

CHARACTERISTICS OF THE RETURN AND RISK OF THE SUSTAINABLY DEVELOPED COMPANIES WITHIN THE EURO ZONE

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Abstract

The concept of sustainable development has determined a major change in the approach of economic development issues by ensuring a dynamic balance between the components of the natural capital and the social-economic systems. The sustainable development deals with the concept of life quality in its complexity, from an economic, social and environmental aspect, promoting the balance among the economic development, the social equity, the efficient use and the conservation of the surrounding environment. As regards the business sector, the sustainable development implies the approach of some strategies and activities that could meet the needs of the companies and their owners but which, at the same time, protects the human resources they will need in the future. By means of the cooperation among the Dow Jones Indexes, STOXX Limited and SAM the first global indexes were born, reflecting the general tendency of the sustainably developed companies in Europe or in the Euro zone. The aim of this study is to analyze the characteristics of the return and risk of the sustainably developed companies that are part of the index portfolio in the Euro zone. Identifying the characteristics of the return and risk allows us to study their implications on the investors' decisions. In order to attain our goal, we shall use statistical and econometric models. The results of the analysis enable us to ascertain that the returns of the index portfolio are leptokurtic, are correlated among them, are dependent and do not follow normal distributions while the portfolio risk varies in time.

Key words: stock market index, risk, return, GARCH-M, EGARCH

INTRODUCTION

Taking into consideration the greater interest in the sustainable development through the cooperation of the Dow Jones, STOXX Limited and SAM Indices, in 1999 the first global indices came into being and reflecting the general trend of sustainable developed companies in Europe or in the Euro area. Four indices are calculated for Europe and for the Euro area. These are Dow Jones STOXX Sustainability, Dow Jones STOXX Sustainability ex AGTAF, Dow Jones STOXX Sustainability ex AGTAF, Dow Jones STOXX Sustainability 40. Within the indices calculated for Europe there are stocks from 18 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom) and within the indices

calculated for the Euro area there are stocks from 12 sustainable developed countries (Austria, Belgium, Finland, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain). The Dow Jones indices of the sustainable development have in their portfolio a variable number of stocks of the top European countries as regards economic, environmental and social criteria. The "ex AGTAF" indices exclude from the portfolio the stocks of the companies that obtain incomes from alcohol, gambling, tobacco, arms and weapons while the "ex AGTAF" indices exclude from the portfolio the stocks of the companies that obtain incomes from alcohol, gambling, tobacco, arms, weapons and adult entertainment.

MATERIAL AND METHOD

The data for the Dow Jones STOXX Sustainability Index ex AGTAF index for

Euro zone were provided by the website that presents the indices (www.stoxx.com) and comprise the period that begins on September 28th, 2001 and ends on October 19th, 2009. During this period there are 2102 daily index closing values registered. The daily returns of the index portfolio were calculated by means of the formula:

$$r_t = (\ln P_t - \ln P_{t-1}) \cdot 100$$

where: r_t - the continuously compounded return

P_t, P_{t-1} - the price of a share or of a portfolio of shares at the moment t , $t-1$ respectively

The daily returns of the index portfolio were marked with LRDJSS. According to the notations in the Eviews software program, the continuously compounded return for the Dow Jones STOXX Sustainability Index ex AGTFAFA portfolio is calculated as follows:

$$\text{LRDJSS} = (\text{LPDJSS}_t - \text{LPDJSS}_{t-1}) \cdot 100$$

where: LRDJSS - the continuously compounded returns of index portfolio

LPDJSS_t, LPDJSS_{t-1} - the logarithmed price of the index at the moment t , $t-1$ respectively

In order to characterize the return and risk of the index portfolio we shall use: indicators of the descriptive statistics, the graphical representation of the return, the Ljung-Box test for testing the correlation between the returns and the square of the returns, the Philips-Perron test for testing the stationarity of the returns, the GARCH-M model and the EGARCH model.

The indicators of the descriptive statistics used are: the average (that offers an estimation of the profits or losses in the case of the stationarity of returns), the standard deviation (that represents a measure of the total risk), the median (that offers the profit or loss chances), the asymmetry and the kurtosis.

The graphical representation of the evolution of returns is used to assess the average stationarity and of the return variance as well as the dependence of return.

The Ljung-Box test is used to test the correlation of returns and of the squares of returns. The hypotheses that were tested are:

$$H_0: \rho_1 = \rho_2 = \dots = \rho_k = 0$$

$$H_1: \rho_1 \neq \rho_2 \neq \dots \neq \rho_k \neq 0$$

For a stationary variable, the k order autocorrelation coefficient is:

$$\rho_k = \frac{\text{Cov}(Y_t, Y_{t-k})}{V(Y_t)}$$

For testing the null hypothesis (that implies the absence of the autocorrelation until the k order) the Q statistics of the Ljung-Box is used, having the following

$$\text{expression: } Q_k = T(T+2) \sum_{i=1}^k \frac{\hat{\rho}_i^2}{T-i}$$

where: T - the number of observations

The null hypothesis implies the absence of the autocorrelation until the k order while the alternative hypothesis implies the existence of the autocorrelation. Supposing that the null hypothesis is true, the Q variable follows a law χ_k^2 (with k degrees of freedom).

In order to verify the stationarity of a variable there are several tests of which the most used ones are: Dickey-Fuller, Augmented Dickey-Fuller and Philips Perron.

The Dickey-Fuller test is for the autoregressive variables of first order. The Dickey-Fuller test uses the general equation:

$$Y_t = c + \gamma t + \alpha Y_{t-1} + \varepsilon_t$$

or in order to simplify the development of the equation $\Delta Y_t = c + \gamma t + \alpha Y_{t-1} + \varepsilon_t$, for which the following elements are verified:

- the significance of the intercept c . By means of the Student test the following hypotheses are tested:

$$H_0: c=0$$

$$H_1: c \neq 0$$

- presence of a trend. By means of the Student test the following hypotheses are tested:

$$H_0: \gamma = 0$$

$$H_1: \gamma \neq 0$$

- presence of a unitary root. By means of the Student test the following hypotheses are tested:

$$H_0: \alpha = 0$$

$$H_1: \alpha < 0$$

If the variable follows an autoregressive model superior to 1 then the Augmented Dickey-Fuller test is used. The Augmented Dickey- Fuller test uses the equation:

$$\Delta Y_t = c + \gamma t + \alpha Y_{t-1} + \beta_1 \Delta Y_{t-1} + \dots + \beta_n \Delta Y_{t-n} + \varepsilon_t$$

The Philips Perron test uses the same equation as the Dickey-Fuller test (DF), $\Delta Y_t = c + \gamma t + \alpha Y_{t-1} + \varepsilon_t$ and calculates the t tests to verify the hypotheses presented in the DF test not only under the errors' independence hypothesis but also under the hypothesis of a potential autocorrelation.

For this study the Philips Perron test was retained. For each of the returns under analysis the following three equations are analysed:

- the model with intercept and trend:
 $\Delta LR_t = c + \gamma t + \alpha LR_{t-1} + \varepsilon_t$
- the model with intercept
 $\Delta LR_t = c + \alpha LR_{t-1} + \varepsilon_t$
- the model without intercept and trend
 $\Delta LR_t = \alpha LR_{t-1} + \varepsilon_t$

After the verification, the model that minimizes the information criteria will be retained and the parameters for the verification of the stationarity will be tested.

The retained information criteria are:

- the Akaike criterion, $AIK = -\frac{2LnL}{T} + \frac{2k}{T}$

where: T – the number of observations

k – the number of parameters

- LnL – the log-verosimilarity function,

$$LnL = -\frac{T}{2}(1 + Ln2\pi) - \frac{T}{2}Ln \frac{\sum \hat{\varepsilon}_t^2}{T}$$

- the Schwartz criterion,

$$SC = -\frac{2LnL}{T} + \frac{2LnT}{T}$$

The estimation of the GARCH-M model (GARCH in Mean) offers a possibility that is valid only if the financial risks remunerate the risk: these models imply that the risk level influences (positively) the return expectancy. This supposition allows to take into account that the explicative variable the conditioned expectancy of the variance (or the conditioned standard variation).

The GARCH(p,q)-M(1) model can also be written this way:

- the ARMA model for Y. For example:

$$Y_t = a_0 + a_1 Y_{t-1} + \varepsilon_t - m_t \varepsilon_{t-1}$$

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$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \varepsilon_{t-2}^2 + \dots + \alpha_p \varepsilon_{t-p}^2 + \beta_1 h_{t-1} + \dots + \beta_p h_{t-p}$$

$$\alpha_0 > 0, \alpha_i \geq 0, \beta_i \geq 0$$

By means of the EGARCH model (exponential GARCH) the asymmetry phenomenon of the impact of news (shocks) on return is modelled: a negative shock with the same force as a positive shock leads to a higher increase of volatility (asymmetric volatility).

The EGARCH model for the (1,1) order has the following formulation:

- the ARMA model for Y:

$$Y_t = a_0 + a_1 Y_{t-1} + \varepsilon_t - m_t \varepsilon_{t-1}$$

$$- \ln h_t = \alpha_0 + \alpha_1 \left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \delta_0 \ln h_{t-1}$$

The asymmetry effect is highlighted by γ_1 . This estimated parameter must be significant and lower than zero.

RESULTS AND DISCUSSION

In order to characterize the distribution of the index portfolio return we turned to the indicators of the descriptive statistics. The average of the portfolio return equal to - 0.008531% is negative, which suggests that the investors shouldn't expect to get a profit in the analyzed period by possessing such a portfolio. The median is positive (0.0228) but very much close to zero and therefore there are over 50% chances to get a profit (positive returns) and less than 50% to get losses if the investment is liquidated at some point during the analyzed period. The distribution of the returns of the index portfolio presents a slight left-sided asymmetry and is strongly leptokurtic (the kurtosis indicator is 8.579 much higher than 3, which is specific to a mezokurtic distribution). The leptokurtosis of the distribution suggests that the investors may get either a very high profit or a very high loss. Due to the kurtosis excess the return distribution does not follow a normal distribution law as the Jarque-Bera test.

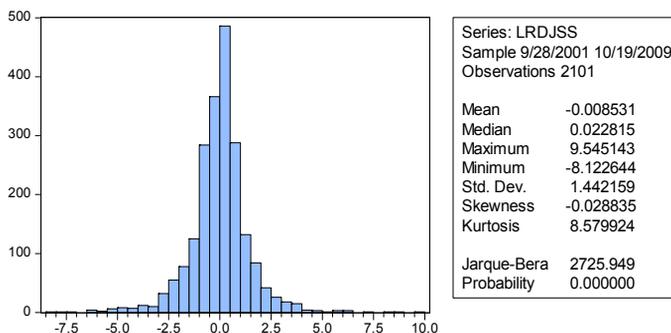


Figure 1. Distribution of the return of the Dow Jones STOXX Sustainability Index ex AGTAF index portfolio during September 28th, 2001 and October 19th, 2009

The graphical representation of the evolution of the index portfolio reveals that the average of the return seems to be constant and the variance is between certain limits, suggesting that the return is stationary during the analyzed period. We shall exactly assess the stationarity of the return on the basis of the Philips-Perron test. This graphical representation suggests that the returns are dependent (the high values of the return are

followed by other high values, while the low values of the return are also followed by low values) or the volatilities are grouped in clusters on certain time periods, suggesting that the high variations are followed by high variations and the low variations are followed by low variations. This characteristic highlights that a shock (for example some piece of new information) on the stock market has a persistent influence in time.

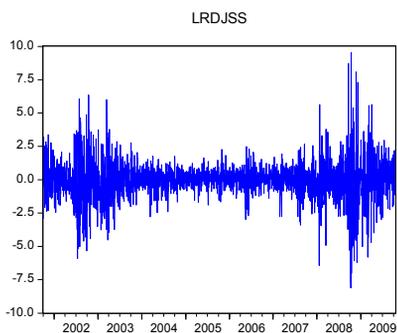


Figure 2. The evolution of the return of the Dow Jones STOXX Sustainability Index ex AGTAF index portfolio during September 28th, 2001 and October 19th, 2009

In order to test the autocorrelation of errors we use the Ljung-Box test. The result obtained demonstrates that the errors are autocorrelated and therefore they can be modelled under the form of an ARMA process. In order to test the returns' dependence we use the Ljung-Box test applied to the square of the index portfolio returns.

Because the probabilities associated with the Ljung-Box test are lower than the taken risk of 0.05 we dismiss the null hypothesis of the lack of autocorrelation of the square of returns and we accept with a 0.95 probability the alternative hypothesis that implies the correlation of the squares of errors. The test also demonstrates us that: the returns of the analyzed portfolio, LRDJSS, are dependent one on each other, explaining the existence of

The asymmetry effect is highlighted by γ_1 . Because this parameter is significant and lower than zero ($\hat{\gamma}_1 = -0,111$) the daily volatilities of the index portfolio are characterized by asymmetry. The new negative information determines a higher volatility compared with the new positive information.

CONCLUSIONS

The sustainable development cannot be achieved by the effort of a single company but by the sustained effort of all the participants to the global economy. In the study under analysis we stopped at the characterization of the return and risk of the Dow Jones STOXX Sustainability Index ex AGTAF index portfolio from the Euro zone that comprises stocks of sustainable developed countries but it excludes from its portfolio the stocks of the companies that get a profit from alcohol, gambling, tobacco, arms, weapons and adult entertainment. The returns of this portfolio are stationary, leptokurtic, auto correlated and dependent. The stationarity of the returns proves that the average and the variance of the daily returns are between certain limits in the analyzed period. The leptokurtosis of the return, a characteristic specific for many financial series, proves that the investors in this portfolio may obtain both high profits and high losses, higher than in the case of a normal distribution. Because the daily returns are correlated among them they could be modelled by means of the Box&Jenkins methodology and their dependence imposes the continuation of the modelling, in order to meet the homoscedasticity hypothesis of errors, by estimating the ARCH-GARCH models.

The estimation of the GARCH-M model reveals that the risk and return of the index

portfolio under analysis are correlated. The risk varies in time but within certain limits, presenting on clusters and being asymmetric, therefore the impact of a new negative piece of news is higher than the impact of a new positive piece of news.

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