

# A CRITICAL EVALUATION OF RISK-RETURN CHARACTERISTICS OF ENVIRONMENTALLY FOCUSED STOCK'S COMPANIES

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## Abstract

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The objective of the paper is to critically evaluate and determine risk-return profile environmentally focused stock's companies which are covered by STOXX Global ESG Environmental Leaders Index and whether this index should be taken in as an independent asset class of investments portfolio for its risk-return improvement. This paper gives an empirical view on the ex-post asset classes characteristics focused mainly on risk side of investment.

environment, investment, stock's companies, risk-return

An environmental investing is a subset of Socially Responsible Investing (SRI) that concentrates on investing in companies or technologies that have a positive effect on the environment, such as businesses making an effort to reduce their greenhouse emissions, or those looking for renewable energy sources. For example, clean technology or “cleantech” companies are those that work to improve operations, performance, productivity and efficiency while lowering their energy consumption, inputs, waste or pollution.

Investors are placing money into environmentally oriented companies for a combination of two reasons: to fulfill perceived ethical responsibilities by helping to improve the environment, and to ride the next big wave in the stock market. But whether you are an individual or institutional investor, the key to making a profit is to choose the right instruments in which to invest.

The growth of environmentally oriented investment funds, exchange traded funds (ETFs) and certificates is on the rise. Investors who are more risk-averse should look to invest in one of these types of funds, which typically provide a good amount of diversification. Environmentally mutual funds invest in a variety of companies, and some will invest in various green industries, such as solar,

wind, bio-fuels, or recycling. ETFs track indices and also offer instant diversification. Finally, there are many funds that invest in international green companies, thereby providing global diversification.

Those investors willing and able to take on more risk can go for a “pure play” strategy – investing directly in environmentally oriented companies. The definition of an environmentally oriented company is a bit subjective, but there are organisations which make a same classification for environmentally oriented companies. One of them is Sustainalytics which supports investors with the development and implementation of responsible investment strategies. Sustainalytics together with STOXX Ltd. offer STOXX® Global ESG Environment Leaders index. The sustainability data is provided by Sustainalytics and the index model is developed by STOXX Ltd.. The indices follow a bottom-up approach and are based on company sustainability ratings. They are based on a very flexible concept, which allows issuers to combine the indices according to their own requirements.

This paper analyses the risk profile and some other important characteristics (e.g. return, Sharpe ratio, Sortino ration) of STOXX Global ESG Environmental Leaders equity index compared to some well known equity indexes:

- STOXX Global Select Dividend 100 Net Return is the composite equity index covering countries in the developed markets. Companies are selected on the basis of dividend criteria and the weighting of the companies in the index is purely based on dividends.
- MSCI World Net Return Index is the composite equity index covering countries in the developed markets. The index is capitalizations weighted.
- CECE Net Return Index is the composite equity index comprising the Czech Republic, Hungary, and Poland. It is a capitalization-weighted index consisting of the Czech, Hungarian, and Polish blue chip stocks, which are members of the respective country index: CTX Czech Traded Index, HTX Hungarian Traded Index, and PTX Polish Traded Index. The index is calculated and disseminated by Wiener Börse.
- iBOXX € SOVEREIGNS EUROZONE 3-5<sup>\*</sup> represents the 3-5 years maturity Eurozone currency sovereign debt issued by Eurozone governments. The Index covers the Sovereigns Eurozone 3-5 years maturity bucket. Within the Index, each bond is weighted according to its amount outstanding. The Index is calculated and disseminated by Deutsche Börse and sponsored by International Index Company Limited ("IIC").
- DBLC Index™ – Optimum Yield balanced (the "Index") is intended to reflect the performance of 14 commodities: WTI Crude Oil, Brent Crude Oil, Heating Oil, RBOB Gasoline, Natural Gas, Aluminium, Copper, Zinc, Gold, Silver, Wheat, Corn, Soybean and Sugar. Recomposition is done using the Optimum Yield methodology that seeks to optimise the roll yield that will maximise the positive roll yield or minimise the negative roll yield. The index is currency hedged on a monthly basis. The index level is hedged by means of a forward contract with a maturity of one month. Index changes during the month are not hedged.

All returns are quarterly total returns (with dividends) expressed in Euros. The data are available from 30<sup>th</sup> September 2001 until 30<sup>th</sup> September 2012 (44 values per index). This time is not a long period due to the short time series of STOXX ESG Environmental Leaders index.

### Measurement of risk

During historic period, problems of objectifications of risk measurement by using a concept of probability and applying statistical analysis were discussed. In 1952, two authors published the ultimate papers for financial industry; the first was H. Markowitz (1952) who identified risk as related to the varying financial outcomes and adopted the standard deviation of the residual assets as the tool for measurement of risks. He also provided a quantitative framework for measuring the portfolio risk. The second one was A. Roy (1952) who introduced the "Safety First" criterion, which meant introduction of a downside risk measurement

principle. A few years later, Markowitz (1959) gave a generalized discussion on the risk and introduced alternative measurement tools as semi-variance, expected value of loss, expected absolute deviation, probability of loss and the maximum loss. Markowitz also introduced his idea of downside-risk and suggested two types of measurement of a downside risk:

- A semi-variance computed from the mean return or below-mean semi-variance ( $SV_m$ );
- A semi-variance computed from a target return or below-target semi-variance ( $SV_t$ ).

Both measures compute a variance using only the returns below the mean return ( $SV_m$ ) or below a target return ( $SV_t$ ). Markowitz called these measures partial or semi-variances, because only a subset of the return distribution is used, see (Nawrocki, 1999).

$$SV_m = \frac{1}{K} \sum_{t=1}^K \max[0, (E - R_t)]^2$$

$$SV_t = \frac{1}{K} \sum_{t=1}^K \max[0, (t - R_t)]^2,$$

where  $R_t$  is an asset return during the time period  $T$ ,  $K$  is the number of observations,  $t$  is the target rate of return and  $E$  is an expected mean return of the asset return. A maximizing function denoted as  $\max$ , indicates that the formula will square the larger of the two values i.e. 0 and  $(E - R_t)$  or  $(t - R_t)$ . After proposing the semi-variance measure, the classical author stayed with the variance measure because it was computationally simpler. The semi-variance optimization models using a coveariance matrix (or semi-covariance if that is your preference) require twice the number of data inputs than the variance model. With the lack of cost-effective computer power and the fact that the variance model was already mathematically very complex in these times as it belonged to the class of quadratic programs, this was a dominant consideration in practical applications until the 1980s. It was used with the advent of the microcomputer (Nawrocki, 1999). Markowitz (1991) and this approach was also further developed in order to define a measure of downside risk.

According to findings by Kahneman and Tversky's (1979) loss aversion preferences imply that investors who dislike downside losses will demand greater compensation, in the form of higher expected returns, for holding shares with high downside risk.

Sortino and Van der Meer (1991) note that standard deviation has one major drawback. Standard deviations measure uncertainty or variability of returns but in some cases this does not match one's intuition about risks. Large positive outcomes are treated as equally risky as large negative ones. In practice, however, positive outliers should be

regarded as a bonus and not as a risk. It is therefore better to look at some measure of downside risk.

## MATERIALS AND METHODS

44 quarterly data per each index were obtained. It is a relatively small sample to make some strong conclusions. Due to this fact, some parametrical tests were not found suitable. Therefore were used some robust statistical methods and bootstrap method, too. It means that robust statistical methods aim to construct statistical procedures that are stable (robust) even when the underlying model is not perfectly satisfied by the available data set. Robust models focus on the statistical properties of the bulk of the data without being distracted by outliers, while in classical models all data equally participate in the analysis. Classical estimators that assign equal importance to all available data are highly sensitive to outliers.

Therefore, in the presence of just a few extreme losses, classical analysis can produce arbitrarily large estimates of mean, variance, and other statistics. Bassett *et al.* (2004) investigate the performance of portfolio return distribution using robust and quantile-based methods, and conclude that the resulting forecasts outperform those under a conventional classical analysis. Perret-Gentil and Victoria-Feser (2005) used robust estimates for mean and the covariance matrix in the mean-variance portfolio selection problem. They showed that the robust portfolio outperforms the classical one, as the outlying observations (that account for 12.5% of the data set) can have serious influence on portfolio selection under the classical approach. The same purposes, i.e. the presence of skewed distributions and extreme values, led to using the interquartile range (by practitioner's hint for a normal distribution is approximately equal to  $1,35 \times \text{standard deviation}$ ).

The bootstrap method was used with only on a small number of data. The bootstrap method was originally proposed by Efron (1979) and it is a computationally-intensive method for estimating the distribution. To use the bootstrap or any other statistical methodology effectively, one has to be

aware of its limitations. The bootstrap is of a value in any situation in which the sample can serve as a surrogate for the population. If the sample is not representative of the population because the sample is too small, biased, or not selected in a random way, or its constituents are not independent, then the bootstrap based techniques fail. Canty *et al.* (2000) also list data outliers, inconsistency of the bootstrap method, incorrect resampling of a model, wrong or inappropriate choice of statistics, non-pivotal test statistics, nonlinearity of the test statistics, and discreteness of the resample statistic as potential sources of error. The pitfall of using the bootstrap method also shows the Terpstra and McKean (2005) and Salibian-Barrera M., and Zamar R. H. (2002).

Therefore for an index analysis there were made 10 times 2 500 bootstrap samples per index that means that each index statistics and characteristic was estimated 10 times. For a "final" enumerating of statistics and characteristics was used trimean.

## RESULTS AND DISCUSSION

Firstly, it was processed an explanatory data analysis of all indices (quarterly data), the results are shown in Tab. I. According to the descriptive data analysis one could say that medians are greater than means except bonds index. STOXX ESG index has higher average return, medians and standard deviations than MSCI World index. STOXX ESG index characteristics are close to STOXX Global Dividend except risk characteristics. STOXX ESG index's minimum value (loss) is highest of all equity indexes. In another way it means that there is a probability of small loss comparing to another equity indexes. In addition, kurtosis statistics show that the majority of indexes distributions have fatter tails than normally distributed variables.

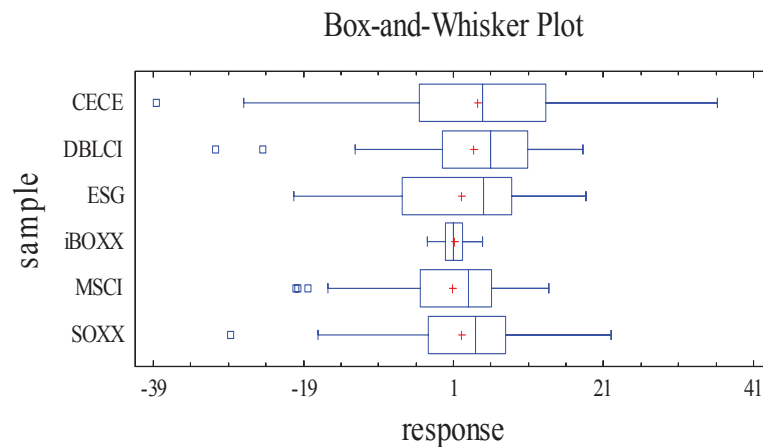
For deeper data analyses the related Box and Whiskers plots were made and results are shown in Fig 1. Result of this analyze corresponds with explanatory data finding, ESG index has no extreme values (outliners) but 1<sup>st</sup> quartile is lowest of all equity indexes.

For complex reward/risk comparing of all indexes were calculated annualized summary statistics.

I: Quarterly summary statistics of equity indices

	CECE	DBLCI	ESG	iBOXX	MSCI	STOXX
Count	44	44	44	44	44	44
Average	4,2	3,6	2,1	1,1	0,9	2,1
Medians	4,9	6,0	5,1	1,0	3,1	4,0
Standard deviation	14,9	10,1	9,6	1,6	8,5	9,1
Minimum	-38,3	-30,7	-20,3	-2,4	-20,2	-28,7
Maximum	36,2	18,2	18,6	4,9	13,7	22
Range	74,8	48,9	38,9	7,4	33,9	50,7
Std. Skewness	-1,2	-3,9	-1,9	-0,1	-2,5	-2,4
Std. Kurtosis	1,05	3,9	-0,4	-0,2	0,6	3,2

Source: Own calculation



1: Box and Whiskers plot  
Source: Own calculation

## II: Annualized summary statistics of equity indices

	CECE	DBLCI	ESG	iBOXX	MSCI	STOXX
Expected Return	16.8	14.4	8.4	4.4	3.6	8.4
Standard Deviation	29.8	20.2	19.2	3.2	17	18.2
Sharpe ratio*	0.48	0.59	0.31	0.59	0.06	0.32

\*Risk free rate is set to 2.5%  
Source: Own calculation

## III: Estimated annualized summary statistics of all indices

	CECE	DBLCI	ESG	iBOXX	MSCI	STOXX
Expected Return	15.3	14.3	7.4	4.3	2.9	8.1
Median	16.3	16.6	8.5	4.3	4.1	9.2
Standard Deviation	28.7	19.1	18.6	3.2	16.4	17.6
Downside Deviation*	12.2	7.1	9.3	0.36	10.1	8.4
5th percentile	-32.6	-20.1	-24.2	-0.8	-25.3	-22.4
Sortino ratio*	0.84	1.31	0.26	-1.94	-0.21	0.37

\*Target return is set to 5%  
Source: Own calculation

Annualized returns were enumerated as quarterly return multiply 4-times. Annualized standard deviations were enumerated as quarterly standard deviations multiply 2-times. For complex reward/risk comparing was used Sharpe ratio (see Tab. II). According to Sharpe ratio has STOXX ESG index better reward/risk profile than MSCI World index, this profile is nearly the same as STOXX Global Dividend index.

Kurtosis statistics (according summary statistics) show that the majority of indexes distributions have fatter tails than normally distributed variables and concurrently Box and Whiskers plots indicates some extreme values for majority of equity indexes therefore a bootstrap techniques was used for enumerating some selected statistical characteristics with impact on downside risk (losses). For enumerating of downside risk was used downside deviation, where target rate of return was set to 5% p.a. The bootstrapped results are shown in Tab. III.

According bootstrapped results is STOXX ESG index better in complex reward/ downside risk indicator comparing to MSC World (nearly the same standard deviation and a bit smaller downside deviation, but more than doubled expected return). The Sortino ratio is positive for STOXX ESG index opposite to MSCI World Index. A comparison of the STOXX ESG index with the STOXX Global Dividend index is not so favorable for STOXX ESG index, all characteristics are better for STOXX Global Dividends index. For portfolio investors is very important how strongly are indexes correlated each to another therefore correlations were enumerated, due the fact some of equity indices should be a better complement to diversified portfolio than others (see Tab. IV), for example if an investor's portfolio includes commodities the best equity index is STOXX Global Dividend, not STOXX ESG index.

## IV: Correlations of all indices

	CECE	DBLCI	ESG	iBOXX	MSCI	STOXX
CECE		0.3233 (44)	0.4408 (44)	0.1820 (44)	-0.0690 (44)	0.2510 (44)
DBLCI	0.3233 (44)		0.2188 (44)	-0.4107 (44)	-0.2871 (44)	-0.0692 (44)
ESG	0.4408 (44)	0.2188 (44)		0.0576 (44)	0.7026 (44)	0.0795 (44)
iBOXX	0.1820 (44)	-0.4107 (44)	0.0576 (44)		-0.3570 (44)	0.3846 (44)
MSCI	-0.0690 (44)	-0.2871 (44)	0.7026 (44)	-0.3570 (44)		0.3846 (44)
STOXX	0.2510 (44)	-0.0692 (44)	0.0795 (44)	0.1544 (44)	0.3846 (44)	

Correlation

(Sample Size)

Source: Own calculation

**CONCLUSIONS**

According obtained result in the process of data analyzing of indexes there were found the following facts. Firstly, STOXX ESG Environmental Leaders index has nearly the same Sharpe ratio as STOXX Global Select Dividend 100 and the statistical characteristics are very similar to STOXX Global

Select Dividend 100. Next, among four equity indexes has STOXX ESG Environmental Leaders index the highest median value. Finally a correlation to commodities is relatively high comparing the rest of equity indexes. This index should not be taken in as an independent asset class of investments portfolio for its risk-return improvement.

**SUMMARY**

This paper analyses the risk profile and some other important characteristics (e.g. return, Sharpe ratio, Sortino ration) of STOXX Global ESG Environmental Leaders equity index compared to some well known equity indexes (MSCI World Net Return Index, CECE Net Return Index, iBOXX € SOVEREIGNS EUROZONE 3-5\* and DBLC Index™ – Optimum Yield balanced). 44 quarterly data per each index were obtained. Apart from some parametrical tests we used some robust statistical methods and bootstrap method. There were made 10 times 2500 bootstrap samples per index. For an index analysis that means that each index statistics and characteristic was estimated 10 times. For a “final” enumerating of statistics and characteristics was used trimean. According to obtained result in the process of data analysing of indexes there were found the following facts. Firstly, STOXX ESG Environmental Leaders index has nearly the same Sharpe ratio as STOXX Global Select Dividend 100 and the statistical characteristics are very similar to STOXX Global Select Dividend 100. Next, among four equity indexes has STOXX ESG Environmental Leaders index the highest median value. Finally, among all equity indices has STOXX ESG the lowest correlation to bond's index but a correlation to commodities is relatively high comparing the rest of equity indexes. This index should not be taken in as an independent asset class of investments portfolio for its risk-return improvement.

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