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## A GARCH Examination of Macroeconomic Effects on U.S. Stock Market: A Distinction Between the Total Market Index and the Sustainability Index

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**Abstract:**

*The paper examines the impact of several macroeconomic variables on the Dow Jones Sustainability and Dow Jones Wilshire 5000 indexes, using a GARCH model and monthly data for the period January, 2000 to January, 2008. The results show that changes in returns of crude oil prices affect negatively the U.S. stock market, contrary to changes in returns of the 10-year bond value that affect it positively. Both economic indicators influence the DJSI with a month delay. Also, the exchange rate volatility affects negatively the returns of the U.S. stock market and the non-farm payroll can be characterised as a stabilising factor for the DJSI.*

**Keywords:** *Corporate Social Responsibility, Dow Jones Sustainability Index, GARCH, macroeconomic indicators.*

**JEL:** *G12, G15, C30*

### 1. Introduction

A large number of studies have investigated the relationship between stock returns and macroeconomic variables. Samitas and Kenourgios (2007) investigated whether long and short run stock returns in four European countries are affected by current and future domestic and international macroeconomic variables. Chen et al. (1986) explored the impact of economic variables in stock returns and their influence on asset price. Islam (2003) investigated the relationship between macroeconomic indicators (interest rate, inflation rate, exchange rate and the industrial productivity) and the Kuala Lumpur Stock Exchange (KLSE) Composite

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Index. Günsel and Çukur (2007) investigated seven macroeconomic variables (interest rate, unanticipated inflation, unanticipated sectoral industrial production, risk premium, exchange rate, money supply and unanticipated sectoral dividend yield) on London Stock Returns. The authors consider the crude oil price, the Yen/U.S. dollar exchange rate and the 10 year bond value (as a measure of interest rate) to be indicators for further investigation of the U.S. stock market.

With regard to the bond value as a measure of interest rate, Shanken (1990) found that nominal T-bill yields are negatively correlated with future stock returns. Stivers and Sun (2002) investigated the behavior of stock market returns and Treasury bonds returns during periods of stock market uncertainty, employing daily data for the period 1988 to 2000. In uncertain periods for stock markets the two variables are moving together. Nevertheless, the stock and Treasury bond have little relation or even a negative relation in periods of high stock market uncertainty. Joseph (2002), concentrating in chemical, electrical, engineering and pharmaceutical industries in the U.K., investigated the relationship between stock returns and exchange rate and interest rate. The results show that exchange rate changes have less impact than interest rate changes on stock returns. Hyde (2007) examining the response of industry stock returns to exchange rate and interest rate risks in four European markets, France, Germany, Italy, and the U.K., has found significant levels of exposure to interest rate only in Germany and France. Elyasiani and Mansur (1998), employing a GARCH-M methodology and using monthly data from January 1970 to December 1992, supported that long-term interest rate has a negative impact on the bank stock returns on the U.S. market. Léon (2008), using the KOSPI 200 and the NCD 91-day yield weekly returns from 31 January 1992 to 16 October 1998, claimed that interest rates have a positive impact on stock returns.

It is generally believed that the crude oil prices affect substantially the U.S. economy (Brown and Yucel, 2002; Sadorsky, 1999). Hamilton (1983) illustrated that oil price increases were responsible for every eight post-World War II U.S. recession except one and concluded that declines in real GNP derived from oil prices from 1948 to 1980. Kling (1985), studying oil price shocks and stock-market behavior, concluded that crude oil price increases and stock market have a negative relationship. Jones and Kaul (1992), focusing on the U.S. market, concluded that the oil prices affected the stock returns for the period 1947 to 1991. Similarly, Jones and Kaul (1996) found that both current and lagged oil prices affected negatively stock returns in the U.S. and Canada markets for the period 1947 to 1991. Sadorsky (1999) provided evidence that aggregate stock returns are affected by shocks of oil prices. The stock prices decline after the 1973-74 oil crisis can be explained by the increase of oil prices documented in Wei (2003). On the contrary, Huang et al. (1996), using a VAR framework, investigated the relationship between daily oil futures returns and U.S. stock return. The results show that oil futures returns and oil company returns are correlated while there is no significant correlation with return of stock market indices such as the S & P 500. Maghyreh (2004), investigating 22 emerging markets, found that oil price changes do not affect the stock returns.

In reference to the exchange rate, Jorion (1990) supported that the relationship between stock returns and exchange rate movements is hardly significant. Aggarwal (1981) supported that changes in exchange rates could change the stock prices. Chamberlain et al. (1997) concluded that the stock returns of U.S. bank sector were sensitive to exchange rates contrary to the Japanese bank sector. Bodnar and Gentry (1993) reported that 11 out of 39 U.S. industries, 4 out of 19 industries in Canada and 7 out of 20 in Japan face significant exposure to exchange rate. Bartov and Bodnar (1994) mentioned that a clear link between stock returns and exchange rate is not obvious; however, there is a lagged relationship between them. Bartram (2004) concluded that the relationship between stock returns and exchange rate movements is non linear. Finally, Islam and Watanapalachaikul (2003) showed significant long-run relationship between exchange rate, interest rate, bonds price and stock prices in the Thailand market for the period 1992-2001.

The announcements of the non - farm payroll (all employees) is considered one of the most important variables of the markets (Andersen and Bollerslev, 1998). It is a variable that measures the number of employees on firms' payrolls. There are four groups of employment that are excluded: general government employees, private household employees, employees of nonprofit organizations that provide assistance to individuals and farm employees (Bank of San Francisco, 2004). The literature review that relates non-farm payrolls and stock market returns is not extensive. Lucey et al. (2008) illustrated that increases in U.S. non-farm payroll have a significant impact on Britain's stock market returns.

This paper examines the impact of economic variables on the formation of DJSI U.S. and DJW 5000 Composite Index returns using a GARCH model. The first index includes companies that integrate Corporate Social Responsibility (CSR) standards in their operations while the second stock index represents all U.S. equity securities. The contribution of this study to the literature is twofold. Firstly, the examination of macroeconomic impact on stock index of companies which apply CSR is considered for the first time and secondly the differences that exist between the two different types of stock market in terms of CSR are recorded.

The literature review of the relationship between crude oil, Yen/U.S. dollar exchange rate, non-farm payrolls and 10 year bond value was illustrated in section 1. Section 2 presents the stock indexes that are adopted by authors, followed by data collection in section 3. The methodology and empirical findings of the study are presented in section 4 and, finally, the conclusions in section 5.

## **2. Stock indexes**

### **2.1 Social Responsible Investment indexes**

The concept of Social Responsible Investment (SRI) has been well defined by Social Investment Forum (2006) as “an investment process that considers the social and environmental consequences of investments, both positive and negative, within the context of rigorous financial analysis”. Sparkes (2002) connects the concept of CSR and SRI: “...CSR and socially responsible investing are in essence mirror images of each other. Each concept basically asserts that business should generate wealth for society but within certain social and environmental frameworks. CSR looks at this from the viewpoint of companies, SRI from the viewpoint of investors in those companies”.

Generally, SRI is the process which identifies and invests in companies that implement CSR standards. In this way, investors can combine the financial objectives and social concerns, investing in SRI indexes such as the Dow Jones Sustainability Indexes (DJSI), the Ethibel Sustainability Index, the Calvert Social Index, the FTSE4Good Index, KLD - Domini 400 Social Index, the Advanced Sustainable Performance Indices, the JSE SRI Index, the Maala Index and the Jantzi Social Index. All SRI indexes propose their own methodology according to their perceptions in order to assess the CSR. The SRI indexes face different challenges, such as lack of transparency, and propose general criteria that are applicable to all sectors, not corresponding to characteristics of each country. Although the new legal and regulatory (Sarbanes - Oxle, OECD Principles of Corporate Governance) environment have established a trend in creating a new stable capital market environment, to enhance transparency and to make corporations more social responsible (Lazarides, 2007). The authors selected the DJSI as a more complete approach for the CSR contrary to most of the studies that adopt the KLD - Domini 400 Social Index. Additionally, the DJSI's assessment methodology covers the main dimensions of the CSR, taking into account different sources. Finally, not only does it propose a core of criteria that are applicable to all type of sectors but it also contains specific criteria relevant to specific sectors, taking into account the challenges and trends of each one.

### **2.2 The Dow Jones Sustainability Indexes**

The DJSI is divided in five different benchmarks: the global, the European, the Eurozone, the North American and the U.S., tracking the performance of companies that lead in the field of CSR. DJSI mentions that corporate sustainability is a business approach that creates long term for the shareholder value, taking into account opportunities and managing risks derived from economic, environmental and social developments. None of the sectors is excluded by DJSI, however, there are specialized sub indexes that exclude alcohol, tobacco, gambling, armaments & firearms companies. The DJSI U.S. is assessed in three distinct sections including an

economic, environmental and social dimension. Each of the dimensions contains a number of sub dimensions with numerous criteria. The composition of DJSI U.S. is changed yearly and is announced in the first week in September and implemented on the third Friday of September (DJSI, 2008b). The DJSI U.S. includes companies that operate in the U.S. and were introduced for the first time on September 23<sup>rd</sup>, 2005. At the end of February of 2008 the DJIS U.S. contained 98 companies from various sectors as such technology, industrials, consumers' services and goods and financials (DJSI, 2008a).

### **2.3 Dow Jones Wilshire 5000 Composite Index**

The Wilshire Associates is a leading investment services and consulting firm which is responsible for calculating and maintaining the Dow Jones Wilshire (DJW) 5000. The name is derived from the 5,000 stocks approximately that are included in the index. The DJW 5000 contains companies that trade in various markets such as the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and the Nasdaq National market. It represents all U.S. equity securities that have readily available prices. The weight of the components is based on full market capitalization and float-adjusted market capitalization reflecting the real number of shares that are available to investors. The composition of the DJW 5000 is reviewed monthly after the close of the third Friday of the month and pre-announced of the 2nd day prior to the implementation date (Dow Jones Indexes).

### **3. Data**

Monthly data of the DJSI (U.S.), DJW 5000 (U.S.), 10 years Bond, Yen/U.S. dollar exchange rate and non farm payrolls (U.S.) for the period 1 February 1999 through 31 January 2008 have been considered for the study. The data of the month closing prices for the DJSI United States are collected from the official web site of Dow Jones Sustainability Indexes, for the DJW 5000 Total Market Index (U.S.) is provided by the Dow Jones Indexes, while the 10 year bond return is available on Bloomberg, the Yen/U.S. dollar exchange rate and total non-farm payrolls (all Employees) are provided by the Federal Reserve Bank of St. Louis and finally the crude oil prices are provided by the Energy Information Administration (Official Energy Statistics from the U.S.A. Government).

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. Preliminary diagnostic tests show that the same month returns of the crude oil price ( $RCO_t$ ) and 10 years Bond prices ( $RB_t$ ) affect the DJW 5000 ( $RDW_t$ ) while the previous month returns of the crude oil price ( $RCO_{t-1}$ ) and 10 years Bond prices ( $RB_{t-1}$ ) influence the returns of the DJSI U.S. ( $RD_t$ ). Moreover, it was found that the volatility of the Yen/U.S. dollar exchange rate returns ( $RY^2_t$ ) affects the returns series of the  $RD_t$  and  $RDW_t$ . It should be noted that at the 1%

significance level the hypothesis that the mean return of the  $RY_{t-1}^2$  is equal to zero is not rejected, which implies that  $\sum [RY_i - E(RY)]^2 = \sum RY_i^2$ . Therefore, the squared returns of the  $RY_{t-1}$  were used as proxy variable for the volatility of Yen/U.S. dollar exchange rate.

#### 4. Methodology and Empirical Findings

Table 1 presents the summary statistics for  $RD_t$ ,  $RDW_t$ ,  $RCO_t$ ,  $RB_t$ ,  $RY_t^2$ , and  $RP_t$  (non-farm payrolls) series. Specifically, the zero mean hypothesis cannot be rejected for the returns series of  $RD_t$ ,  $RDW_t$ ,  $RCO_t$ ,  $RB_t$  while the sample means returns of  $RY_t^2$  and  $RP_t$  are positive and statistically significant. Also, according to the Jarque-Bera statistics and the value of kurtosis<sup>e</sup>, there are significant departures from the normality hypothesis only for the  $RY_t^2$ ,  $RB_t$  series. Moreover, the Dickey-Fuller test, employed to determine whether there is a unit root, suggested that the return series have been produced by stationary series.

Table 2 shows the sample autocorrelation function (ACF) and partial autocorrelation function (PACF) for monthly returns and squared monthly returns for of the  $RD_t$ , and  $RDW_t$  variables. It can be observed that while there is no significant autocorrelation in simple returns at any lag, there is generally a significant autocorrelation in squared monthly returns at all lags.

**TABEL 1: Sample statistics for  $RDS_t$ ,  $RDW_t$ ,  $RCO_t$ ,  $RB_t$ ,  $RY_t^2$ , and  $RP_t$  series.**

Statistics	DJSI	DJW5000	CRUDE OIL	BOND	(Yen/Dollar) <sup>2</sup>	PROLIS
Observations	95	95	95	95	95	95
Mean	0.0011	0.0003	0.0121	-0.0060	0.0005	0.0006
Median	0.0000	0.0095	0.0200	-0.0086	0.0002	0.0006
Std. Dev.	0.0428	0.0415	0.0766	0.0615	0.0006	0.0012
Skewness	-0.3258	-0.5561	-0.5677	0.7333	1.5222	-0.2356
Kurtosis	3.3127	3.1194	2.8576	4.6949	4.3209	3.0566
Jarque-Bera	2.0679	4.9522	5.1825	19.8856	43.5962	0.8918
Augmented Dickey-Fuller (ADF)	-10.123	-9.198	-9.256	-8.504	-9.863	-3.972

<sup>e</sup> For normal distribution the value of kurtosis is three.

**TABEL 2: Test for serial dependence in First and Second Moments of  $RDS_t$  and  $RDW_t$**

	Returns				Squared Returns		
	Lags	Auto-correlation	Partial Auto-correlation	LB(n)	Auto-correlation	Partial Auto-correlation	LB(n)
DJSI	1	-0.032	-0.032	0.1007	0.255	0.255	6.3691
	6	0.11	0.094	5.6852	0.421	0.346	42.45
	12	-0.065	-0.086	9.9695	0.259	0.053	64.719
	24	0.091	0.061	23.136	0.007	-0.13	90.512
	36	-0.017	0.074	28.164	-0.082	-0.074	99.789
DJW 5000	1	-0.032	-0.032	0.1007	0.156	0.156	2.3709
	6	0.11	0.094	5.6852	0.168	0.089	23.357
	12	-0.065	-0.086	9.9695	0.243	0.092	50.801
	24	0.091	0.061	23.136	0.006	-0.027	79.361
	36	-0.017	0.074	28.164	-0.091	-0.141	87.588

*Notes: LB(n) are the n-lag Ljung-Box statistics for  $RDS_t$ ,  $RDS_t^2$ ,  $RDW_t^2$  and  $RDW_t^2$  respectively. LB(n) follows chi-square distribution with n degree of freedom; the sample period contains 95 monthly returns.*

In order to take into account the autocorrelation structure in squared returns of the  $RD_t$  and  $RDW_t$  dependent variables, the GARCH (generalized autoregressive conditional heteroskedasticity) process has been used. Financial models such as ARCH (Engle, 1982) and generalized ARCH (Bollerslev, 1986) are able to capture volatility clustering and predict the volatility. Specifically, the ARCH model allows the conditional variance of a time series to change over time as a function of past squared errors by imposing an autoregressive structure on conditional variance and allowing volatility shocks to persist over time. Bollerslev (1986) extends the ARCH process to GARCH, which for more flexibility in the lag structure. Empirical research has found evidence of large changes in stock prices followed by small changes of either signs. Therefore, the GARCH models, which take into account the volatility-clustering phenomenon of security prices, are more suitable in modelling volatility of financial assets and macroeconomics variables like the 10 year bond, exchange rates and so on.

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

$$\text{The mean equation } Y_t = X_t' \theta + u_t \quad (1)$$

Where  $X_t$  is a vector of exogenous variables.

$$\sigma_t^2 = a_1 + \alpha_2 u_{t-1}^2 + a_3 \sigma_{t-1}^2 \quad (2)$$

where the parameters  $\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$  satisfy  $\alpha_1 > 0$ ,  $\alpha_2 \geq 0$  and  $\alpha_3 \geq 0$  and are explained as follows:

$\alpha_1$ : A constant term.

$\alpha_2 u_{t-1}^2$  (the ARCH term): News about volatility from the previous period are measured as the lag of the squared residual  $u_{t-1}^2$  from the mean equation.

$a_3 \sigma_{t-1}^2$  (the GARCH term): Last period's forecast variance as a function of the past residuals  $u_{t-2}, u_{t-3}, \dots$ ,

The Integrated Generalized Autoregressive Conditional Heteroscedasticity (IGARCH) is a restricted version of the GARCH model (Engle, 1982 and Bollerslev, 1986). In this model the sum of the persistent parameters sum up to one, and therefore there is a unit root in the GARCH process and stated as:

$$\sigma_t^2 = \alpha_2 u_{t-1}^2 + a_3 \sigma_{t-1}^2 \quad (3)$$

The IGARCH-models imply that shocks to the series affect all future horizons. That is, the IGARCH model is characterised by infinite memory. Although the assumption of short memory, such as in GARCH models is usually not fulfilled the implications of IGARCH-models are too strong regarding the empirical findings.

The preliminary statistical analysis 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  $RD_t$  and  $RDW_t$  series.

For the DJSI U.S.:

Mean equation:

$$RD_t = b_1 + b_2 RCO_{t-1} + b_3 RB_{t-1} + b_4 RY_t^2 + u_t \quad (4)$$

Variance equation GARCH(1,1):

$$\sigma_t^2 = a_1 + a_2 u_{t-1}^2 + a_3 \sigma_{t-1}^2 + \alpha_4 RP_t \quad (5)$$

$$u_t \sim N(0, \sigma_t^2)$$

For the DJW 5000 (U.S.):

Mean equation:

$$RDW_t = b_1 + b_2 RCO_t + b_3 RB_t + b_4 RY_t^2 + u_t \quad (6)$$

Variance equation IGARCH(1,1):

$$\sigma_t^2 = a_1 + a_2 u_{t-1}^2 + a_3 \sigma_{t-1}^2 + \alpha_4 RP_t \quad (7)$$

$$u_t \sim N(0, \sigma_t^2)$$

The estimations of the mean and the conditional variance of the return series are based on the following variables:

- $RCO_t$  reflects the returns of crude oil.
- $RB_t$ , reflects the returns of the 10 year bond and, indirectly, the changes of the interest rate.

- $RY_t^2$  reflects the volatility of the Yen/U.S. dollar exchange rate returns
- $RP_t$  is the variable which measures the non - farm payrolls in the U.S.

Diagnostic tests for the appropriateness of the GARCH (1,1) and IGARCH (1,1) specifications are based on the LB and Jarque-Bera statistics. The results show that the GARCH (1, 1) and IGARCH (1,1) fit the data, given that none of the LB statistics of the standardized residuals and the standardized squared residuals are significant (Table 3 and Table 4). Also, with the application of the Jarque-Bera test (1.287 for the  $RD_t$  and 2.97 for the  $RDW_t$ ) it was found that the normality of the residuals  $u_t$  cannot be rejected.

**TABLE 3: LB test for the standardized residuals of the GARCH (1, 1) model**

	Residuals				Squared Residuals		
	Lags	Auto-correlation	Partial Auto-correlation	LB(n)	Auto-correlation	Partial Auto-correlation	LB(n)
DJSI	1	-0.127	-0.127	1.5724	0.065	0.065	0.4121
	6	0.006	0.028	2.2074	0.226	0.208	10.921
	12	-0.039	-0.021	3.5071	0.117	0.032	15.535
	24	0.066	0.075	7.572	-0.079	-0.075	20.721
	36	-0.056	-0.003	18.365	0.108	0.185	27.405

*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 94 observations.*

**TABLE 4: LB test for the standardized residuals of the IGARCH (1, 1) model.**

	Residuals				Squared Residuals		
	Lags	Auto-correlation	Partial Auto-correlation	LB(n)	Auto-correlation	Partial Auto-correlation	LB(n)
DJW5000	1	0.084	0.084	0.6877	-0.094	-0.094	0.8646
	6	0.134	0.061	11.078	0.022	0.004	3.3799
	12	0.024	0.002	14.218	-0.038	-0.041	4.898
	24	-0.027	0.007	20.945	-0.069	-0.141	18.938
	36	-0.096	0.007	30.257	0.082	0.018	27.001

*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 94 observations.*

In Table 5 the results for the mean equations are presented. The statistically significance of the  $b_2$  coefficient indicates that the increase of crude oil returns ( $RCO_{t-1}$ ) have almost the same negative effect on the conditional mean returns of the dependent variables. The crude oil is a basic cost variable in most companies and as a result its increasing price affects their profits and thus their stock returns. Regarding the effect of the Bond value, variation in real interest rates induces a positive correlation between stock and bond returns since the prices of both assets are effected by changes of the discount rate. The lag effect of interest rates and crude oil returns in the DJSI model can be attributed to the investors' behavior to macroeconomic variable changes and more specific they take into account the trend of these variables. Investors seem to delay their investment decisions in order to realize whether the economic variables are permanent or temporary, as Günsel and Çukur (2007) suggest. The different reaction of the two stock indexes is due the fact that the investors of the DJSI U.S. seem to be more cautious than the investors of the DJUSL and the DJUSM. They believe that these types of companies are more secure to invest because most of the time they appeared to have a stable stock market reaction, efficient management structures (Syriopoulos, 2007) and positive relationship with financial performance. Therefore, investors are interested in those companies for long term investments. Bloom et al. (2006) support this view that investors prefer to invest their money in secure economies.

Finally, the volatility of the Yen/U.S. dollar exchange rate returns ( $RY^2_t$ ) exerts negative influence on the conditional mean returns of the dependent variables. This can be explained by the fact that the volatility of Yen/U.S. dollar weakens the confidence in U.S. values and generally in the U.S. market, creating an unstable environment for companies.

In Table 6 the results of the variance equations are presented. The  $\alpha_2$  coefficient, which captures the impact of previous month news on current conditional variance, does not appear statistically significant for the DJSI and marginally not significant for the DJW 5000. The value of the  $\alpha_3$  coefficient, which reflects the influence of  $\sigma^2_{t-1}$  (the older information residuals  $u_{t-2}, u_{t-3}, \dots$ ), is positive and statistically significant for all indexes, implying that the volatility shocks (information) are slowly assimilated in the U.S. market. Moreover, the coefficient  $a_4$ , which measures the impact of the non-farm payrolls ( $RP_t$ ) returns on the variance equation, is negative and statistically significant for the DJSI. This implies that news about added employees in the U.S. economy affects the investors' sentiment for the social responsibly companies diminishing the level of conditional volatility, as the employment is responsibility of CSR. Finally, in the IGARCH(1,1) model the sum of the ARCH and GARCH estimates ( $a_2+a_3$ ) suggests that the conditional variance is non-stationary in covariance, which means that shocks have a permanent effect on volatility.

**TABLE 5. Mean equations**

	b <sub>1</sub>	b <sub>2</sub>	b <sub>3</sub>	b <sub>4</sub>
DJSI	0.0148* (0.0044)	-0.1101* (0.0443)	0.1032** (0.0531)	-22.61* (5.11)
DJW5000	0.0125* (0.00455)	-0.1008** (0.0524)	0.2138* (0.0507)	- 12.11** (4.977)

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

**TABLE 6: Variance Equations**

	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>
DJSI	0.000816*** (0.00045)	0.0602 (0.0769)	0.4993*** (0.2680)	- 0.3793** (0.1603)
DJW5000	- -	0.1165 (0.0715)	0.8835* (0.0715)	-0.00144 (0.0161)

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

## 5. Conclusions

This study examines the role of macroeconomic factors in U.S. stock market using a GARCH model. Specifically, we have examined the influence of the crude oil returns, Yen/U.S. dollar exchange rate, 10 year bond value and non-farm payrolls variables on companies that integrate CSR activities (DJSI U.S.) and all U.S. equity securities. The findings show that the crude oil returns affects negatively the U.S. stock returns, contrary to the 10 year bond value that affects them positively. Additionally, the DJSI U.S. reacts with a month delay in changes of the crude oil and the 10 year bond returns. This does not mean that the market for these companies is inefficient. Probably, the investors' sentiment about the stability of companies which integrate CSR is such that they wait for the realization of possible trends of economic variables in order to decide for their investments.

Also, the results showed existence of a negative relationship between the U.S. stock market and the exchange rate Yen/U.S. dollar fluctuations. Finally, the stabilizing effect of the non-farm payroll on the DJSI U.S., at the macroeconomic level, can be attributed to the relation between corporate social performance and employment indicators which have already been observed by Brammer et al. (2005) at the microeconomic level.

This research contributes to the managerial science as it will provide scientific elements to identify and validate the effects of some macroeconomic variables over the stock market performance. Therefore, more efficient risk measurement models could be established and will allow greater confidence levels to the decision making process in stock market investments.

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