{,}139 + 0.576 = 0.715$ 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 increase of oil prices exerts negative effect on DJSI return series. Possible explanation of this stabilizing effect is the increase of oil prices is associated with the reduced economic uncertainty. The increase of oil prices can be a sign for investor of economic growth which leads to lower level of DJSIW returns risk.

Table 5. Mean equations

$$DJSIW_t = b_1 + b_2 GOLD_{t-1} + b_3 BOND_t + b_4 TWUSDI_4 + b_5 CO2_{t-2} + u_t$$

b_1	b_2	b_3	b_4	b_5
0.008139*	-0.178395*	0.206817*	-0.8502*	-1.96067*
(0.002598)	(0.053378)	(0.032958)	(0.14918)	(0.72256)

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

Table 6. Variance Equations

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

c_0	c_1	c_2	c_3
0.001525*	0.13977**	0.576831*	-0.01793*
(0.000485)	(0.059605)	(0.092372)	(0.006983)

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

4. DISCUSSION AND CONCLUSION

Unlike to conventional investments, SRI is an investment that takes into account social, environmental or other ethical considerations within the context of rigorous financial analysis. A number of empirical studies has been focused on the determinants of conventional stock index returns. However, the luck of studies focused on socially responsible indexes have triggered the interest to examine their main driver. For the purpose of this study, DJSI was used to identify socially responsible companies according to economic, environmental and social criteria. In particular, the DJSIW is used in the proposed model incorporating the top 10% of the largest 2,500 companies in the S&P Global BM. As far as the drivers of DJSIW are concerned, four main variables are, gold, US dollar value to major currencies, interest rate and air pollution, whilst oil price is examined whether it affects the volatility of DJSIW returns.

By employing GARCH model, the results revealed that gold variable affects the DJSIW returns negatively consistent with Baur and Lucey (2010). Evidence was found that gold acts as a safe haven for socially responsible stock market. This result is crucial to investors as they elaborate their knowledge in relation to portfolio management. In particular, higher gold prices send a signal to investors that the general market conditions are worsen affecting investor's behavior and portfolio managers adjusting their portfolios by selling shares, a fact that works also vice versa. For the first time the empirical literature regarding the relationship between gold and socially responsible stock returns is empowered by providing a negative relationship between them. Socially responsible investors should consider gold prices as a crucial determinant for predicting socially responsible stock returns. Additionally, gold can be used as hedge against stock returns because of the negative relationship with stock returns giving the opportunity to risk analysts to formulate their strategy in relation with socially responsible stock returns.

The US dollar value to major currencies has a negative effect on DJSIW returns. The strong US dollar currency reflects the healthy US economy which in turn reflects the prospects for the global economy as the US dollar currency use in international transaction has increased since the post-World-War-II era (Carbaugh and Hedrick, 2009). Despite the fact that the US dollar value can be used as a sign of the global health, the results illustrated a negative effect on returns. As USA is among the largest exports economies in the world, when the US currency is getting stronger the US exports are becoming more expensive which decreases corporate earnings. The result obtained from this study intends to shed light on the effect of the US dollar value to socially responsible stock returns. Thus, governmental authorities should be very cautious in relation of exchange policy since it affects the socially responsible stock market inducing investors' profits or losses.

The US 10 Year Bond's value is used as a proxy for interest rate while bond value and interest rate has an inverse relation. The results revealed a negative effect of interest rate on DJSIW consistent with Elyasiani and Mansur (1998). Variations of interest rate affect not only consumers but the investor's behavior as well. The increase of interest rate leads to stock returns of companies fall as future cash flow of firms is affected negatively which in turn leads to reduced firms' profits which in turn decrease the dividends to shareholders.

In addition, it is found that air pollution in terms of CO2 affects negatively the DJSIW consistent with Levy and Yagil (2011) and Lepori et al. (2016). This implies that when the air pollution is worsen the human mood is depressed which in turn affects the decision making process of investors by selling shares. This implies that important investment decisions are under the influence of intense emotion derived by air pollution. From a theoretical point of you, the results confirm that air pollution level affects investors' mood in different ways and considered as a stressor leading to physical and psychological responses (Evans et al., 1987). In addition, this study confirms the significant role of air pollution and economic consequences established by economists (Levy and Yagil, 2011). Thus, investors are able to predict stock returns in relation to air pollution devising an investment strategy along with conventional ones.

Finally, the results showed that oil prices have a stabilized effect on the conditional variance of the DJSIW returns consistent with Hammoudeh et al. (2004). On the one hand, the increase of oil prices reflect the optimist business environment for the global companies which in turn affects the investor's behavior restricting the volatility of DJSIW returns. On the other hand, the decrease of oil prices increase the pessimism for the global economy leading to higher levels of uncertainty of DJSI returns. Thus, these results filled the gap regarding oil prices on socially responsible stock market illustrating that the oil price increase is considered as a factor with a stabilizing effect on the variance of socially responsible stock returns. This view is particularly of paramount significance since it presents to investors how vital global commodities for economic growth such as oil affect the socially responsible stock returns a fact that has significant implications for strategic long or short term portfolios.

Future studies may extend this approach by investigating specific countries in order to elicit homogeneous results and compare the results among different countries. In addition, future studies should compare simultaneously both a conventional and socially responsible stock index so as to identify similarities and differences of the investors' behavior.

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