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ETHICAL AND CONVENTIONAL STOCK PRICE PERFORMANCE: AN EMPIRICAL INVESTIGATION UNDER CAPM-GARCH MODELS

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ABSTRACT

The present paper aims to examine the financial performance of the Moroccan Ethical, Social and Governance index (ESG10) compared to its conventional counterpart the Moroccan All Shares Index MASI index. The ethical investment is a kind of investment that applies screenings criteria to include or exclude assets from a portfolio. This asset filtering strategy, however, may have additional financial costs compared with traditional investments. Therefore, we will examine the following issue: Does ethical investment impact positively/negatively on corporates' stock market performances? The study covers the period 2019-2022. To this end, various performance ratios was used and a CAPM-GARCH model was estimated. Our findings indicate that the ethical index is not only more volatile than the conventional peer, but also shows a smaller return. This paper is one of the first studies to tackle comparative performances for the ESG 10 index, which was launched by the Casablanca Stock Exchange in September 2018.

Contribution/ Originality: This study contributes to the literature on the economic performance of ethical investment in general and in Morocco in particular. The ESG10 index which tracks the evolution of ethical investment in Morocco is recently implemented in September 2018, thus, our study contributes to the academic literature on the financial performance of the ESG10 compared to its classical counterpart MASI index. It uses the estimation methodology based on CAPM-GRACH models, this modelling approach allows to take into account the crisis period related to the COVID-19 pandemic and the high volatility of returns. This study is one of the very few studies that have investigated conditional return volatility of moroccan ethical investment.

1. INTRODUCTION

Socially responsible investment (SRI) is a strategy aiming at maximizing both financial returns and social & societal wellfare. The particular and multidimensional nature of performance[1] of corporate raises the question of whether there is a trade-off between the financial dimensions of performance and the non-financial dimensions. More recently in the literature, SRI has tended to replace the older term *ethical investment*, although they are probably not exact synonyms.

[1]In the context of SRI investment, performance becomes multidimensional, in addition to financial performance, SRI must take into account the non-financial dimensions of corporate performance, such as the impact on corporate governance, the environmental dimension and social/societal relations.

Offering a critical review of the socially responsible investment (SRI) literature, Renneboog, Ter Horst, and Zhang (2008), concluded that existing studies suggest, but do not unequivocally demonstrate, that SRI investors are willing to accept suboptimal financial performance to pursue social or ethical goals. In contrast, Hong and Kacperczyk (2009) studied the sin stocks of publicly traded companies involved in alcohol, tobacco, and gambling production. They concluded that these sin stocks[2] have higher expected returns than otherwise comparable stocks.

Heinkel, Kraus, and Zechner (2001) explored the effect of exclusionary ethical investing on firm behavior in an equilibrium and risk-averse environment. They showed that exclusionary ethical investing leads to polluting firms being owned by fewer investors, as green investors avoid the stocks of polluting firms. In their model, empirically reasonable parameter estimates indicate that more than 20% of green investors are needed to induce polluting firms to reform.

Theoretical work on the relationship between SRI and expected returns explains the difference in returns between SRI and conventional investment by the fact that excess demand for socially responsible stocks leads to their overvaluation, while insufficient demand for non-socially responsible stocks leads to their undervaluation. In this sense, insufficient demand for non-socially responsible stocks limits the opportunities for risk sharing and implies a higher risk premium than SRI. However, the results of several empirical studies have contradicted the predictions of theoretical models. The authors Galema, Plantinga, and Scholtens (2008) have explained these contradictory results by the misinterpretation of the risk-adjusted performance measures used in most empirical studies.

Driven by globalization, Corporate Social Responsibility (CSR) activities are being extended to today's most critical social issues, such as combating global warming, promoting energy efficiency and renewable energy, stopping pollution, saving endangered wildlife and promoting diversity. By voluntarily adopting additional measures to improve the quality of life of employees (Social) and their stakeholders (Societal), these obligations go beyond the legal requirements to comply with the legislation of each country.

In order to combine/balance sustainability[3] with financial profit generation, managers use a concept known as the triple bottom line. This concept consists of a commitment by companies to measure the social and environmental impact of their activities in parallel with their financial performance.[4] From the point of view of an investor in general, and fund managers in particular, SRI requires a social, environmental and ethical review of companies in addition to conventional financial analysis.

By adopting socially responsible investment (SRI) as a differentiation strategy, several mutual funds have popularized this concept in the financial markets. Indeed, the inclusion of societal, environmental, and governance criteria in the screening decision process has resulted in so-called socially responsible indexes. It is clear that the criteria used in the filtering of these indexes are essentially based on sectoral exclusion, and vary from one country to another, from one rating agency to another, and even from one index provider to another (El Khamlichi, 2019).

Does the integration of ethics into investments reduce financial performance, as measured by risk-adjusted returns, or, on the contrary, improve the profitability of funds and companies that adopt it? Several academicians and practitioners have studied this issue, using a variety of methodologies. The majority of these studies have shown that the financial performance of SRI funds does not differ significantly from their conventional counterparts, or from a conventional benchmark (Burlacu, Isabelle, & Denis, 2004; El Khamlichi, 2013; El Khamlichi, 2019).

1.1. Article's Problematic Question

Given the divergence on SRI indexes performance studies, relative to their conventional counterparts, our study is to examine whether SRIs systematically under-perform or outperform their conventional counterparts? we will

[2] A *sin* stock is a publicly traded company involved in or associated with an activity considered unethical or immoral.

[3] In this work, sustainability is referred to as societal and environmental performance.

[4] This concept can be broken down into the "three Ps": profit, people and planet.

empirically test whether ethical filtration, as measured by the ESG_10 index does not preclude the financial benefits realization.

This paper contributes to the literature on the impact of ethical filtration on the risk-adjusted financial performance of the Casablanca ESG 10 ethical index compared to its conventional counterpart the Casablanca MASI. We analyze the performance of both indexes using various risk-adjusted performance measures, namely Sharpe ratio, Treynor ratio, Jensen alpha, Black-Treynor ratio and Sortino ratio.

This article is organized as follows: Section 2 provides a brief overview of previous empirical studies on the performance of socially responsible investments. Section 3 briefly describes the data sample used and the working methodology. The empirical results are discussed in Section 4, and Section 5 presents the conclusion.

2. LITERATURE REVUE

The first studies of socially responsible stock market indexes date back to the mid-1990s and focused solely on the US market. Thus, the study by Shank, Manullang, and Hill (2005) focused on the American Domini Social Index 400 (DSI 400 Index[5]) by comparing it to two benchmarks: the S&P 500 and the CRSP[6]. This study concluded that ethical filters have no impact on the performance of the indexes. This conclusion was confirmed by other studies on the same index (Abramson & Chung, 2000).

However, Kurtz (1997); Bauer, Koedijk, and Otten (2005) and Renneboog et al. (2008) have concluded that stocks of socially responsible companies do not underperform the market as a whole (For an overview of the literature, see (Renneboog et al., 2008)). In the same vein, Kempf and Osthoff (2007) implemented a simple trading strategy based on KLD[7] Research & Analytics' socially responsible ratings: buy stocks with high socially responsible ratings and sell stocks with low socially responsible ratings. They found that this strategy leads to high abnormal returns of up to 8.7% per year.

In contrast, (Hong & Kacperczyk, 2009) have provided evidence of social norms effects on markets by studying the sin stocks of publicly traded companies involved in alcohol, tobacco, and gambling production. Consistent with the hypothesis that there is a societal norm against financing vice-promoting transactions and that some investors, particularly norm-subject institutions, pay a financial cost by abstaining from these stocks. They found that sin stocks are held less by normatively constrained institutions[8]. Sin stocks also have higher expected returns than otherwise comparable stocks, plus they are undervalued and have higher book-to-market values.

Individual investors do not have complete information[9] on the securities (expected return, variance, covariance with other securities,…etc). By not having information on some securities, individual investors do not include them in their portfolio, so we can consider securities that should be excluded from the portfolio based on some SRI criteria, a priori as securities lacking information (Białkowski, Gottschalk, & Wisniewski, 2008).

Other theoretical models based on investors' preferences for green companies (Heinkel et al., 2001) have shown that exclusionary ethical investment leads to polluting companies being held by fewer investors, since *green* investors avoid polluting companies' shares. This demand lack for the *irresponsible* shares companies implies that they are undervalued. Moreover, the risk-sharing opportunities for investors in the shares of these *irresponsible* companies are limited, which leads to a rise in the return premium. The decline in the share prices of polluting companies, thus increasing their cost of capital, provides an incentive for them to become socially responsible.

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[5] US DSI is a market capitalization-weighted index of 400 US companies considered to have environmental, social, and governance characteristics.

[6] The Center for Research in Security Prices (CRSP), part of the Booth School of Business, is a vendor of historical time series data on securities.

7 Launched in May 1990, the MSCI KLD 400 Social Index is the first Socially Responsible Investing (SRI) index.

[8] Typically, are pension funds.

[9] Information asymmetry.

Based on a sample of French SRI funds, (Capelle-Blancard & Monjon, 2014), examined whether the financial performance of socially responsible investment (SRI) mutual funds is related to the characteristics of the screening process. Their results showed that there is evidence that greater screening intensity slightly reduces financial performance (but the relationship goes in the opposite direction as screening becomes more difficult).

Using a dynamic mean-variance model based on the *shortage* function approach to evaluate the performance of SRI and environmentally friendly (EF) funds, (Ito, Managi, & Matsuda, 2013) empirically showed that SRI funds outperformed conventional funds in the EU and US markets.

In order to study the behavior of socially responsible indexes in crisis period, (El Khamlichi, 2013) studied 3 SR indexes from 3 different regions (US, Europe and Canada). Its results show the existence of a strong correlation between ethical indexes and their benchmark indexes[10], and the absence of a difference in performance during a financial crisis.

3. DATA AND METHODOLOGY DESCRIPTION

3.1. Data

The historical data we used to conduct this work comes from different sources. Data on the Casablanca Ethical, Social and Governance (ESG10) benchmark index and its classic counterpart, the MASI index, are downloaded directly from the Casablanca Stock Exchange website (https://www.casablanca-bourse.com/). The Casablanca ESG_10 index includes the 10 listed stocks with the highest ESG ratings from Vigeo Eiris.

The Casablanca ESG 10 index is composed of 10 stocks listed on the Casablanca Stock Exchange. The constituent stocks are reviewed annually based on the ratings assigned by the Vigeo Eiris agency. The companies that make up the ESG10 index have been evaluated and ranked on the basis of their compliance with 38 criteria and more than 330 indicators of environmental, governance, social and societal responsibility applied by Vigeo Eiris. The filtering is summarized in groups of corresponding elements referring to a general theme. Vigeo Eiris has identified three filters:

1. The relevance of these companies' commitments.
2. The effectiveness of their management systems.
3. Their ability to control risks and improve performance.

The first filter concerns the way the company interacts with its social environment. The second filter, which concerns corporate governance, examines the way the company is governed and managed. Finally, the third filter concerns the management of risks related to the company's products and production processes and its environmental policies.

The historical data represent the historical prices of the ESG10 and MASI indexes, each observation represents the daily closing price. The time period covered by this data is from January 1, 2019 to December 31, 2021, yielding 745 observations for each series. When we need the aggregated data by month, these data are measured at the end of each calendar month, similarly, the annual data are aggregated at the end of each calendar year. Finally, the historical proxy variable that captures the evolution of the non-risky yield is represented by the weighted average rate of treasury bill issues with a maturity of 52 weeks, which we downloaded from BANK AL MAGHRIB. In addition, we used the MASI[11] as a proxy variable which presents the evolution of the market as a whole and to provide a measure of its performance.

Further authors have also used the same data to study the relationship between financial performance and ethics as represented by ESG10 (one example is the study by Amzil (2020)).

[10] Generally, SR indexes are subsets of conventional indexes.

[11] Moroccan All Shares Index, is a cross-sectional index, it includes all the stocks listed on the Casablanca Stock Exchange. It is thus a broad index, making it possible to follow in an optimal way the development of the whole population of values of the quotation.

3.1.1. Presentation of the ESG 10 Index Which Tracks the Performance of Moroccan Corporate CSR-Labeled

Launched on September 27, 2018, with a base value of 1000 points and for the reference date of 29/12/2017, the Casablanca Stock Exchange, presents the ESG10 index as a thematic index that calculates the price performance of socially responsible companies, listed on the Casablanca Stock Exchange.

According to the Casablanca Stock Exchange release[12], the launch of the Casablanca ESG10 Index comes in response to the commitments made by the Casablanca Stock Exchange on the sidelines of Conference of the Parties Change COP[13] 22, as part of the "Moroccan Financial Sector Roadmap" and the "Marrakech Pledge."

3.2. Methodology

In this work, we consider the MASI to be the *classical* or *conventional* control index, in the way that the investment objectives of the companies issuing securities included in the MASI are solely financial and do not mention any *ethical* or *social responsibility* criteria. We use the daily returns of the MASI index as a market reference.

In this study, we examine the performance of the Casablanca ESG10 socially responsible stock index relative to its conventional counterpart the MASI, which is considered as a benchmark. The sample period is from January 1, 2019 to December 31, 2021, yielding 745 daily observations for each series. It should be noted that the choice of the historical period is critical and not neutral, indeed, this period is characterized by a major effect that disrupted the financial markets; the COVID_19 pandemic took place at the end of 2019 and its effects on the global economy were felt from 2020. Thus, this sample period allows us to analyze the performance and resilience of the socially responsible index relative to the conventional index before and during the COVID_19 pandemic crisis.

3.2.1. Computing Returns

The series of the two indexes we have are composed of daily observations, we define the holding period as one business day and we define the return by the following formula:

$$\text{rend}_t = \frac{\text{Indice}_t}{\text{Indice}_{t-1}} - 1 \qquad (1)$$

Equation 1 presents the formula for calculating the return based on the price series, under the assumption that the return is discrete. The notation $rend_t$ with a subscript t, denotes a return from day $t-1$ to day t. This is the index value on day t divided by the index value on day $t-1$ and then we subtract 1 from the formula. However, the calculation of the returns by the formula in Equation 1 assumes that the returns are discrete. In practice and in the context of financial risk management, we transform the formula slightly. In fact, by its formula, the discrete return is bounded by the lower value of -1 or less -100%. In other words, by the formula we can't lose more than 100% of the portfolio. However, the discrete return, calculated by the formula can take any positive number. There is no economic reason why the stock market cannot increase by more than 100. By doing so, this forces the distribution of discrete returns to be non-symmetric.

The standard statistical methods that we will use later for the analysis of the two indexes ESG10 and MASI work best when applied to symmetric data. To this end, we will transform the discrete return defined by the formula. The return is now computed by the following formula:

12 DP indice ESG sept 2018 DEF VF - Copie.pdf (casablanca-bourse.com).

13 For nearly three decades the UN has been bringing together almost every country on earth for global climate summits – called COPs.

$$\begin{aligned} \text{rend}_t &= \frac{\text{Indice}_t}{\text{Indice}_{t-1}} - 1 \\ \text{rend}_t + 1 &= \frac{\text{Indice}_t}{\text{Indice}_{t-1}} \\ \ln(rend_t + 1) &= ln(\frac{\text{Indice}_t}{\text{Indice}_{t-1}}) \\ \ln(rend_t + 1) &= ln(\text{Indice}_t) - ln(\text{Indice}_{t-1}) \end{aligned} \quad (2)$$

Thus, Equation 2 shows that the return is calculated as the logarithmic difference in prices. To nuance between the discrete and logarithmic returns of the formula, Equation 3 denotes the logarithmic return by $logrend_t$. Thus, we can calculate the series of logarithmic returns in two ways, either we calculate the discrete returns and then we calculate the logarithmic returns $logrend_t = \ln(rend_t + 1)$ or we calculate the logarithmic returns directly from the series of indexes by the following formula :

$$logrend_t = \ln(p_t) - \ln(p_{t-1}) \quad (3)$$

The logarithmic return is also known as the compounded return, or continuous yield. The Equation 4 is used to calculate the annualized returns $r_{a,t}$ which will be used later in the analyses, its formula is the following:

$$r_{a,t} = [\ln(p_t) - ln(p_{t-1})] \times 255 \quad (4)$$

3.2.2. Risk Measures

After calculating the returns of the stock market indicators by the formula , we will first make an assumption on the distribution of the returns, we assume the normality of the distribution of the returns, with this assumption, we can define the key measure of risk, the VaR, it is widely used as a measure of risk that evaluates the market risk of a portfolio. If X is a random variable that represents the returns calculated over a given period of time, the VaR at the $alpha$ level is defined by the following formula:

$$VaR_\alpha(X) = -\inf\{x \in \mathbb{R}: F_X(x) > \alpha\} = F_Y^{-1}(1 - \alpha) \quad (5)$$

Where $F_X(x)$ is the returns cumulative distribution function. In common statistical parlance, VaR is the quantile of $\alpha\%$ of the returns probability density function, which is assumed to follow a normal distribution. Practically, the VaR calculated by the formula is the amount that a portfolio could lose with a given probability called $(1 - alpha)$ over a given period (day, week, month,…etc).

Imported from the financial sector in the late 1980s, the VaR was widely publicized following its adoption by the Basel II committee. it is used as a risk measurement tool that assesses the market risk of a portfolio. It corresponds to the amount of losses that should only be exceeded with a given probability. Statistically speaking, the VaR is a quantile of the distribution of profits and losses, which can be derived for any given level of significance and a given time horizon. For a series of returns, the VaR is defined as the high quantile, for example, the quantile at 95%, of the negative value of the returns (the losses), assuming normal market conditions.

$$VaR = -\bar{r} - \sqrt{\sigma}.z_c \quad (6)$$

Where $\bar{r}$ is the returns mean, σ is returns volatily level and z_c is the standard normal distribution quantile.

In addition to VaR, which is used as a proxy measure to assess the level of financial risk associated with a stock index, there is another measure that is more accurate and informative than VaR, called Expected Shortfall (ES), which, like VaR, is dependent on the return distribution shape. For a given probability level $1 - \alpha$ and during a given holding period, the expected shortfall (ES) is the expected return $\mathbb{E}(r_i)$ given that the return is lower than the associated VaR. In the world of financial risk management, the expected loss (EL) is also referred to as the conditional value at risk or cVaR. Expected loss is considered a more useful risk measure than VaR because it is a consistent spectral measure of financial portfolio risk. For a given $alpha$-quantile level, expected loss (EL) is defined as the average loss in portfolio value given that a loss occurs at or below the $alpha$-quantile. Its formal definition is defined by the following formula:

$$\mathrm{ES}_\alpha(X) = -\frac{1}{\alpha}\int_0^\alpha VaR_\gamma(X)d\gamma \quad (7)$$

Where $\mathrm{VaR}_\gamma(X)$ is the value at risk (VaR).

3.2.3. Performance Measure

In the literature, we find several measures of financial performance[14], these measures consist of studying the relationship between expected returns and the risk associated with investing in risky financial assets. Several measures have been introduced to evaluate the performance of stock market indexes and these often differ depending on the type of risk measure considered. To evaluate the financial performance of the ESG10 ethical index and its conventional counterpart, we apply different standard performance measures, namely Jensen's alpha, Sharpe's ratio, Sortino's ratio and Jensen's alpha and two improved Sharpe's ratios based on other risk indicators (semivariance and VaR).

The first risk-adjusted performance measure we will use to compare the performance of the ESG10 index to its conventional counterpart is Jensen's alpha; this is a measure based on systematic risk, it measures the excess of the performance of a fund or portfolio[15] over the theoretical performance estimated by the capital asset pricing model (CAPM) theory. The coefficient $\alpha_{i,t}$ in equation represents the Jensen alpha of the index i evaluated within the CAPM theory of Sharpe (1964) and Lintner (1966):

$$\alpha_i = r_{i,t} - \left[r_{f,t} + \beta\left(r_{m,t} - r_{f,t}\right)\right] + \epsilon_t \quad (8)$$

Where α_i denotes Jensen's alpha (Jensen, 1968), r_i is the ESG10 index return according to the CAPM theory, r_f is the risk-free rate, β_i is the ESG10 index risk level relative to the overall market index, and r_m captures the Moroccan market return, as measured by the MASI index.

If the Jensen's alpha value is greater than 0, it means that the index to be compared its performance, the ESG10, is doing better than the market benchmark, in that case the MASI, whereby we can say that the ESG10 ethical index "outperforms" its benchmark counterpart. In other words, the ESG10 index is not only an ethical index, but it manages to beat the market performance. The higher the indicator, the better the performance of the ESG10 index. On the other hand, if the value of Jensen's alpha is less than 0, the performance of the ethical index turns out to be lower than that of the market, in which case we say that the ESG10 index "underperforms" its counterpart. The portfolio represented by the ESG10 index underperforms as predicted by the CAPM model.

Under standard ordinary least squares (OLS) hypotheses, the CAPM represented by equation is estimated by the least square method, where it is assumed that $\mathbb{E}(\epsilon_t^2) = \sigma^2$. Quite often, the financial data is caracterised by excessive volatility, where $\mathbb{E}(\epsilon_t^2) = f(t)$. Hence, the Jensen's alpha (Jensen, 1968) estimated by equation may provide misleading financial performance estimation. In order to correct the bias that could be generated by the equation , we extend the linear specification of the CAPM to make the variance of the ESG10 risk premium to be a function of time and conditional on its past values as well as on the past levels of the error terms, using (Bollerslev, 1986) Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models.

In order to take into account the hetoroscedasticity of errors, (Bollerslev, 1986) suggested the following specification: The conditional variance ht follows a GARCH(1,1) model :

$$\begin{aligned} \alpha_i &= r_{i,t} - \left[r_{f,t} + \beta\left(r_{m,t} - r_{f,t}\right)\right] + \sqrt{h}_t\eta_t \\ h_t &= a_0 + \beta_1 h_{t-1} + a_1\epsilon_{t-1}^2 \\ \eta_t &\sim N(0,1) \end{aligned} \quad (9)$$

Where η_t is a gaussian $i.i.d$ process with $\mathbb{E}(\eta) = 0$ and $V(\eta) = \sigma_\eta^2$, β_1 and a_1 are positive values.

[14] The fundamental difference between these measures is the way of assessing the risk

[15] A stock market indicator is considered a financial portfolio

Before estimating the CAPM-GARCH model of Equation 9, we have to decide whether it is preferable to basic specification of CAPM (model 8), to this end, the ARCH-LM test was used to test the homoscedasticity of the errors Equation 8 as a null hypothesis against heteroscedasticity (equation of model 9).

Proceeding with specification 9 provides a more robust estimate of Jensen's alpha and thus offers a more accurate measure of financial performance.

For an investor who is assumed to be rational, the relationship between the average return $\bar{r}$ and the standard deviation of this return σ_r of a stock market index over a given period constitutes the first criterion that allows him to define optimal investment strategies. These two statistics are generally used to form measures of index performance that are widely used in the empirical literature. The ratio of Sharpe (1964), which we will note (SR), is one of the measures that evaluates the performance of stock market indexes based on the two statistics characterizing the distribution of return: The mean and the volatility of returns. As such, the SR is a measure of the average risk premium per unit of total risk, it is calculated by the following formula:

$$\mathrm{SR} = \frac{(R_{i,t} - R_{f,t})}{\sigma(R_{i,t})} \tag{10}$$

Where $R_{i,t}$ denotes the stock market return of the i index, $\sigma(R_{i,t})$ the total risk and $R_{f,t}$ the risk-free investment return. The SR ratio defined by the formula 10 evaluates the marginal return per unit of total risk associated with the investment in the i index. Thus, the higher the value of the SR ratio of an index i, the higher its financial performance.

However, according to the standard CAPM theory (8), a rational investor can eliminate idiosyncratic risk by diversifying his portfolio. However, the SR measures the level of risk by the total risk $\sigma_{r,t}$ (systematic and non-systematic risk), for this reason, the measure of performance by the SR ratio is not precise and does not reflect the rational aspect of investors. In order to overcome the problem posed by using the total risk for the SR calculation, the empirical literature now recommends using a "modified Sharpe" ratio using a modified Cornish-Fisher VaR or CVaR/Expected Loss as a measure of risk.

Another ratio similar to Sharpe's was developed by Sortino and Price (1994). The idea of Sortino and Price (1994) is that risk should be measured in terms of not achieving the investment objective. This gives rise to the notion of minimum acceptable return or (MAR). All the measures proposed by Sortino and Price (1994) include MAR and are more sensitive to downside or extreme risks than measures that use volatility measured by the standard deviation of returns as a measure of risk. It is defined by the following formula:

$$\mathrm{RatiodeSortino} = \frac{(R_{i,t} - RMA_t)}{SV(R_{i,t})} \tag{11}$$

Where $SV(R_{i,t})$ is the return semi-variance of index i.

Since the Sortino ratio focuses solely on the negative deviation of a portfolio's returns from the mean, it provides a better picture of a portfolio's risk-adjusted performance.

The performance ratios we have just presented are based on financial theory, which relates expected returns and the risk associated with investing in risky financial assets. However, in order to be valid, these indicators assume that the returns have a Gaussian distribution^[The normal distribution is probably the best known distribution in statistics, on the one hand, it is completely defined by two parameters: the mean and the standard deviation, on the other hand, under particular conditions, the central limit theorem (CLT) or the law of large numbers states that the sum of random numbers can be approximated by a normal distribution, despite the fact that these random numbers themselves did not come from a normal distribution. However, this is a serious limitation, as the two key measures of risk, the VaR, and the expected loss (EL) are related to the return distribution shape.

If returns are normally distributed, the value-at-risk (VaR) and expected loss (EL) are easy to calculate. However, the assumption of normal returns is usually violated and the empirical distributions of returns often have non-Gaussian distributions. Given these limitations, (Keating & Shadwick, 2002) presented a new approach to analyzing return distributions, the Omega function, which can be used as a performance measure. This measure has the advantage of letting go of the assumption that returns are a posteriori normally distributed. The Omega ratio is defined as the weighted probability ratio of gains to losses for a threshold return target[16]. The ratio is calculated as follows:

$$\Omega(\theta) = \frac{\int_{\theta}^{\infty}[1-F(r)]dr}{\int_{-\infty}^{0}F(r)dr} \tag{12}$$

Where $F(r)$ is the returns cumulative probability distribution function and θ is the target return threshold, which defines what is considered a gain versus a loss. The omega ratio is based on a partition in the distribution of cumulative returns, it allows to create a zone of losses and a zone of gains in relation to the threshold defined by the investor. A high omega ratio indicates that the asset provides more gains than losses for a certain threshold θ and would therefore be preferred by investors.

4. EMPIRICAL IMPLEMENTATION AND RESULTS

4.1. Preliminary Analysis' Results

4.1.1. Performance of the Ethical ESG10 Index Compared to the Conventional MASI Index

After importing the ESG10 and MASI indexes history daily prices, we calculated the returns of the two indexes by the formula 3. At the first import[17], the data was stored in *data.frame* format, we modified the format to xts[18] to simplify the calculations. To evaluate the level of risk associated with these two indexes (MASI and ESG10), we are interested in the short-term volatility (fluctuations) of the indexes, that is why we are interested in the daily returns.

MASI index had 11306.19 points on January 02, 2019 and reached 13358.32 points on December 31, 2021. Likewise, the ethical ESG10 index recorded 901.21 points on January 02, 2019 and 998.02 points on December 31, 2021. However, the index level itself is not informative, it is the index value change that is, that is why we will focus on the returns fluctuations rather than the indexes closing prices level.

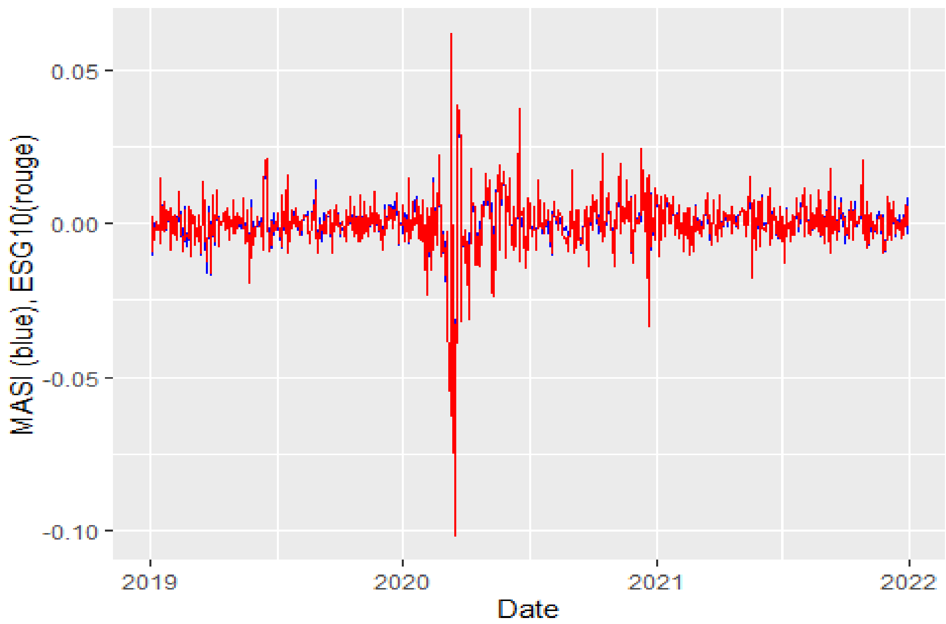

Figure 1. Daily return patterns of the ESG 10 index and its conventional peer MASI.

[16] This ratio is presented in the literature as an alternative to the sharpe ratio.

[17] For the numerical treatment of the data, we used the R application, version 4.1.1 (2021-08-10).

[18] Extensible Time Series. Standard format for time series in R.

Analyzing the price history of the two indexes, we notice that both of them show the same trend. After a depressing evolution at the beginning of 2019, the prices of both indexes resumed the upward trend from June 2019. The year 2020 was marked by an unprecedented fall in the both indexes prices following the unprecedented health crisis generated by the Covid-19 pandemic. After the measures adopted by the Moroccan financial authorities, the reopening, albeit partial, of the Moroccan territory and the recovery of the world economy, the prices of both indicators resumed the upward trend from July 2020 Figure 1.

As part of the measures taken by the Moroccan financial authorities to curb the effects of the economic crisis linked to the Covid-19 pandemic crisis, (Bank Al Maghrib, 2020) has activated a set of both conventional and unconventional instruments. In particular, it has twice lowered the policy rate by a total of 75 basis points to 1.50%, its lowest level ever[19]

The Figure 1 traces the history of daily returns of the ESG10 ethical index and its conventional counterpart the MASI. the graph reveals two findings:

- The both indexes daily returns show the same trend, with a slight outperformance of the non-Socially Responsible Investment SRI index MASI over most observations in the study sample.
- Apart from the beginning of 2019, the daily returns of the two indexes showed gloomy returns over the years 2020 and 2021, with an unprecedented level of volatility in the first quarter of the year 2020, this quarter was marked by an unprecedented health crisis generated by the Covid-19 pandemic and the adoption of very strict containment measures by the Moroccan authorities, which have seriously laid out flat many Moroccan economic sectors.

The unprecedented health crisis generated by the Covid-19 pandemic has had an indiscriminate impact on developed, emerging and developing countries alike. The heavy drain on Moroccan GDP has been reflected in the poor performance of Moroccan stock market indicators, combined with high volatility. However, the proactive management [To manage the effects of the health crisis, Morocco created a watchdog mechanism led by the Comité de Veille Economique (CVE) and carried out support measures deployed to businesses in difficulty and vulnerable families] of the Covid-19 health pandemic in Morocco has helped cushion the economic and social shocks that the Moroccan economy has been facing. As of June 2020, the Moroccan financial market has reacted positively to the economic support measures by improving the performance of its overall stock market index, the MASI, as well as the ESG10 ethical index.

Figure 2. Monthly return patterns of the ESG 10 index and its conventional peer MASI.

[19] In addition to the reduction in the policy rate, to ensure that banks have the liquidity they need, (Bank Al Maghrib, 2020) has fully released the mandatory reserve account and extended the list of assets eligible for its refinancing operations, tripling their potential to 450 billion dirhams, while meeting all of their demand.

The Figure 2 shows ESG10 index monthly returns evolution and its counterpart MASI. The ethical ESG10 index tracks the performance of ten Moroccan companies listed on the Casablanca Stock Exchange, qualified as *Top performers* according to the rating obtained by the agency *Vigeo Eiris*. Thus, the ESG10 index can be considered as a sub-group of the MASI index, which explains the almost identical daily and monthly return curves.

After a rather usual return during 2019, the year 2020 was marked by an unprecedented decline. Indeed, on March 16, 2020, the MASI index realized a spectacular decline, i.e. -10.16% in a single day, while the ESG10 ethical index in turn showed a decline but less than the MASI, i.e. a decline of -9.23%.

Table 1. Summary of the daily performance for the ESG10 and the MASI indexes.

Statistics	ESG10	MASI
Observations	744	744
Minimum	-0.102	-0.092
Quartile 1	-0.003	-0.003
Median	0.000	0.000
Arithmetic Mean	0.000	0.000
Geometric Mean	0.000	0.000
Quartile 3	0.004	0.004
Maximum	0.062	0.053
SE Mean	0.000	0.000
LCL Mean (0.95)	-0.001	0.000
UCL Mean (0.95)	0.001	0.001
Variance	0.000	0.000
Stdev	0.009	0.008
Skewness	-2.348	-2.681
Kurtosis	29.722	33.016

Table 1 presents the descriptive statistics daily returns of the two indexes. Over the sample period of 744 daily observations, the arithmetic mean return of the ESG10 index was positive by a value of 0.0001, while over the same period, its conventional counterpart achieved an average return of 0.0002. In addition, the 95% confidence interval of the estimated average return of the ESG10 index is wider ([-0.0005; 0.0008]) relative to the estimated average return of the MASI index ([-0.0004; 0.0008]), suggesting a more accurate estimation of the average MASI return relative to that of the ethical index. On the basis of the empirical average of the returns of the two indexes, and on the sample we have, it seems that the ESG10 index underperforms its conventional peer. Moreover, the table shows that daily and annual returns are more volatile for the ESG10 index relative to the global MASI. The ethical index is not just less profitable, but it is even more volatile. In fact, financial theory states that a riskier asset[20], it should be able to offer its holder a higher return than another less risky asset, in other words, it should offer its holder a risk premium.

Table 2. Summary of ESG10 and MASI return volatility.

Volatility measures	ESG10	MASI
Mean Absolute deviation	0.005	0.004
Daily Std Dev	0.009	0.008
Annualized Std Dev	0.149	0.132

Table 2 presents the elementary volatility return statistics for the two indices, Mean Absolute deviation, Daily Std Deviation and Annualize Std Deviation respectively. The three statistics reveal that the ethical index return is more volatile than its conventional counterpart.

In this study, to calculate the VaR, we set $alpha$ to 5% and we considered the holding period of one day for both indexes. We used the returns series calculated by the formula (3). As shown in Table 3, the ESG10 SRI index

[20] In this work, we use return volatility as a proxy measure of the level of risk associated with an asset or portfolio of assets.

VaR is higher than the conventional MASI index. The losses associated with holding the portfolio composed of the ESG10 are greater than those associated with holding a portfolio composed of the conventional MASI index. In other words, for a one-day holding period and for $alpha = 5\%$, the maximum loss (negative returns) of the MASI index is -0.0135506 while this loss reaches -0.0153142 for the SRI ESG10 index. If we assume that both indexes have a value of 100 on day t and that the distributions of the returns of both indexes follow a normal distribution, for a value of $\alpha = 0.05$ and for an investor who would have the choice of investing in a diversified portfolio of SRI stocks such as the ESG10 index and a non-ISR portfolio such as the MASI, there is a probability of 0.95 that the investor will lose no more than 1.5314195 in the ESG10 portfolio and no more than 1.3550606 if he invests in the non-ISR portfolio such as the MASI. In terms of risk as computed by VaR, it is clear that the ESG10 portfolio is more riskier than its MASI peer.

Table 3. Calculating VaR of MASI and ESG10 indexes.

VaR_MASI	VaR_ESG10
-0.014	-0.015

Table 4. Performance indicators of the ESG10 index compared to the MASI index based on the CAPM model.

Performance indicators	ESG10 performance relative to the MASI
Alpha	0.001
Beta	1.094
Beta+	1.115
Beta-	1.085
R-squared	0.952
Annualized Alpha	-0.027
Correlation	0.976
Correlation p-value	0.000
Tracking Error	0.035
Active Premium	-0.025
Information Ratio	-0.717
Treynor Ratio	0.022

4.2. Financial Performance Measures

In order to refine our preliminary analysis, we have applied various performance measures and reported the main results in the Table 3. We started our analysis by estimating the Jensen's alpha ratio under the standard CAPM specification Equation 8, which we believe is most appropriate to address our problem of the over/under performance of the ESG10 ethical index compared to its conventional peer. The estimated value of Jensen's alpha [?], on the basis of our sample was a negative value of $\alpha = -0.0001$. This shows that the performance of the ESG10 Ethical Index is lower than the MASI index. In other words, on the basis of the sample we have, the ESG10 ethical index has underperformed its benchmark index represented by MASI. This finding is consistent with the results of the descriptive statistics analysis (see Table 1).

As noted in the section 3.2.3, SR assesses the marginal return per unit of total risk. Table 4 shows the values of this indicator for the two indexes. The SR value of the MASI (.0267) is higher than the SR value of the ESG10 (0.0145). This means that the financial performance of the MASI index, as measured by SR, is high compared to that of the ESG10 ethical index. We should note that the excess returns of both indexes are associated with a higher risk due to the fact that the SR value is between 0 and 1. Therefore, the risk level associated with both SRI and non-SRI investments is quite high, which is generally typical of developing and emerging stock markets.

Table 5. Sharpe ratio of the ESG10 and MASI indexes.

Sharpe ratio indicator	ESG10	MASI
StdDev Sharpe (Rf=0%, p=95%):	0.015	0.027

The results of the modified Sharpe ratio are in line with the results of the Sharpe Ratio and agree with the preliminary analysis results (see Table 5). In fact, changing the way of looking at the risk, taking into consideration the expected loss (EL) rather than total risk, does not alter the finding that the ESG10 ISR index is underperforming the MASI benchmark index.

Table 6. Modified Sharpe ratio of the ESG10 and MASI indexes.

Modified Sharpe ratio indicator	ESG10	MASI
ES Sharpe (Rf=0%, p=95%):	0.003	0.007

Table 7. The expected loss at a 95% level of likelihood for the ESG10 and MASI indexes.

Expected loss indicator	ESG10	MASI
ES	-0.019	-0.017

If we assume that the returns are normally distributed, for a 95% probability and a one-day holding period, the expected loss when investing in the ESG10 ISR portfolio is -0.0192395, while it is only -0.01705 when investing at the conventional non-ISR index. This implies that if ESG10 index daily return is less than VaR which is -0.0153142, the average loss is approximately 0.0192264 whereas it would be 0.0170383 in case of investing in the MASI portfolio. The two risk measures, the VaR and the ES yield the same result: investment in the SRI portfolio is riskier compared to its conventional peer the MASI Table 6.

4.3. Financial Performance Measures under CAPM-GARCH Specification

Before estimating the the CAPM-GARCH(1,1) specification (model 9), we checked the order of integration of the conventional (MASI) index and ethical index (ESG10) by applying an Augmented Dickey–Fuller Test. Both indexes are not stationary[21]. In addition, analysis of the graphs 1 of the daily returns of the two indexes shows the presence of a co-movement between the conventional index and ethical one, suggesting a comparable level of performance. It should be noted that the returns of the two indexes are more volatile during the period of the Covid-19 pandemic crisis, which suggests the presence of ARCH effects.

Moreover, as suggested by Table 1, the hypothesis of normality assumed when calculating the different performance ratios is rejected for both conventional and ethical indexes. Likewise, the Omega ratio, considered as an alternative to the simple and modified Sharpe ratio, since it does not assume the returns normality, yields a similar results. The Table 7 shows the values of this ratio for the two stock market indexes. The Omega ratio value for the ESG10 ethical index (1.05) is less than that for the conventional MASI index (1.098), suggesting that MASI index provides more gains relative to losses at the threshold θ[22] than does the ethical ESG10 index. However, it must be noted that the Omega ratio values do not diverge enough for the two indexes.

Table 8. Omega ratio of the ESG10 and MASI indexes.

	ESG10	MASI
Omega (L = 0%)	1.051	1.098

Table 8 presents the Omega ratio, which is defined as the probability weighted ratio of gains versus losses for some threshold return target. The results of the estimation shows that an investment portfolio composition based on replicating the performance of the conventional investment as represented by MASI index has a higher probability of gain than the investment portfolio that replicates the ethical investment as represented by the ESG index10.

[21] We have not reported the results of the unit root tests to save space but they are available on request.

[22] In this work, we have set the threshold value θ to be zero.

In order to measure financial performance by Jensen's alpha, while overcoming the limitations of the standard CAPM specification (8), the CAPM-GARCH(1,1) specification was used (9).

Table 9. CAPM-NGARCH estimates.

Parameters estimates	Estimate	Std. Error	t value	Pr(> |t|)
Mu	-0.003	0.000	-2.600	0.01
Mxreg1	1.069	0.020	53.200	0.00
Omega	0.000	0.000	0.600	0.58
Alpha1	0.365	0.170	2.200	0.03
Beta1	0.593	0.040	16.800	0.00

The model was estimated in several steps. First of all, model (8) was estimated by the ordinary least squares method. Then, we applied an ARCH test to check the conditional variation of the residual variance. The null hypothesis of errors homoscedasticity was not accepted, which indicate an additional evidence of an ARCH effect. The results of the ARCH effect test confirm the empirical finding of high volatility in the returns of both indexes Figure 1. Finally, we focused on the specification and estimation of the appropriate variance model, where mean equation is represented by the CAPM specification. Different GARCH specifications[23] were tested, therefore, the CAPM-NGARCH(1,1) specification was chosen to estimate Jensen's alpha. The key results for CAPM-NGARCH(1,1) are summarized in Table 9.

The *mu* value in Table 9, which stands for α_i in the mean equation (CAPM-NGARCH 9) is the estimate of the Jensen's alpha, this estimate value -0.0025427 is negative and statically significant, which indicates and confirms once again, that the ethical index ESG10 underperforms the benchmark MASI. Also, the *mxreg1* which stands for β in the mean equation (CAPM-NGARCH 9), it measures the reaction of the ethical index ESG10 to the market as a whole, as measured by the MASI index. It should be noted that the beta value of the ethical index ESG10 is statistically significant and close to the value of 1, this result is in line with the beta estimated by the standard CAPM specification (Table 1). Moreover, *Omega* is the α_0, *alpha1* is the α_1 and *beta1* is the β_1 in the variance Equation 9. Apart from the value of the Omega coefficient, the other estimated coefficients of the variance equation are positive and statistically significant, which confirms the findings relating to the high volatility of the return figure of the two indexes Figure 1 and the relevance of the adopted specification. We note that this conclusion is also suggested by the previous performance measures Table 3 and confirming the robustness of our previous results.

In overall, assessing the financial performance of the indexes is not a straightforward exercise and the outcome is highly dependent on the approach used to measure performance. Indeed, the period of analysis is not a monolithic block; it was marked by the crisis related to the Covid 19 pandemic. However, the estimates of the different approaches are convergent and conclusive.

5. CONCLUSION

Since the end of the 90s of the past centuries, different stock markets have created so-called ethical or socially responsible (SR) indexes in order to provide a reference point for investors concerned about ethical issues in their investment decision-making. This movement began in the developed countries with an awareness of non-financial standards within the investing decision process, but began to expand to include the emerging and developing markets.

L'impact de l'éthique sur la performance des portefeuilles a été largement discuté dans la littérature financière. Néanmoins, les nombreuses études empiriques sur cette question peinent à atteindre un consensus commun, laissant le débat ouvert à d'autres investigations.

[23] The other specifications allow for asymmetric returns and the heaviness of the return distribution tails. like GARCH-t, EGARCH.

This situation can be due to the lack of a theoretical and conceptual basis for the studies, the lack of uniformity in the assessment of CSR and the variety of the criteria used by rating agencies, as well as the different performance measures that are used.

In order to better investigate the concept of CSR investment performance in the financial markets, this paper aims to determine if SRI positively or negatively impacts the companies' stock market performances? To this end, the empirical analysis focuses on the ethical index Casablanca ESG 10, using the data from January 2019 to December 2021.

In addition, various risk adjusted performance measures were used, such as the Sharpe ratio, the Treynor ratio, the Jensen Alpha and the Sortino ratio. These ratios are derived from the classic financial theory and suppose that returns are normally distributed. To account for the fact that distributions are often non-Gaussian, we calculated other measures such as the Omega ratio.

In a preliminary analysis, we have compared the performance of the ESG10 ethical index to the broad Moroccan stock market index, the MASI. The graphical analysis reveals that both indexes are following the same pattern. The descriptive statistics analysis shows that the ethical index has lower returns than its benchmark. The risk measure shows that the VaR at 5% of the ESG10 is higher than the conventional MASI. The Casablanca Stock Exchange ethical index is not only less profitable, but also more volatile.

The findings of risk-adjusted performance measures support this conclusion. Indeed, the Jensen alpha of the ESG 10 index is negative, whereas the Sharpe ratio and the Omega of this index are both below that of their benchmark, the MASI. This can be interpreted as the novelty of the index in the Casablanca stock market and that Moroccan investors are not yet familiar with this kind of investments.

The management implications of these results are multiple. The paper is among the first to try to assess the risk/return tradeoff of the ESG 10 index relative to its traditional peer. This could lead to the orientation of the investment decision toward this kind of index, or on the contrary to realize that the investors have to sacrifice to be ethical.

Of the limitations of our study, we note the short period of study (it covered 3 years from January 2019 until December 2021), this is due to the novelty of this index that was just introduced in the Moroccan stock exchange market in 2018, and lack of a large historical data that can be exploited. Further investigation might more thoroughly explore the ethical commitments of all the companies making up this index, as well as the impact that inclusion (or removal) from the index might have on the performance of each company.

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