Quantitative Economics and Management Studies (QEMS) *ISSN: 2722-6247 (online)*
Vol. 1 No. 6 (2020)
https://doi.org/10.35877/454RI.qems220

Comparative risk analysis by VaR: an empirical application to ethical market indices

Abdelkader Derbali[a,b,*], Hany A Saleh[c]

[a]*Department of Administrative and Financial Sciences and Techniques, Community College, Taibah University, Saudi Arabia*
[b]*Department of Finance and Accounting, Higher Institute of Informatics and Management of Kairouan, Kairouan University, Kairouan, Tunisia*
[c]*Insurance and Actuarial Sciences, Mansoura University, Egypt*

Abstract

In recent years, companies' actions towards factors of production have multiplied. The human dimension is increasingly present in decisions and companies feel socially responsible. The sustainability of companies necessarily requires limiting the negative environmental effects because of these production activities. Ethical finance in general, whether Islamic or not, is a growing demand on the part of consumers and states. The aim of this paper is to assess the risk of two ethically responsible indices such as S&P500 Shariah index and S&P500 Environment and Socially Responsible index. In this paper, we will conduct a comparative study of market risk on two ethically responsible indices: the Islamic Index of the Shariah (S&P500 Shariah index) and the S&P500 Environment and Socially Responsible index during the period from 30/09/2010 to 21/09/2018. The evolution of the market will be represented by the general index of the S&P500. To do this, we use different approaches to value at risk such as VaR parametric approach, VaR non-parametric approach and the Theory of Extreme Values approach. Our results show that, on the one hand, the S&P500 Environment and Socially Responsible index is less risky than the S&P500 Shariah index and the S&P500 index. On the other hand, the S&P500 Shariah index is at low risk when yields are extreme. We conclude that the S&P500 Environment and Socially Responsible index is less risky than the Shariah S&P500 Index when you consider that yields are moving under normal market conditions.

Keywords: Market risk, Value at Risk, Islamic index, Ethically responsible index.

1. Introduction

Islamic financial engineering has made it possible to design a range of financial products and services intended for individuals and institutional investors concerned with ethics in their portfolios. This is how Islamic finance first entered the financial markets by offering investors solutions such as investment funds, stock indices and Islamic bonds, called sukuk. Their launch was part of the logic of offering investors a way to diversify their portfolios, allowing them to invest in accordance with their religious principles. We propose to study more particularly investment funds and stock market indices in accordance with the precepts of sharia.

As for Islamic investment funds, their number currently stands at 680 funds with US $ 70 billion in assets under management (Eurekahedge, 2010; Yilmaz et al., 2020). They are mainly equity funds, more than half of which are made up of funds invested in Saudi Arabia or Malaysia. The control of their conformity to the rules and precepts of Islam is ensured by an independent Sharia committee composed of jurisconsults specialized in Moslem law and more particularly in business law.

The literature on these funds has been particularly interested in the Malaysian market (Abdullah et al., 2007; Saad et al., 2010). Some studies have focused on Islamic funds invested in Saudi Arabia (Merdad et al., 2010) and Italy

* Corresponding author.
E-mail address: derbaliabdelkader@outlook.fr (Abdelkader Derbali)

(Collina, 2009). However, other researchers have studied samples of Islamic funds that are globally diverse and cover several countries and geographic areas (Hayat and Kraeussl, 2011). The results of their study differ as to the outperformance or underperformance of Islamic funds.

Thus, some researches find that these funds outperform their benchmarks (Abdullah et al., 2007), others find that these funds are, on the contrary, incapable of generating additional profitability (Merdad et al., 2010) or conclude by the absence of a significant difference in performance (El Fakhani et al., 2005). Other researchers who have taken part in this question come to more nuanced conclusions. They attribute the difference in performance to factors such as the choice of geographic investment areas (Hoepner et al., 2011), the choice of benchmark (Hayat and Kraeussl, 2011), the size of Islamic funds (Saad et al., 2010) or the economic situation (Hayat and Kraeussl, 2011).

In a context of stock market volatility, it has become essential to be able to quantify risk through robust approaches. Thus, risk managers and, in general, economic operators, are particularly sensitive to the occurrence of substantial losses. From this perspective, it is useful to establish a rigorous system for managing the risks of extreme price fluctuations.

One of the challenges for risk managers is to implement rare event management models that can better predict its consequences. In terms of market risk, we may be concerned with determining the VaR day for losses we incur on an asset or portfolio that can be traded due to adverse market movements.

It is in this climate of instability the ethical clues have appeared. It should be noted that there has been interest in investments and indices in accordance with Shariah law (Ben Rejeb and Arfaoui, 2019; Landi, and Sciarelli, 2019; Bhuiyan et al., 2020; Yulmaz et al., 2020). Indeed, Islamic investments embody certain values sought in recent years, such as equity and profit-sharing.

The world's most remarkable growth in financial engineering is Islamic investments because of the high yields and precepts on which some investors in Islamic oil countries are founded and desired. Global Islamic financial assets reach $1800 billion in 2013, according to figures from the global Islamic finance conference GIFC (2012).

The specificities of Islamic finance and its characteristics in the face of risk, especially in times of financial instability, distinguish them from conventional institutions because they are not subject to the same types of risk. In times of the financial crisis, Islamic financial instruments were able to attract more investors seeking to invest their capital in its non-interest-generating instruments. The diversity of Islamic capital market instruments such as mutual funds and sukuks have enabled a flourishing Islamic capital market. At the same time, socially responsible indices have multiplied by the major financial centers.

Islamic investment is based on five fundamental principles. It is a question of prohibiting interest (riba), taking excessive uncertainty (gharar), speculation (maysir), investing in industries "contrary to ethics" and finally we must share the risks and returns Shanmugam and Zahari (2009). This means that Muslim investors are not allowed to invest in speculative futures, options and other derivatives and that Muslims do not have access to conventional credit.

Most of the studies looking at stock market performance focus on conventional indices. In recent years, there has been evidence that the empirical literature of the performance of Islamic stock indexes has continued to grow. Two streams of study can be distinguished. A current that deals with the performance of conventional stock indexes against Islamic stock indexes. The other current examines the performance of Islamic funds and compares it with conventional funds.

An analysis of monthly returns over four crisis and non-crisis subside periods reveals that Islamic indices outperform their conventional counterparts in times of crisis, but the results are inconclusive for non-crisis periods. This could be due to the conservative nature of Shariah-compliant investments offering investors a superior investment alternative in times of crisis Catherine Soke Fun Ho et al. (2014).

Several studies deal with risk-adjusted performance. They used performance measures such as Sharpe's ratio, the Treynor index and average comparison tests. The results of the Ahmad and Ibrahim (2002) study, which covered a period of 1999 and 2002 comparing gross yields and risks for the entire period and the bearish period.

Using the cointegration technique, the two authors Hakim and Rashidian (2002) discuss the relationship between DJIMI (The Dow Jones Islamic Market Index), the Wilshire 5000 Index, which measures the performance of most

publicly traded companies headquartered in the United States and the risk-free rate over the period from December 10, 1999 to 9 April 2002. Their results show that the selection process used for DJIMI shares did not involve any losses and that Muslim investors are no less well off by investing in an Islamic index as a subset of a much larger portfolio.

A study by Hussein (2004) compares the performance of the FTSE Global Islamic Index with the FTSE All World Index. The results of the financial asset balance model (CAPM) estimate suggest that the performance of the Islamic index is superior to that of its conventional counterpart. In addition, the Islamic index is doing better during the period of economic growth than during the bearish period.

Hussein and Omran (2005) analyze the performance of DJIMI, which reports on the effects of industry, size, and economic conditions on Islamic indices. The authors noted that Islamic indices outperform their conventional counterparts when bull markets. but underperform if markets are bearish. Raphie and Roman (2011) analyze the risk and performance characteristics of a sample of 145 Islamic equity funds over the 2000-2009 period. Using Jensen's (1968) version of the Financial Asset Assessment Model (CAPM). They estimated risk-adjusted performance (alpha) and systematic risk (beta) for each Islamic equity fund. The results revealed that Islamic Investment Funds (IIFs) on average underperformed their Islamic and conventional benchmarks over the 2000-2009 period. By analysing the effects of the financial crisis. They showed that this underperformance appears to have increased during the crisis period. Albaity and Ahmad (2008) analyze the risk and performance performance of malaysia's Kuala Lumpur Shariah Index (KLSI) and the Kuala Lumpur Composite Index (KLCI) in 1999-2005. The results showed that Islamic indices are not significantly lower than traditional indices. Using cointegration tests. They revealed that the two series are stuck in the long term. In addition, Granger's bivariate test indicates the presence of short-term two-way causality between the indices.

Statman (2019) studies the performance of socially responsible indices. It found that the returns of the DS400 Index, which is a capitalization-weighted index of 400 U.S. securities that offer exposure to companies with exceptional environmental, social and governance (ESG) ratings and excludes companies whose products have negative social or environmental impacts, were higher than those of the S&P500 index over the period from May 1990 to April 2004 and did not have them at each sub-period. In general, socially responsible indices (SRIs) outperformed the S&P500 index during the boom of the late 1990s, but they lagged during the crisis of the early 2000s. The correlations between the yields of the SRI indexes and those of the S&P500 index are high. This correlation was 0.939 between DJ Sustainability Index and between January 1995 and April 2004. After that, it is estimated at 0.985 Index DS 400 and S&P500 over the period from September 1999 and April 2004. Other Studies compared the performance of the SRI index DS 400, Sauer (1997) S&P500 Index of Conventional Companies (1997).

The study of the performance of U.S. mutual funds reveals no statistically significant relationship between the returns of socially responsible mutual compared to conventional funds Hamilton et al. (1993), Goldreyer and Diltz (1999) and Bauer et al. (2005).

As part of this communication, we will be looking at the flagship index of the S&P500 created by Standard and Poor's, which consists of the 500 securities listed on the U.S. exchanges (NYSE or NASDAQ) that are the most representative of the U.S. economy. We remember as an Islamic clue, The S&P500 Shariah index includes all components that comply with the S&P500 Shariah index, the main benchmark of the U.S. equity market that will be compared to the Environmental and Social Responsibility Index, which is designed to measure the performance of the S&P500 securities that meet the criteria for environmental and social sustainability.

The rest of this paper is organized as follow, in section 2, we present the econometric methodology used in our study. Section 3 presents the empirical findings of our paper. Finally, section 4 concludes.

2. Methodology

The concept of VaR is crucial because of the multiplicity of its applications. The hypotheses on which the estimation methods are based have developed significantly to integrate the phenomena observed empirically. We will first present the definition of VaR and then we will set out the different methods of estimations in the last place we approach its limits.

The VaR is the maximum expected loss of a portfolio over a time horizon and a level of confidence given under normal market conditions. The idea is to summarize in one number all the potential losses that a portfolio can suffer by aggregating all its positions. The VaR is therefore a probabilistic measure. Two variables are fundamental to interpreting VaR:

- Confidence level α: it is the probability that the loss will not be higher than expected. This is set at 99% by the regulatory authorities; this threshold indicates the degree of risk coverage. If the degree of risk aversion is high, the risk manager wants to have enough capital to cover the risk. And therefore, the higher the level of confidence. 99% coverage is much more demanding and therefore much more expensive than 90% coverage.
- The T-horizon: which corresponds to the period over which the variation is measured. The choice of T generally depends on three factors: market liquidity, i.e. the length of time it takes to liquidate positions. Asset rotation: the more active the management, the shorter the duration and statistical reliability: the shorter the horizon, the more reliable the VaR method.

2.1. VaR estimation methods

In general. several methods of measurement of VaR are distinguished. they are based on assumptions of the distribution of the probability of the underlying asset. in this case we are talking about a parametric method. other methods allow a semi or non-parametric estimate of VaR.

The VaR estimate is the estimate of the amount of probability distribution of an asset's returns (loss and profit). The choice of such estimation method has an influence on the results of the VaR. Indeed. For the same risk and even bank one could have different capital requirements depending on the method used to calculate the VaR. This is a disadvantage if the capital requirements are higher than the amount it needs. This leads to a sub-optimal allocation of capital. There is also a problem with accurate estimates of the solvency of the financial system. The opposite effect may occur as banks will tend to use methods that require the lowest level of capital which will pose a threat to their creditworthiness. Although VaR is a very simple and intuitive measure its measurement is a major statistical problem.

Engle and Manganelli (2001) found that existing models for calculating VaR use different methodologies. They all follow a common general structure. which can be summarized in three points: first for the valuation of the portfolio in relation to the market (mark-to-market). in a second estimate of the distribution of portfolio returns. And finally, the calculation of the VaR of the portfolio.

2.1.1. Parametric methods

To assess risk, it is necessary to involve probabilities because the main cause of the risk is uncertainty related to future price developments. The process takes place in two stages: first describing all future events and then assigning a weight to each of them to represent their probability of realization.

The resulting model is synthesized by its frequency diagram. called probability law or model distribution. In the case of VaR, we can directly study the evolution of the target value or related to the movements of various sources of risk called risk factors. The simplest model is the normal law, which is characterized by two parameters: average and variance. This approach is the standard method:

$$R_t \sim N(\mu_t, \sigma^2) \tag{1}$$

and,

$$(R_t - \mu)/\sigma \sim N(0,1) \tag{2}$$

with,

$$R_t = ln\left(\frac{P_{t+1}}{P_t}\right) \tag{3}$$

The loss realized during a day is the negative logarithmic variation noted between a day j and day j-1. We have the probability of achieving a maximum loss is given by:

$$P(R_t < VaR_\alpha) = \alpha \tag{4}$$

The standard normal transformation is:

$$P\left((R_t - \mu)/\sigma < (VaR_\alpha - \mu/\sigma)\right) = \alpha \tag{5}$$

and,

$$P(Z < z_\alpha) = \alpha \tag{6}$$

We have:

$$z_\alpha = (VaR_\alpha - \mu)/\sigma \tag{7}$$

We conclude:

$$VaR_\alpha = \mu + z_\alpha \sigma \tag{8}$$

Conditional VaR or CVaR is the average loss beyond VaR. It is defined as follows:

$$CVaR_\alpha = VaR_\alpha + E(R_t - VaR_\alpha / R_t > VaR) \tag{9}$$

2.1.2. Non-parametric methods

Historical simulation uses past profits/losses to predict future profits/losses. Therefore, the choice of sample size is of paramount importance in the estimate period. This approach simplifies the calculation process as it makes no assumptions about the distribution of portfolio returns. So, it captures non-normal features such as thick tails. And eliminate the use and estimation of volatility and correlations. It avoids any risk modelling. And can be applied to all types of linear and non-linear portfolios. This gives it a theoretical superiority over the parametric approach.

The VaR is based on a strong hypothesis. normal distribution. With such a method of calculation. It is therefore assumed that the distribution of yields is invariant and can then be simulated by past yields. The historical simulation is based on the concept of mobile windows. The analyst chooses an observation window; then the returns of the portfolios inside this window are sorted from in an ascending order and the amount α is given by the yield that leaves α% of the observations on its left side (1- α%) comments on his right side. To calculate the VaR the next day. the entire window is moved to the next observation and the entire procedure is repeated.

2.1.3. The Theory of Extreme Values approach

Empirical analysis shows that the series are not normal. This is due to the existence of extreme values. Statistically, there is an excess of skewness and kurtosis. The study of extreme values suggests the study of the tails of the distribution or equivalently the analysis of the larger observation of a sample. TEV is like the counterpart of classical statistical theory which is mainly based on the study of the average rather than extreme observations. To improve the estimate of losses. We will propose to use the extreme values approach that has been used primarily. The VaR is therefore given by the relationship:

$$q_p = VaR_p = u + \frac{\beta}{\xi}\left\{\left(\frac{n}{N_u}p\right)^{-\xi} - 1\right\} \tag{10}$$

The CVaR is then given by:

$$CVaR_p = \frac{q_p}{1-\xi} + \frac{\beta - \xi u}{1-\xi} \tag{11}$$

Where, p indicates the confidence level = (1-α), β is a scale parameter, μ present the average, u presents a threshold, ξ is a shape parameter or tail index, Nu is the number of observations exceeding the threshold u and n is the total number of observations.

The tail index ξ reflects the thickness of the tails while the scale parameter σ reflects the dispersion of the distribution around the mean. The higher the ξ, the thicker the tail. The different values of these parameters define the different forms of PDM. Pareto (ξ> 0), Uniform (ξ = 1), Exponential (ξ = 0). To estimate these parameters. two general methods are used: the semi-parametric method based on Hill type estimators (1975) and the parametric methods based on specific GPDs to be used. Danielsson and de Vries (1997) use a semi-parametric approach based on Hill's estimator to estimate the tail index.

$$G_x = 1 - \left(1 + \frac{\xi x}{\beta}\right) \tag{12}$$

Various methods can be used to estimate DGP laws. We find the method based on the maximum likelihood Smith (1987), the method of weighted moments (Greenwood et al., 1970), the method of moments (Christopeit, 1994) or the Baysian methods (Lye et al.,1993). Hosking and Wallis (1987) have shown that the first method is a real alternative.

There are also non-parametric approaches to estimating the tail index. The Pickands estimator (1975), Hill (1975) for Fréchet distributions only and the estimator of Dekkers-Einmahl-de Hann (Dekkers et al., 1989). the choice of the best estimator of the tail index has not been decided. Indeed, these different estimators vary depending on k. The choice of k is a delicate problem for $\xi > 0.5$. Smith (1987) Hosking and Wallis (1987) prove that the conditions of regularity of the likelihood function are met and that the likelihood estimator leads to an unbiased, asymptoticly normal estimator.

3. Results and discussions

Our study is carried out on daily data from the indices of the S&P500 index, the S&P500 Shariah index and the S&P500 Environment and Socially Responsible index. We are particularly interested in the rate of daily rate of return (calculated according to equation 3). The series cover the period from 30/09/2010 to 21/09/2018 (i.e. 2009 observations).

Figure 1 illustrates the evolution of indices over the analysis period. The observation of this same figure allows, on the one hand, to observe a general upward trend and that the three indices have more than doubled over the period. On the other hand, according to Figure 2, the indices are showing increasing fluctuations. We are seeing a lot of volatility in the dynamics of returns. Figure 1 histograms provide a graphic conclusion that distributions are not normal.

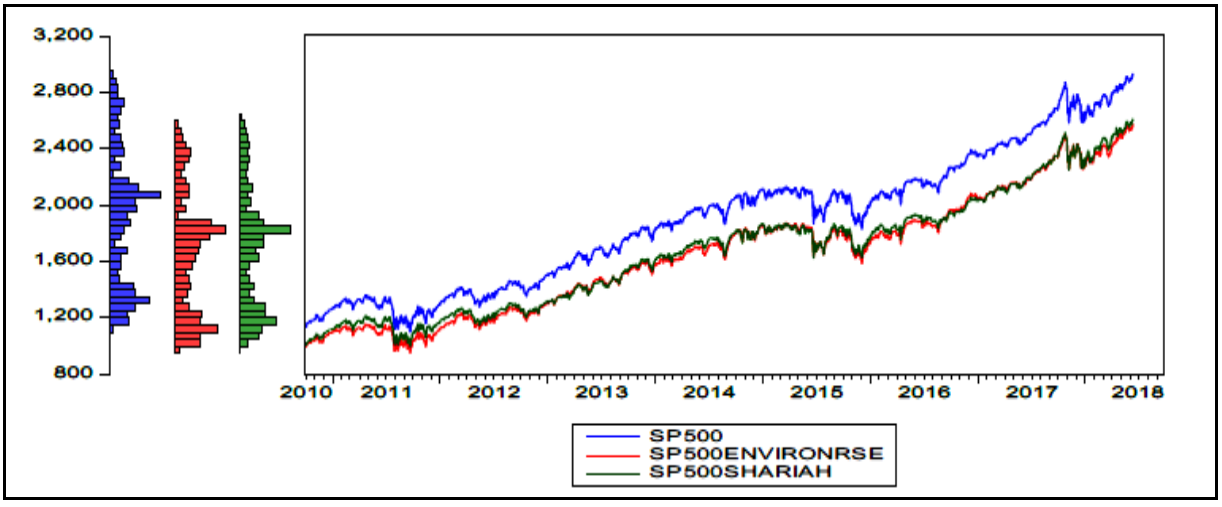

Fig 1. Indices evolution during the period from 30/09/2010 to 21/09/2018
Source: Own Elaboration

Table 1 summarizes key statistics on the performance of the three indices. Yield distributions are non-symmetrical. the probability of obtaining below-average values is higher than that of obtaining high values than the average, i.e. there are more downwards than upwards. The average yield is close to zero. It is also noted that the highest performance is recorded by the general market index of the S&P500 (up 4.63%) but also the lowest yield (-6.89%). This means that the market is much more volatile than the other two indices. The Islamic Index of S&P500 Shariah index provides the highest minimum rate of return (-6%) but also the lowest maximum return (4.29%). This translates into a small standard deviation (0.88%). So, a moderate risk compared to the standard deviations of the other indices. These same statistics confirm the non-normality of yields (the probability is 0). The statistic of Jarque-Bera statistic is significantly higher than critical value 5.9915 of a Chi-Square χ^2 at the 5% level which means that the distribution of yields deviates strongly from normal distribution.

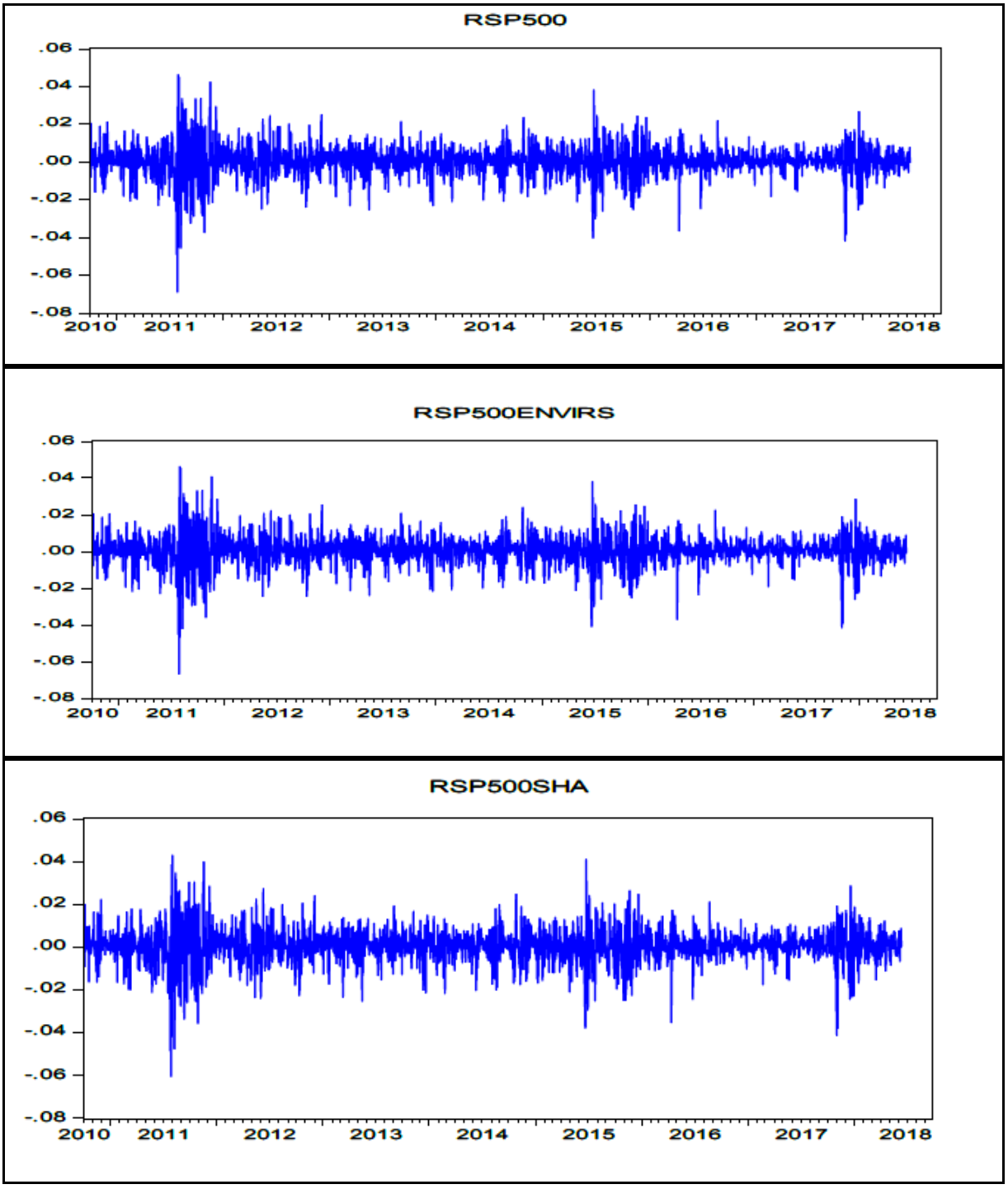

Fig. 2. Returns of used indices during the period from 30/09/2010 to 21/09/2018
Source: Own Elaboration

Table 1. Descriptive statistics

	R S&P 500	R S&P500 Environment and Socially Responsible	R S&P 500 Shariah
Mean	0.000470	0.000470	0.000472
Median	0.000572	0.000600	0.000570
Maximum	0.046317	0.046277	0.042959
Minimum	-0.068958	-0.066583	-0.060418
Std. Dev.	0.008915	0.008779	0.008871
Skewness	-0.584512	-0.553630	-0.501726
Kurtosis	8.381309	8.181493	7.323597
Jarque-Bera	2537.201	2348.849	1648.268
Probability	0.000000	0.000000	0.00000

Source: Own Elaboration

The study of the correlation in Table 2 reveals that there is a strong positive correlation between the different indices. This means that the indices are strongly and positively linked since this correlation coefficient is much close to 1.

Table 2. Correlation Matrix

	R S&P 500	R S&P 500 ENVIRS	R S&P 500 Shariah
R S&P 500	1	0.995200	0.988040
R S&P 500 ENVIRS	0.995200	1	0.979938
R S&P 500 Shariah	0.988040	0.979938	1

Source: Own Elaboration

Table 3 presents the results of the maximum yield loss estimate given a 95% confidence level and 99 based on variance-covariance. The CVaR is a measure that aims to improve the estimate of the risk of loss in the event of a loss greater than the VaR. It represents the average loss beyond the VaR.

We find that for a confidence level of 99% the maximum loss of yields that one could have is -2.54%, -2.49% and -2.48% respectively for the returns of S&P500 index, S&P500 Shariah index and S&P500 Environment and Socially Responsible index. According to its same figures on the one hand, the ethical indices of shariah and the S&P500 Environment and Socially Responsible index are less risky than the general index of the S&P500. On the other hand, the S&P500 Shariah index is a risky one compared to the S&P500 Environment and Socially Responsible index. For a level beyond the VaR, i.e. in the event of a crisis, it is noted that the S&P500 Shariah index is less risky (-6%) the other two indices (-6.17%) S&P500 Environment and Socially Responsible index (-6.09%).

Table 3. Market Risk Estimates using the Historical Simulation Approach

VaR-CVaR Historically				
Confidence level	**95%**		**99%**	
Estiamtion	**VaR**	**CVaR**	**VaR**	**CVaR**
Return of S&P 500 index	-0.014723033	-0.036572293	-0.02548489	-0.061769585
Return of S&P 500 Shariah index	-0.014575461	-0.036407343	-0.024966703	-0.060033638
Return of S&P 500 Environment & Socially Responsible index	-0.014430678	-0.036242947	-0.024804837	-0.060934222

Source: Own Elaboration

Table 4 shows the estimate of maximum loss by the parametric approach variance covariance (It tells us that the S&P500 Environment and Socially Responsible index is the least risky for a 99% confidence level is -19.89% against respectively - 20.21% and - 20.10% for the indices S&P500 Index and S&P500 Shariah index. It is also observed that the Shariah index offers the lowest CVaR, which makes the case for investment in this index in times of crisis.

Table 4. Market Risk Estimates using the Variance Covariance Approach

VaR-CVaR According to the Variance-Covariance Approach				
Confidence level	**95%**		**99%**	
Estimation	**VaR**	**CVaR**	**VaR**	**CVaR**
Return of S&P 500 index	-0,014150742	-0.038 253414	-0,020212805	-0.061454112
Return of S&P 500 Shariah index	-0,014076401	-0.039974127	-0,020108639	-0.060992214
Return of S&P 500 Environment & Socially Responsible index	-0,01392843	-0.03789564	-0,01989847	-0.06118567

Source: Own Elaboration

Table 5 shows estimates of the maximum loss of yields. To set the thresholds, we based on the quantile of the normal law and on the function of excesses relative to the average.

It presents the results of the estimation by the maximum likelihood method of the generalized parameters of the Pareto distribution. The value taken by the parameter $\hat{\xi}$ provides information on the weight of the queues in the distribution. In other words, the higher the tail indices $\hat{\xi}$, the thicker the distribution considered. A tail index greater than zero therefore means that the probability of occurrence of extreme returns and therefore the risk of extreme losses. The risk of an investment, extreme losses, is therefore all the greater the higher the corresponding tail index. Thus, the case $\hat{\xi} > 0$ is the most interesting in risk management models because the GPD is thick-tailed. We deduce the values of VaR and CVaR for the returns of the indices in accordance with equations (11) and (12). At a 95% quantile level, the estimated VaR of GPD for the S&P500 returns is -7.08%, i.e. with the GPD model, we are 95% convinced that the market return expected would not drop more than -7.08%. According to this same table, it can be seen that the values of the maximum loss will be recorded by the general S&P500 market index followed by the S&P500 Environment and Socially Responsible index and finally by the S&P 500 Shariah index.

Table 5. Market Risk Estimates using the TEV Approach

Indices	**Fixed level**		$\hat{\xi}$	$\hat{\beta}$	**VaR**		**CVaR**	
	Nu	**u**			**95%**	**99%**	**95%**	**99%**
Return of S&P 500 index	113	-0.0084	0.1823	1.1588	-0.0708	-0.07243	-0.0988	-0.1008
Return of S&P 500 Shariah index	82	-0.0156	0.1687	1.4920	-0.0615	-0.0627	-0.0887	-0.0902
Return of S&P 500 Environment & Socially Responsible index	96	-0.0148	0.1755	1.3539	-0.0669	-0.0682	-0.0944	-0.0959

Source: Own Elaboration

Compared to different approaches to estimating VaR, it is also interesting to note that the TEV sui approach based on generalized Pareto distribution has produced higher estimates of VaR and CVaR than the other two approaches at the

confidence level of 95% and 99%, and that, unlike the other two approaches, the S&P500 Shariah index is less risky than the S&P500 Environment and Socially Responsible index. This is since the S&P500 Environment and Socially Responsible index has extreme movements that are much larger than the S&P500 Shariah index.

4. Conclusion

The aim of this paper is to study the market risk on two ethically responsible indices: the Islamic Index of the Shariah (S&P500 Shariah index) and the S&P500 Environment and Socially Responsible index during the period from 30/09/2010 to 21/09/2018. Then, we use different approaches to value at risk such as VaR parametric approach, VaR non-parametric approach and the Theory of Extreme Values approach.

We have studied market risk on ethical indices through the S&P500 Environment and Socially Responsible index, which presents the evolution of corporate values on the U.S. stock market, putting sustainable development at the heart of their strategies, S&P500 Shariah index, which represents all components that comply with the S&P500 Shariah index, and the general market index of the S&P500.

Different approaches to estimating the value at risk have shown that the general index is much riskier but offers a higher profitability than the other two ethical indices. We have also notice that the S&P500 Environment and Socially Responsible index is less risky than the Shariah S&P500 Index when you consider that yields are moving under normal market conditions. The S&P500 Shariah index changes behaviours as soon as extreme returns are considered. It offers the lowest risk, especially when the market is in a period of permanent recession.

Acknowledgements

The authors would acknowledge the Editor in Chief and the anonymous reviewers for their important and supportive remarks and comments which improve the quality of the article.

References

Abdullah, F., Hassan, T. and Mohamad, S. (2007). Investigation of performance of Malaysian Islamic unit trust funds. Managerial Finance, 33(2), 142-153. https://doi.org/10.1108/03074350710715854

Ahmad, Z., & Ibrahim, H. (2002). A study of performance of the KLSE Syariah Index. *Malaysian Management Journal*, 6(1&2), 25-34. http://e-journal.uum.edu.my/index.php/mmj/article/view/8594

Albaity, M., & Ahmad, R. (2008). Performance of Syariah and Composite Indices: Evidence from Bursa Malaysia. *Asian Academy of Management Journal of Accounting and Finance (AAMJAF), Penerbit Universiti Sains Malaysia*, 4(1), 23-43. http://web.usm.my/journal/aamjaf/vol%204-1-2008/4-1-2.pdf

Bauer, R., Koedijk, K., & Otten, R. (2005). International Evidence on Ethical Mutual Fund Performance and Investment Style, *Journal of Banking & finance*, 29(7), 1751-1767. https://doi.org/10.1016/j.jbankfin.2004.06.035

Ben Rejeb, A., & Arfaoui, M. (2019). Do Islamic stock indexes outperform conventional stock indexes? A state space modeling approach. *European Journal of Management and Business Economics*, 28 (3), 301-322. https://doi.org/10.1108/EJMBE-08-2018-0088

Bhuiyan, R.A., Puspa, M., Saiti, B., & Ghani, G.M. (2020). Comparative analysis between global sukuk and bond indices: value-at-risk approach. *Journal of Islamic Accounting and Business Research*, 11(6), 1245-1256. https://doi.org/10.1108/JIABR-02-2018-0019

Danielsson, J., & De Vries, C. (1998). Beyond the Sample: Extreme Quantile and Probability Estimation. *London School of Economics*, Tinbergen Institute Discussion Papers, Discussion Paper, No. 98-016/2. https://www.econstor.eu/bitstream/10419/85542/1/98016.pdf

Dekkers, A.L.M., Einmahl, J.H.J., & Haan, D.L. (1989). A moment estimator for the index of an extreme-value distribution. *The Annals of Statistics*, 17(4), 1833–1855. https://doi.org/10.1214/aos/1176347397

Eurekahedge. (2010). Overview of 2009 Key Trends in Islamic Funds. http://eurekahedge.blogspot.fr/2010/01/overview-of-2009-key-trends-in-islamic.html.

Goldreyer, E., & Diltz, J.D. (1999). The Performance of Socially Responsible Mutual Funds: Incorporating Sociopolitical Information in Portfolio Selection. *Managerial Finance*, 25(1), 23-36. https://doi.org/10.1108/03074359910765830

Hamilton, S., Joe, H., & Statman, M. (1993). Doing well while doing good? The investment performance of socially responsible mutual funds. *Financial Analysts Journal*, 49(6), 62-66. https://doi.org/10.2469/faj.v49.n6.62

Hayat, R., & Kraeussl, R. (2011). Risk and return characteristics of Islamic equity funds. *Emerging Markets Review*, 12 (2), 189-203. https://doi.org/10.1016/j.ememar.2011.02.002

Hill, B.M. (1975). A simple general approach to inference about the tail of a distribution. *Annals of statistics*, 3(5), 1163-1174. https://www.jstor.org/stable/2958370

Ho, C.S.F., Afiqah, A.N.M, Muhamad, H.Y., & Zamzamin, Y.Z. (2014). Performance of global Islamic versus conventional share indices: International evidence. *Pacific-Basin Finance Journal*, 28(2), 110–121. https://doi.org/10.1016/j.pacfin.2013.09.002

Hoepner, A.G.F., Rammal, H.G., & Rezec, M. (2011). Islamic mutual funds 'financial performance and international investment style: evidence from 20 countries. *The European Journal of Finance*, 17(9-10), 829–850. https://doi.org/10.1080/1351847X.2010.538521

Hosking, J.R.M., & Wallis, J.R. (1987). Parameter and Quantile Estimation for the Generalized Pareto Distribution. *Technometrics*, 29(3), 339-349. https://doi.org/10.1016/j.jkss.2017.02.003

Hussein, K., & Omran, M. (2005). Ethical Investment Revisited Evidence from Dow Jones Islamic Indexes. *The Journal of Investing Fall*, 14(3), 105-126. https://doi.org/10.3905/joi.2005.580557

Hussein, K.A. (2004). Ethical Investment: Empirical Evidence from FTSE Islamic Index. *Islamic Economic Studies*, 12(1), 22-40. http://iesjournal.org/english/Docs/096.pdf

Landi, G., & Sciarelli, M. (2019). Towards a more ethical market: the impact of ESG rating on corporate financial performance. *Social Responsibility Journal*, 15(1), 11-27. https://doi.org/10.1108/SRJ-11-2017-0254

Merdad, H., Hassan, M.K., & Alhenawi, Y. (2010). Islamic Versus Conventional Mutual Funds Performance in Saudi Arabia: A Case Study. *Journal of King Abdulaziz University: Islamic Economics*, 26(2), 161-198. https://www.kau.edu.sa/Files/121/Researches/58939_29217.pdf

Raphie, H., & Kraeussl, R. (2011). Risk and return characteristics of Islamic equity funds. *Emerging Markets Review*, 12(2), 189-203. https://doi.org/10.1016/j.ememar.2011.02.002

Saad, N.M., Majid, M.S.A., Kassim, S., Hamid, Z., & Yusof, R.M. (2010). A comparative analysis of the performance of conventional and Islamic unit trust companies in Malaysia. *International Journal of Managerial Finance*, 6(1), 24–47. https://doi.org/10.1108/17439131011015779

Sauer, D.A. (1997). The impact of social-resonsibility screens on investment performance: Evidence frm the Domini 400 social index and Domini equity fund. *Review of Financial Economics*, 6(2), 137–149. https://doi.org/10.1016/S1058-3300(97)90002-1

Shanmugam, B., & Zahari, R. (2009). A primer on Islamic finance. The research foundation of CFA institute. ISBN-13: 978-1934667248

Smith, R.L. (1987). Estimating tails of probability distributions. *Annals of statistics*, 15(3), 1174-1207. https://www.jstor.org/stable/2241822

Statman, M. (2019). Socially responsible mutual funds. *Financial Analysts Journal*, 56(3), 30-39. https://doi.org/10.2469/faj.v56.n3.2358

Yilmaz, M.K., Aksoy, M., & Tatoglu, E. (2020). Does the Stock Market Value Inclusion in a Sustainability Index? Evidence from Borsa Istanbul. *Sustainability*, 12 (2), 483-496. https://doi.org/10.3390/su12020483