DOES THE SRI STOCK INDEX RETURN CO-MOVEMENTS: EVIDENCE OF THE FTSE STOCK MARKETS

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Keywords	ABSTRACT
SRI, FTSE, Cointegration, VECM	This paper investigates the long-run equilibrium relationship among the FTSE SRI stock index return markets by using the Johansen cointegrtion and VECM model. The empirical results indicated that there is a long-run cointegration relationship among them and the coefficient of the speed of adjustment in FTSE stock index return is negative significant. The show that these stock index return markets are significantly adjusted to disequilibrium from the long-run relationship. According to the variance decomposition analysis, the empirical results stated that the FTSE4 Good index exhibit the significant explanation power to other markets. Next, the empirical results of impulse response analysis display that uni- and bi-directional causality between FTSE stock index return markets. Finally, according to above results, the FTSE stock index return markets can quickly respond to the information from others which show that markets are efficiency. Therefore, investors should respond to the information from others when they are making investment. The efficiency market hypothesis is supported by this analysis.
JEL Classification C58, F36, G13	

1. INTRODUCTION

In recent years, the research into the area of Corporate Social Responsibility(CSR) has generated considerable interest among academic and practitioners over the past decades. Based on the portfolio theory, a lot of investors will see to reduce the risk through diversification and to maximize the returns through socially responsible investment. At the same time, the CSR investment gives the individual and institutional investors have the chance to meet their needs and objectives. Therefore, the socially responsible investment. Recently, large institutional investors are placing a greater emphasis on investing in firms that CSR activities(Guenster et al, 2011, Omid Sabbaghi,2013). The commission of the European Comities(2001) defines CSR "is a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis." Another widely definition come from the World Business Concul (1999) for sustainable development, which stated that CSR "is the continuing commitment by business to contribute to economic development while improving the quality of life of the workforce and their families as well as of the

community and society at large. Another well-cited definition of CSR is Caroll (1999), who argued that companies have economic, legal, ethical and discretionary responsibility. Social Responsible Investing (SRI) has attracted significant interest for several years around the world as many non-governmental organizations, governments, scholars and practitioners are involved in its promotion. SRI is a kind of investment process that integrates social environmental and ethical considerations into the investment decision-making process. Social Investment Forum (2006) well defined the concept of SRI as "an investment process that considers the social and environmental consequences of investments, both positive and negative, within the context of rigorous financial analysis". Generally, SRI is the process which identifies and invest in company that implement CSR standards. In the past two decades, SRI has changed from an activity carried out by a small number of specialist retail investment funds into an investment philosophy adopted by a growing proportion of large investment institutions, i.e., large pension funds and insurance company(Sparkes and cowton,2004, Eduardo et al.,2013). Generally, SRI is the process which identifies and invests in companies that implement CSR standards. In this way, investors can combine the financial objective and social concerns, investing in SRI index(NiKolaos,2010). To address our research, we need a reliable and comprehensive definition of the term SRI. SRI is a kind of investment process that integrates social, environmental and /or ethical considerations into the investment "decision-making" process. The development of the SRI is associated with the growing awareness among investors, companies, and governments in regard to the impact that social and environmental risks may have on long-term issues ranging from sustainable development to long term corporate performance(Eurosif, 2008).

The CSR Europe (2003) mentions the SRI in order to describe investment decisions informed by CSR considerations. SRI combines investors" financial objectives with their concerns about social, environmental and ethical issues. Finally, Sparkers(2002) stated that CSR and socially responsible investing are in essence mirror images of each other, each concept basically asserts that business should generate wealth of society but within certain social and environmental frameworks,CSR looks at this from the viewpoint of companies. This paper try to use the VECM model to find out does the SRI stock index return comovement together in the long run or not. According to the empirical results of VECM, we find that negative and significant effect of the lagged error correction term among stock markets which indicated that FTSE SRI stock index return exhibit long-run equilibrium relationship and comovement together by the short run adjusted the disequilibrium to the long-run equilibrium. The remainder of this paper is organized as follows. Section 2 provides a review of the related literature, while section 3 describe the theory adopted related to this study. In section 4 we present the methodology and data. Section 5 the empirical results are discussion at here. Finally, in section 6 we summarize our conclusions. The objective of this paper try to use the VECM model analyze the FTSE SRI stock index return is there any long-run relationship between them. Besides that, the variance decomposition and impulse response analysis show that the FTSE SRI stock index markets estimate the relative contribution of structural shock to the variation and trace the dynamic response to the effect in one variable upon itself and on other variables.

2. LITERATURE REVIEW

The stock market integration hypothesis stated that there were potential gains from international portfolio diversification if returns from investment in different national stock markets are not perfectly correlated. This implies that low levels of co-movement of stock price offer investors the benefit of diversifying their holdings across the global stock markets. That is, investors who allocated some of their portfolio to share from other countries can increase the portfolio expected return with no increase in risk. The relationship between international stock price returns integrated have been investigated extensively(i.e, Stulz 1981, Jorion & Schmartz 1986, Taylor and Tonks 1989, Jeon and Von-Furstenberg 1990, Arsharapalli and Doukas, 1993, Cheung and Ng 1992, Koop 1994, Lee and Kim 1994, Chowdury 1994, Arshanapalli, Doukas and lay 1995, Hassan and Naka 1996, Chaudhuri 1997, Lenchman 1998, Chen et al. 2002, Diamands 2008, Wong et al. 2005, Hoqut 2007, Li and Majerowskn 2008, Menon er al. 2009, Bastos and Caiado 2010, Park 2010, Subhani et al. 2011, Horvah and Petrovski 2012, Tripathi and Sethi 2012, Thomas Dimpfl 2014, Srimivsan et al 2014).

Some recent papers focus on the relationship of macroeconomic variables between SRI index, for example, Nikolaos et al.(2010) using a GARCH model and monthly data examines the impact of several macroeconomic variables on Dow Jones sustainability and Dow Jones Wilshire 5000 indexes. The results show that changes in returns of crude oil prices affect negatively the U.S. stock market. Nikolas et al (2009) used GJR-GARCH model investigated the relationship between 10 year bond value, Yen/US dollar exchange rate, non-farm payrolls and crude oil to U.S. Dow Jones sustainability index. Results show that an increase of the 10 year bond and non-farm payrolls lead to an increase of the DJSI returns. Hussen (2004) used the Sharpe, Jansen and Treynor ratios analyzed the performance of the FTSE-GII, FTSE4Good Global and FTSE All-world indices and show that the FTSE4Good index outperformed the FTSE All-World index. Hoti et al. (2008) used the Vector ARMA-GARCH model found that the DJSI index and the Ethibel sustainability index gave rise to spillover effect, while the only spillover effect from the Dow Jones Industrial Average to the DJSI returns was found. Hoti et al. (2007) found that five sustainability and ethical index exhibited co-national volatility clustering and asymmetric volatility effects by using GARCH models. Obernadorfer et al. (2013) used the event study and t-GARCH(1.1) model analyzed the effect of the Dow Jones STOXX sustainability index and the Dow Jones sustainability world index(DJSI world) on stock performance. Empirical result suggest that stock markets may penalized the inclusion of a firm sustainability stock index and strongly negative effect on the inclusion in the DJSI world. Hoti et al. (2005) used the univariate GARCH model analyzed the DJSI world, DJSI STOXX and DJSI EURO sustainability index is there any strong evidence of volatility clustering, short and long persistence of shocks to the index returns, and asymmetric leverage between positive and negative shocks to returns. The empirical estimates showed that there was strong evidence of volatility clustering, with both short and long run persistence of shocks to the index returns. A great number of above research used the GARCH related model to test the dynamic relationship between SRI market index return, motivated by the investors who can earn abnormal profits from one market information to trade another market. But just few studies used the VECM model to investigate the lead-lag or long-run equilibrium relationship between

the responsible investment index return and stock market index return. Therefore, we use the VECM model to investigate the long run equilibrium relationship between FTSE index returns, and through the impulse response function and variance decomposition analysis analysis the dynamic relationship and the relative contributions of the stock markets.

3. THEORY AND SRI STOCK INDEX BACKGROUND

3.1 Theory

The fundamental model of stock price which is widely used in the literature, think about that stock price follow a random walk model. The concept of random walk hypothesis to economics and finance that Fama (1970) has captured this idea in his work. Fama (1970) stated that an informational efficient market, prices fully reflect all available information. An investor responds to the new information before the profits from trading on the assets quickly disappear. The rapid growth of information technology and economic globalization this happen instaneously. Therefore, information based trading is always risky; and in an efficient market, price changes are random and unpredictable.

The study of markets efficiency helps us to understand the behavior of that specific markets. However, the increasing levels of trade interaction and the easing of regulatory rules governing the movement of capital have allowed investors to look for international portfolio diversification among the markets. Azad(2009) stated that the study of the behavior of several stock markets has encouraged academics, policy markets and international fund managers to ascertain whether these markets are truly interlinked, interdependent, cointegrated and , therefore contagious to each other. He also clarify the relationship between market efficiency and cointegration. The assumption is related to market integration and statistical cointegration. If asset prices in two different markets are integrated of same order(i.e, I(1)), then these prices are, by and large, cointegrated. The rules applies if the markets considered are geographically close, and , of course, their financial markets are highly integrated. However, to further investigated whether the long-term relationship exists at all among these markets, we have to look at their statistical significance, which we can do using the cointegration test procedure.

The sustainability investment stock index return was assumed as a function of other investment stock index return. Thus the general function form was specified as follows:

$$p_{i,t} = f(p_{i,t-1}) \tag{1}$$

The model can be written as:

$$p_{i,t} = \alpha + \beta_0 p_{i,t-1} + e_{i,t} \tag{2}$$

Where $p_{i,t}$ is the price of stock i at time t, α and β are the parameters to be estimated and $e_{i,t}$ is the error term at time t.

3.2 SRI stock index background

In this paper, there are four-variable SRI index to study the relationship between stock markets. The variables considered for the model are the following:

3.2.1 FTSE4Good-IBEX indexes

The FTSE Group has partnered with Bolsasy Mercados Espanoles(BME) to create the FTSE4Good IBEX index at April 2008. The index comprises companies in the BME's IBEX 35 index and the FTSE Spain All Cap Index that need good standards of practice incorporate social responsibility. These companies are working towards environmental sustainability developing positive relationships with stakeholders and upholding and supporting universal human right.(FTSE 2014). The selection of companies is based on a three-step procedures and covers three key areas(environmental, social and human rights). The FTSE4Good-IBEX is not a static index because it is reviewed twice a year in order to add or remove companies, depending on their economic, social and environmental performance (Ortas et al. 2013).

3.2.2 FTSE Global 100

The FTSE Global 100 is a market-capitalization weighted index representing the performance of the 100 largest and most highly capitalized UK-domiciled blue chip companies, listed on the London Stock Exchange, which pass screening for size and liquidity. The index is the leading share index in Europe and represents approximately 82% of the UK's market capitalization of the whole London Stock Exchange and is suitable as the basis for investment products, such as funds, derivatives and exchange-trade funds. The FTSE 100 index also accounts for 9.15% of the world's equity market capitalization. The FTSE 100 is the most widely used UK stock market indicator. The constituents of the UK FTSE indices all traded on the LSE are ranked by market capitalization-the value of all the shares added together. The FTSE 100 has a fixed number of constituents 100 and it tracks the performance of these highly-capitalized companies.

3.2.3 FTSE4G00d European Index

The FTSE European Index Series is designed to measure the performance of companies resident and incorporated in Europe. It comprises three real-time tradable indices, which are designed for trading of derivatives, index-tracking funds, exchange trade funds and performance benchmarks. All indices times are calculated and published in Euros.

3.2.4 MSCI UK Index

The MSCI United Kingdom Index is designed to measure the performance of the large and midcap segments of the UK market. With 107 constituents, the index covers approximately 85% of the free float-adjusted measure capitalization in the UK.

4. DATA AND METHODOLOGY

4.1 Descriptive Statistics of the Data

Daily data of the FTSE4 Good IBEX(FT4IBEX)) FTSE Global 100(FTSEGL$), FTSE4Good Europe(FT4GBEU) and MSCI UK(MSUTDKL) for the period March 10 2000 through March 8 2013 have been considered for the study. Daily stock price returns fro the selected stock market data are calculated as, $R_{i,t} = 100x \log(P_{i,t} / P_{i,t-1})$ where $R_{i,t}$ and $P_{i,t}$ are the daily stock *i* returns and prices at time *t*, respectively. The descriptive statistics of the data used in our study is as shown in table 1. The statistic value indicated that the value of skewness is greater than zero and the value of kurtosis is greater than 3 and the J-B statistics value is significant at 1% level. The results of summary statistics exhibit that the variables are not normally distributed about its mean and variance.

Table 1. Summary statistics

variables	FT4IBEX	FTSEGL	FT4GBEU	MSUTDKL
Mean	8774.155	937.415	3368.793	1592.369
Median	8706.800	954.560	3419.640	1636.133
Maximum	13331.100	1186.280	4436.280	1920.400
Minimum	5535.300	573.340	2118.100	1037.907
Std. Dev.	1537.029	124.394	404.000	185.127
Skewness	0.405	-0.633	-0.416	-0.942
Kurtosis	3.140	2.815	3.401	3.092
Jarque-Bera	36.138***	87.464***	45.638***	190.273***

Note:***,**and* indicate at least significant at 1%,5% and 10% level, respectively.

4.2 Methodology

The main purpose of this paper is to examine the relationships among sustainability investment price by apply the VECM model. Before applying the VECM models, we must determine the appropriate model specification by identifying the order of integration of each variable series and the existence of cointegration among the variables. If the variables have a unit root, it is best to take first difference in order to make the variables stationary. By the way, if there is a cointegration relationship in the system, we can use the Vector Error Correction model rather than the VAR model in the first difference. We, therefore, conduct the unit root, cointegration test, causality, impulse response analysis and variance decomposition and summarize the results.

4.2.1 Unit Root Testing

We begin through testing for the presence of a unit root in each of the series using the Augmented Dickey and Fuller(ADF)(1979) and Phillips Perron(PP)(1988) unit root tests are then employed to examine the stationary of underlying time-series data. In co-integration tests, the difference economic time series variables are required to be integrated of order one I(1). That is the data should be nonstationary of random walk process but stationary in their first difference. To identify the order of integration for each variable. Dickey and Fuller (1979) used the following regression equation:

$$\Delta Y_t = \alpha + \beta t + \rho Y_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad (3)$$

Where Δ is the difference operator, ΔY_t is the first difference of the data variable being tested, r and ρ are parameters to be estimated, and ε_t is an residual error term. If the ADF test fails to reject the test levels but rejects the test in first difference, the series contains one unit root and is of integrated order I(1). For the ADF test, we must specify the number of lagged first difference terms to add in the test regression. In this study, the lag was specified according to Schwarz Information Criterion(SIC) for each variables. The test for a unit root in the series is a test of the null hypothesis the $\rho = 0$. If the hypothesis cannot be rejected the series is assumed to be non-stationary.

4.2.2 Co-integration and Granger Causality

The next step of the analysis is to investigate the number of cointegration relation between series. From an economic point of view, cointegration implies that variables can drift apart in the short run, but they will show a long run equilibrium. Therefore, we further examine whether there is a cointegration relationship in the variables. Johansen(1988) and Johansen and Juselius(1990) maximum likelihood co-integration tests are employed to examine if the variables are cointegrated or not. Here, two conventional cointegration tests are performed; one is the Johansen's trace test of no cointegration against four cointegration vectors. We allow for a linear trend in the data and use the lag length which is selected via the Schwarz information criterion for both tests. Johansen's cointegration test has been used to investigate the long-run relationship between the variables. Besides, the causal relationship between selected stock markets was investigated by estimating the following VECM(Johansen, 1988, Johansen and Juselius,1990). The procedure is based on MLE estimation of the model as below:

$$\Delta Y_t = \alpha + \delta_1 \Delta Y_{t-1} + \delta_2 \Delta Y_{t-2} + \cdots + \delta_{k-1} \Delta Y_{t-k+1} + \pi Y_{t-1} + u_t \qquad (4)$$

Where ΔY_t is *(nX1)* vector of sustainability investment market price index changes in period t, α is *(nx1)* vector of constant error term. ΔY_t is the first difference of stock index return. δ_i and π are *(nxn)* coefficient matrix with($i = 1 \cdots k-1$), of short-run dynamics, π is the *nxn* long-term equilibrium relationship among the variables in ΔY_t, and u_t is (nx1) vector of error term and it is independent of all explanatory variables.

Information about the number of cointegrating relationships among the variables is given by the rank of the π matrix. Johansen(1988) used the reduce rank regression procedure to estimate π matrix, and the trace test statistics is used to test the null hypothesis of most r cointegrating vectors against the alternative greater than r, which are computed by using the following formulas:

$$\lambda_{trace} = -T \sum_{j=r+1}^{k} \ln(1 - \hat{\lambda}_j), \ \lambda_{max} = -T \ln(1 - \hat{\lambda}_{r+1}) \tag{5}$$

Where T is the sample size, $\hat{\lambda}_j$ and $\hat{\lambda}_{r+1}$ are the estimated values of the characteristic roots obtained from the matrix. The trace test tests the null hypothesis of r cointegrating vectors, while the maximum eigenvalue test the null hypothesis of r cointegrating vectors against the alternative hypothesis of $r+1$ cointegrating vectors.

4.2.3 Vector Error Correlation Model (VECM)

If the stock variable series are I(1) co-integrated then the VECM model(Engle and Granger, 1987) is represented by

$$\Delta Y_t = u_{11} + \sum_{i=1}^{n} \beta_{1i} \Delta W_{t-i} + \sum_{i=1}^{n} \gamma_{1i} \Delta Y_{t-i} + \sum_{i=1}^{n} \alpha_{1i} \Delta X_{t-i} + \sum_{i=1}^{n} \theta_{1i} \Delta Z_{t-i} + A_{11} EC_{t-1} + \varepsilon_{1t} \tag{6}$$

$$\Delta X_t = u_{21} + \sum_{i=1}^{n} \beta_{2i} \Delta W_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \Delta Y_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta X_{t-i} + \sum_{i=1}^{n} \theta_{2i} \Delta Z_{t-i} + A_{21} EC_{t-1} + \varepsilon_{2t} \tag{7}$$

$$\Delta W_t = u_{31} + \sum_{i=1}^{n} \beta_{3i} \Delta W_{t-i} + \sum_{i=1}^{n} \gamma_{3i} \Delta Y_{t-i} + \sum_{i=1}^{n} \alpha_{3i} \Delta X_{t-i} + \sum_{i=1}^{n} \theta_{3i} \Delta Z_{t-i} + A_{31} EC_{t-1} + \varepsilon_{3t} \tag{8}$$

$$\Delta Z_t = u_{41} + \sum_{i=1}^{n} \beta_{4i} \Delta W_{t-i} + \sum_{i=1}^{n} \gamma_{4i} \Delta Y_{t-i} + \sum_{i=1}^{n} \alpha_{4i} \Delta X_{t-i} + \sum_{i=1}^{n} \theta_{4i} \Delta Z_{t-i} + A_{41} EC_{t-1} + \varepsilon_{4t} \tag{9}$$

Where Δ is the difference operator, $\varepsilon_{1t}...\varepsilon_{4t}$ are the white noise error terms, $\Delta Y_{t-i} \cdots \Delta Z_{t-i}$ are stationary variables, EC_{t-1} is the error correction term derived from the long-run co-integration relationship, and *n* is the optimal lag length orders of the variables. In this model, the deviation from equilibrium affects the short-run dynamics of variables in the system. In this methodology, the lag right-hand side variables' coefficients show that short run effect, which is called impact multiplier. The parameters coefficients of error correction variables show the connection of the disequilibrium from the long-run equilibrium and the coefficients are called adjustment effects. If coefficient of error correction term is large, response to the precious period's deviation from long-run equilibrium is high while small value of error correction term's coefficient can be interpreted as left-hand side variable is unresponsive to last period's equilibrium error. With this model; long-run relationship can be captured by adjustment coefficient. If we find out both coefficients of error correction term to be zero. We conclude that there is no long-run relationship and model should be estimated by using VAR model. We also conducted the causality test based on Granger's approach(Granger 1969) in order to see any influences between stock markets have considered. In order to test for Granger causality, we considered stock market index variables. After estimating the Granger-causality we run a F-test for joint insignificance of the coefficients. Assuming the null hypothesis that variables does not Granger cause and vice versa, a rejection of the null hypothesis shows a presence of Granger causality. The Granger causality tests are performed for each pair of stock indices.

5. EMPIRICAL STUDY AND RESULTS

The first step in the empirical analysis to perform a co integration test is that order of integration of variables has the same order. In order to detect the order of integration we employed two unit root test, that is the Augmented Dickey-Fuller(AD) test(Dickey & Fuller,1979) and the Phillips-Perron(PP) test (Phillips & Perron,1988) unit root test results are shown in Table 2. The null hypothesis of a unit root is not reject for all variables in levels. Rather, all variables become stationary after first difference, which means that they are I(1) stationary.

Table 2. Unit Root Test

	ADF		PP	
Variables	level	1st difference	level	1st difference
FT4IBEX	-2.591	-34.545***	-2.491	-34.590***
FTSEGL	-2.267	-42.186***	-1.924	-54.265***
FT4GBEU	-2.144	-60.228***	-2.380	-60.629***
MSUTDKL	-2.141	-37.869***	-2.065	-61.685***

Note:***,**and* indicate at least significant at 1%,5% and 10% level, respectively.

5.1 Johansen Cointegration Test

In order to further investigate cointegration results among the variables, the multivariate cointegration technique of Johansen(1988) is employed. Here, the two conventional cointegration tests are performed, namely, the trace and maximum eigenvalue test statistic. The trace test examines the null hypothesis that the number of cointegrating vectors in the system, r is less than or equal to r_0 when $r_0 < p$ and p is the number of variable in the system, whereas the alternative hypothesis is that the impact matrix is of a full rank. The maximum eigenvalue test examines the null hypothesis that there are r_0 cointegrating vectors versus the alternative of $r_0 + 1$ cointegrating vectors. We allow for a linear trend in the data and use the lag length supplying the small critical value is determined as the lag length of the model by Akaike Information Criteria(AIC) for both tests. The results are exhibit at Table 3, that the trace statistic indicated significant evidence of long-run relationship, where as the maximum eigenvalue statistics also shows evidence of long-run relationship with at most four cointegrating vector. Therefore, we will proceed to estimate the VECM models.

Table 3. Results of Johansen Cointegration Test

H0	HA	λ max	95%	λ trace	95%
r=0	r=1	131.9910	27.58434	379.8385	47.85613
r≤1	r=2	97.16897	21.13162	247.8475	29.79707
r≤2	r=3	80.19446	14.26460	150.6786	15.49471
r≤3	r=4	70.48410	3.841466	70.48410	3.841466

Note:*r* indicated the number of cointegration vector. Critical value are from Mackinnon （1990）P-Values.Trace test and Max-eigen value test indicates cointegrating equations at the 5% level.

5.2 Vector Error Correction Model and Granger Causality

Granger Causality approach has been the most method to determing the causality validity between SRI stock index returns. It is important to access how stock price affect one another. According to the Bildirki and Bakirtas(2014), and Gupta and Guidi(2012) stated that if variables are cointegrated then the standard Granger causality test results will be invalid. In this situation, the VECM model check the causality relationship among variables. The using of VECM model error correction term to test for causality is that it allows testing for short-run causality through the lagged difference explanatory variables and testing for long-run causality through the lagged ECM_{t-1} term. The presence of cointegration between variables suggest a long term relationship among these variables under consideration. Then, the VECM model can be applied. The long-run dynamic was examined through the effect of the lagged error correction term in the VECM. Empirical results of Table 4 show significant error correction term with a negative sign for all the major SRI stock market returns. The figure indicates that when FT4IBEX is off the long-run equilibrium, FT4IBEX adjust towards its long-run equilibrium with about 10.06% of the adjustment taking place within the year. The FT4IBEX adjusts slowly towards its long-run equilibrium. The coefficient of the speed of adjustment in FTSEGL$, FT4GBEU and MSUTDKL is also negatively significant. The magnitude of the error correction term is found to be 10%,0.8% and 5.1%,respectively. This implies that these major stock markets are significantly adjusted to disequilibrium from the long-run relationship or the response with which the previous period's deviations from the long-run relationships are corrected is found to be significant in these major stock markets.

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Table 4. Vector Error Correction Estimates

	FT4IBEX	FTSEGL$	FT4GBEU	MSUTDKL
ECM	-1.006***	-1.010	-0.082	-0.513***
	(-5.487)	(-1.724)	(-1.792)	(-6.370)
FT4IBEX(-1)	-0.925***	-0.008	-0.161**	-0.085***
	(-8.326)	(-0.937)	(-4.633)	(-5.563)
FT4IBEX(-12)	-0.295***	-0.007	-0.063*	-0.028*
	(-4.554)	(-1.457)	(-3.130)	(-3.174)
FTSEGL$(-1)	0.837	-1.073***	-2.375*	-1.255*
	(0.307)	(-5.047)	(-2.791)	(-3.357)
FTSEGL$(-12)	-0.221	-0.051	-0.199	-0.109
	(-0.275)	(-0.808)	(-0.795)	(-0.995)
FT4GBEU(-1)	-0.503	0.001	-0.345	0.322*
	(-0.778)	(0.015)	(-1.708)	(3.637)
FT4GBEU(-12)	0.188	-0.025	-0.004	0.025
	(0.532)	(-0.891)	(-0.042)	(0.523)
MSUTDKL(-1)	1.634	0.196	1.781**	-0.063
	(1.242)	(1.909)	(4.331)	(-0.353)
MSUTDKL(-12)	1.090	0.079	0.383	0.107
	(1.709)	(1.586)	(1.919)	(1.230)
intercept	0.048	0.001	-0.003	0.013
	(0.011)	(0.003)	(-0.002)	(0.024)
R^2	0.498	0.472	0.537	0.549
F-value	24.661	22.269	26.858	30.335
Log-likelihood	-8130.142	-4894.458	-6654.604	-5611.645
AIC	12.892	7.793	10.567	8.923

Note:***,**and* indicate at least significant at 1%, 5% and 10% level, respectively.

According to Table 4, for the FT4GBEU, and FTSEGL$ didn't find that these two major SRI stock return are significantly influenced by each other. However, FT4IBEX, FTSEGL$ and MUSTDKL significantly affected FT4GBEU and FT4IBEX,FTSEGL$ significantly affected MSUTDKL at least 90% significant level. As a result of Table 4, the FT4IBEX(-1) and FTSEGL$(-1) increased by 1%, the stock price return of FT4GBEU will be decrease by 1.6% and 23.75%. Besides that, the FT4IBEX(-1) and FTSEGL$(-1) rise by 10%, the MSUTDKL will decrease by 0.8% and 12.55%. This implies that if the stock price return of FT4IBEX and FTSEGL$ rise, this has a significant negative impact on the FT4GBEU and MSUTDKL at the short-run. Recall that although cointegration between variables does not specify the direction of a causal relation. If any between variables. The results of causality between variables are presented in Table 5. FTSEGL$ Granger cause FT4IBEX granger cause FTSEGL$ at 95% significance level. There is also a bi-directional Granger cause relationship between MSUTDKL and FTSEGL$. Besides, there is a one-way unidirectional causation between FT4GBEU and FT$IBEX and FTSEGL$. According to Table 5, we found significant one-way or two-way granger causality between major SRI stock market return.

Table 5. Variance Decomposition

Variable	Period	S.E.	DFT4IBEX	DFTSEGL$	DF4GBEU	DMSUTDKL
DFT4IBEX	1	149.589	100.000	0.000	0.000	0.000
	8	157.433	94.362	1.762	3.614	0.262
	16	170.216	93.079	1.850	4.487	0.585
	24	178.057	92.999	2.014	4.406	0.581
	30	184.440	93.020	2.041	4.374	0.565
DFTSEGL$	1	11.683	64.020	35.980	0.000	0.000
	8	12.236	61.056	36.734	1.763	0.447
	16	13.269	59.356	37.209	2.518	0.917
	24	13.979	57.811	38.590	2.644	0.955
	30	14.507	57.030	39.236	2.771	0.963
DF4GBEU	1	46.765	80.519	6.685	12.796	0.000
	8	49.740	74.092	11.096	14.415	0.397
	16	52.997	73.108	12.178	13.814	0.890
	24	55.079	72.860	13.321	12.950	0.869
	30	56.679	72.850	13.937	12.364	0.849
DMSUTDKL	1	20.559	68.453	11.435	9.782	10.331
	8	22.135	61.463	16.204	12.721	9.612
	16	23.532	60.385	17.515	12.699	9.401
	24	24.479	59.560	18.947	12.242	9.252
	30	25.211	59.193	19.756	11.961	9.090

5.3 Variance Decomposition and Impulse Response Analysis

The impact of SRI stock index return shocks between each other is analyzed using both the forecast variance decomposition and impulse response functions The forecast variance decomposition decomposes the forecast error variance and estimates the relative importance of structural shocks, where as the impulse response analysis helps to access the direction, magnitude, timing and duration of a one-time standard deviation shock between stock markets. The relative contribution of these stock market shock to the variation is captured using the variance decomposition method. The results of variance decomposition analysis based on VECM for the major SRI stock markets over a 30-day horizon are presented in Table 6. The numbers reported indicated the percentage of the forecast error of the four shocks at different time horizons from one day(short-term) to thirty days(long-term). The results of variance decomposition suggest that the importance of DFT4IBEX explains 64.02% of the variations in DFTSEGL$ and it reduce to the 57.03% after 30 days. The empirical result show that the DFT4IBEX explained by its own shock at 94.36% on the 8 trading days, and then it decrease to 93.02% on the 30 trading days. About 74% of variation in the forecast error for DFT4GBEU is explained by innovations of DFT4IBEX after 8 trading days. Results show that DFT4IBEX explains 68.45% of the variations in the DMSUTDKL on the first trading day, and it reduce to 59.19% on the 30th trading days. The shock of other stock markets ranges between 19.76%,11.96% and 9.09% at the 20th trading days. This result indicated that the DFT4IBEX exhibit the importance stock market returns in explaining variations in the other stock markets.

The impulse response functions trace the dynamic response to the effect in one variable upon itself and on all other variables. The findings from the impulse response functions are provided in Figure 1. According to the impulse response functions, in respond to one unit standard deviation shock applied to DFT4IBEX produces a significant positive impact on DFTSEGL$,DFT4GBEU and DMSUTDKL in the short run. Also, in response to a unit shock in DFTSEGL$, DFT4GBEU and DMSUTDKL positive impact at short run then decrease at long run. In response to a one standard deviation shock in DFT4GBEU,DFT4IBEX and DFTSEGL$ negative impact at short-run. However, positive impact at DMSUTDKL at short run. In response to a one standard deviation shock in DMSUTDKL, did not find any significant impact on other variables. The above result suggest that existence of a unidirectional causality running from DFT4GBEU to DMSUTDKL and DFT4IBEX tp DFTSEGL$, DFT4GBEU and DMSUTDKL and DFTSEGL$ to DFT4GBEU and DMSUTDKL in the short-run. Also, the results show no long-run impact effect.

Figure 1. Impulse response of FTSE SRI stock Index Market Returns
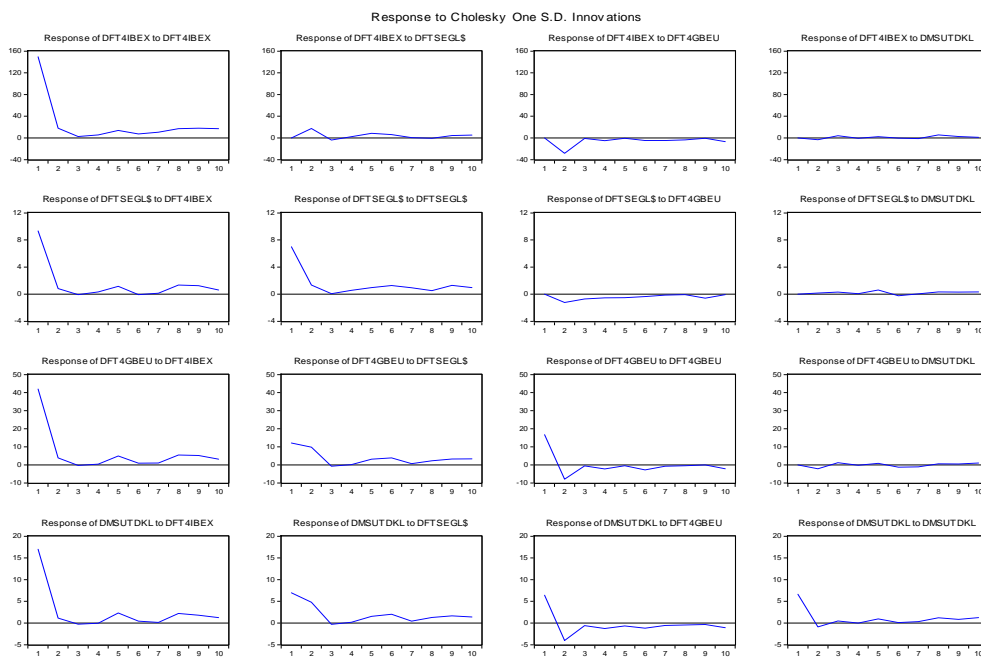
6. CONCLUSION

This paper try to use the VECM model to find out does the SRI stock index return comovement together in the long run or not. According to the empirical results of VECM, we find that negative and significant effect of the lagged error correction term among stock markets which indicated that FTSE SRI stock index return exhibit long-run equilibrium relationship and comovement together by the short run adjusted the disequilibrium to the long-run equilibrium. By the way, the granger causality show that bi-directional granger cause relationship between MSUTDKL and FTSEGL$ and one-way unidirectional causality between FT4GBEU and FT4IBEX and FTSEGL$. Next, the analysis empirical result of the variance decomposition reported that the importance of DFT4IBEX explain the variations in DFTSEGL$ and DMSUTDKL. The result stated that the DFT4IBEX exhibit the importance stock market returns in explaining variations in the other stock markets. So, that is why the FTSE4GoodIBEX is the most important investment indicator index for the investor, fund manager, and investing bank. Then, the empirical result from the impulse response function, the DFT4IBEX provides a significant positive impact on the other SRI stock index return market in the short run and also in DFTSEGL$ one unit shock significant positive impact shock to DFT4GBEU and DMSUTDKL. However, in respond to a one unit shock in DFT4GBEU significant negative impact shock to DFT4IBEX and DFTSEGL$. The response of the SRI stock index return is quickly at the short-run, show that market response the information instaneously and efficiently. Lastly, based on the above analysis, the SRI stock index return display the long-run equilibrium relationship between markets. According to this result, we know that if the investor try to investigate the SRI stock should be consider the linkage about other SRI stock markets. Here, we can also see the impact effect of SRI stock return affected by other stock markets. Based on this analysis, the investor should respond to the new information from the other SRI stock markets because of the information efficiency.

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