International Journal of Islamic Banking and Finance Research
Vol. 8, No. 1; 2021
ISSN 2576-4136 E-ISSN 2576-4144
Published by CRIBFB, USA

PERFORMANCE COMPARISON OF ISLAMIC PORTFOLIOS WITH AFRICAN INDEX

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Received: September 23, 2021 Accepted: November 30, 2021 Online Published: December 31, 2021

DOI: 10.46281/ijibfr.v8i1.1600 URL: https://doi.org/10.46281/ijibfr.v8i1.1600

ABSTRACT

The objective of this study is to see if the "sharia compatible" stock portfolios common to the various stock exchanges have better returns than the classic African indices. We propose two new methodologies based on the median statistic to build sharia-compliant portfolios to which we add the Dow Jones Islamic Market World (DJIMI) methodology. These three Islamic portfolios are compared with 13 African stock market indices (JTOPI, DCIBT, BRVM10, BRVMCI, MDEX, NSE20, MASI, NGSE30, FTN098, ALSIUG, DSEI, TUNINDEX, LASILZ). First, we looked at the returns and volatilities of weekly and monthly data for Islamic portfolios and classic indices and compared the spreads of their returns and risks. We find the results to be quite divergent, although we can see a trend that Islamic portfolios are more profitable and riskier than conventional indices; for both weekly and monthly data. We show with a risk-adjusted performance analysis that Islamic portfolios outperform traditional index.

Keywords: Islamic Finance, Median Filtering, Qualitative Filtering, Quantitative Filtering, Portfolios.

JEL Classification Codes: G10, G11, G12, G14, G53.

INTRODUCTION

Islamic finance has finished proving its worth in the global financial landscape. Much of African capital is concentrated in Gulf countries where the majority of their stock markets have limited absorptive capacity. As a result, these capitals are constantly looking for new markets in accordance with Islamic law (Bouslama, 2009).

Africa is not left out in the face of the desire to attract Muslim investment from the different continents. Islamic investing arouses keen interest in African countries especially those with Muslim majority. Indeed, West Africa and the Maghreb countries are the largest Muslim community in Africa and in the eyes of their financial institutions, attracting this capital is becoming more and more essential for the economy of its regions (Ndiaye, 2019).

The specificity of Africa in Islamic finance is mainly due to the importance of its Muslim community. It turns out that there are rich Muslims in Africa who abide by Islamic injunctions in financial transactions (Koita & Diaw, 2014). This African characteristic is one of the major symbolic arguments in favor of the development of African-style Islamic finance.

Now, Africa has 37 scholarships (local, regional) in 36 countries. In this, these financial centers constitute an object of interest and scientific research, a fertile ground for investigation… More precisely, it will be a question here of how to help these stock markets to ensure the distribution of funds to individuals or companies that have a productive investment program.

This research fits into these aspects cited above by focusing on Islamic finance and its performance against traditional index. So, the problematic of our study is as follows: how to make the African zone more competitive with the application of the median criterion of quantitative filters in the attraction of Muslim and foreign capital?

The term "Islamic finance" covers all financial transactions and products compliant with "Sharia". This style of portfolio management reflects the desire of a category of investors to grow their capital in accordance with the religious precepts that are supposed to govern their spiritual temporal life (Peillex & Ureche-Rangau, 2015). While the term "portfolio" designates a set of shared representative of a given market. In other words, it is the weighted or unweighted average of the prices of the stock panels, grouped according to their zone, their country and / or their sector and / or their capitalization. This definition is broad enough to leave the door open to the creation of multiple portfolios.

Africa's participation in the Islamic finance debate began with the academic work of (Koita & Diaw, 2014) who investigated the possibility of investing in BRVM. To this end, they applied the Islamic filtering methodology on stock market data 2008-2009 and financial statements for the year 2011. The results of this first work were sufficiently convincing for these authors to conclude on the existence of an Islamic investment possibility in the financial market of the BRVM.

Then, Kafou and Chakir (2017) studied the impact of the application of the Islamic filtering method on the pool of stocks making up the MASI index (Maroccan All Shares Index) considered as the main composite index of the Casablanca stock exchange in a perspective to provide this financial market with a “Sharia compatible” index. The authors conclude that five sectors are represented in the final index, namely housing and construction, agrifood, distribution, technology and health, unlike the financial sector, which is totally excluded.

Mbengue (2017), proposed an index from the stock exchanges of Ghana, Nigeria and the BRVM using the Standard & Poors methodological guide. To this end, he applied the Islamic filtering methodology on the 2012-2014 stock market data. From the second filtering, it appears that 27 companies are accepted to form the Islamic index.

Finally, Ndiaye (2019) studied the possibility of attracting investment from Gulf countries on the financial centers of Ghana, Nigeria and Morocco through the creation of a common “Sharia compatible”

stock market index by applying filtering of the DJIMI index. At the end of this screening process, 34 companies are considered "Sharia compatible" and form the "Ecowas 34 Shariah Index" with a high exclusion rate of 85%.

According to El Khamlichi (2012), the performance of portfolios and managers is of particular importance in the academic and professional world. However, measuring this profitability is proving to be a difficult exercise for which no perfectly satisfactory solution has been found (Portrait & Poncet, 2009). Techniques using profitability and the risk incurred began in the 1960s with so-called classic measures such as the Sharpe ratio, Jensen's alpha...

To our knowledge, there is no research on the use of the median as a filtering method, as well as the comparison of portfolios in the African dung beetle markets at large. Indeed, companies do not have the same characteristics from one sector to another, it is necessary to have heterogeneous thresholds for the purposes of filtering.

Beyond religious motivation, some investors are primarily concerned with the performance of their portfolio. Indeed, agents' decisions are influenced by the expectation of profitability and the degree of risk present in the financial assets to be acquired. That said, the question that arises is whether Islamic portfolios perform better or worse, compared to their conventional counterparts.

The objective of this study is to see if the "sharia compatible" stock portfolios common to the various stock exchanges have better returns than the classic African indexes. This is to clarify the choice of eligible titles in the light of the precepts of Islam. It will also be a question of highlighting the method of calculation by analyzing the results obtained from the comparison of Islamic portfolios and traditional indexes. We will also outline the challenges and recommendations involved in creating such portfolios.

This contribution lies in the proposal of a new methodology which integrates the median criterion in the filtering of stock market values. The median is much more robust than the average. It is also consistent with the principle of "wassatiya" (happy medium) that the fraction of 33% used by many studies.

The results of such a study can provide African and foreign investors with insight into the relevance of incorporating ethical or Islamic criteria into their decision to invest in African stock exchanges.

The remainder of the document is structured as follows. We will present the data first. Then, we will describe the methodology with the statistical tools for calculating the performance of African indexes. Finally, we present the results.

DATA AND METHODOLOGY

Data

The data used come from the investing.com site managed by Fusion Media Ltd. It is a database that contains financial information in real time and over a long period of time. It allowed us to obtain the weekly and monthly prices of the various indexes analyzed over the period of study. We use the DJIMI-type Islamic stock market index, on a weekly and monthly basis, over the period from January 2011 to December 2015. Indeed, access to data before 2011 and beyond 2015 was limited with regard to financial statements of companies.

Methodology

For a share to be included in this index, it must pass the qualitative and quantitative filters. Indeed, the introduction of the qualitative filter consists in carrying out a sectoral exclusion.

The quantitative filter completes the qualitative filter for a better selection of share and it consists in sorting the companies to keep only those whose financial structure is able to meet the requirements expressed in the form of ratios.

To remain in compliance with the principles of "Sharia", "Sharia" committees impose a number of criteria in terms of liquidity, claims and debt on share traded on financial markets. This filter is also expressed as a ratio.

Among the methods for selecting stocks for a stock market index in Islamic finance, the most commonly accepted criteria, within the meaning of El-Gamal (2001), are those retained by the “sharia” committee of DJIMI (Debt Ratio , Liquidity Ratio and Debt Ratio).

Unlike previous works, we have chosen to conduct research that better reflects the specificities and needs of Africa in terms of stock markets. Indeed, the ratios applied on international stock exchange differ from one index to another, from one country to another or from one continent to another.

After the qualitative filter, we proceed to a sector classification of listed companies. Then, we take two approaches. The first is to calculate the median over all the companies that have passed the qualitative filter. The second is to calculate the medians by business sector that has passed the first filter. Finally, for both approaches, an action is selected if the value of its ratio is less than or equal to the median of the ratios of the selected companies (either all or by sector).

We use the median for three main reasons:

- A statistical reason: it is more robust than the average in the face of extreme values.
- A religious reason: the median is a principle of Islam which is the golden mean or "wassatiya" to define the threshold of acceptance / rejection.
- A financial reason: using the median allows the portfolio to be diversified.

Table 1. The filter of DJIM and the filters of the medians

Filters	**Dow Jones Islamic Market Index**	**General Median**	**Sectoral Median**
Debt Ratio (RE)	$\frac{\text{total debts}}{\text{AMC 24 last months}} < 33\%$	70%	33%
Liquidity Ratio (RL)	$\frac{total\ cash\ and\ interest^{1}}{AMC\ 24\ last\ months} < 33\%$	10%	70%
Debt Ratio (RC)	$\frac{\text{total receivables}}{\text{AMC 24 last months}} < 33\%$	18 %	70%

Nb : AMC = Average Market Capitalisation

Total Cash and Interest-Bearing Securities

Source: Construction of the authors from the financial database and documents on DJIM

Table 1 shows that the general median and the sectoral median, unlike the DJIMI index (33%), show disparities in the thresholds of the ratios. Concerning the general median, the thresholds varying from 10% to 70%. Compared to the sectoral median, the threshold for ratios varying from 33% to 70%.

Logarithmic Yield

Within the framework of this work, we favored the calculation of the logarithmic profitability. In order to analyze in detail the performance of our panel of indexes, we calculate the weekly and monthly profitability. Indeed, when financial cash flows are generated continuously, the return on a financial asset can be calculated using the natural logarithm. Such profitability compared to simple returns has the property of being additive and attenuating heterocedasticity, which makes it possible to sum all the logarithmic returns over the period of the study. The calculation is obtained from their respective closing prices:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \quad (1)$$

With :

Pt : Price at time t

Average Return

Once the profitability has been calculated for each period [t − 1, t], we sought to calculate the average returns for the different periods considered. To do this, the geometric mean of the yields has been favored. According to statistics, the geometric means has the advantage of being less sensitive to extreme values in a data series than the arithmetic means.

$$\overline{R_t} = \sqrt[n]{\prod_{i=1}^{n}(1 + R_t)} \text{ -1 (2)}$$

Subsequently, $\overline{R}t$ must be annualized for the analysis to be standardized and comparable.

Annual profitability is expressed as:

$$\overline{R}_A = (1 + \overline{R}_t)^n - 1 \quad (3)$$

With:

$\overline{R_A}$ *: Average annual profitability*

$\overline{R_t}$ *: Average periodic profitability*

n : number of periods in the year

n corresponding to the number of weeks and months of the stock markets in our study interval (243 weeks and 56 months).

Volatility

Volatility is a widely used indicator in finance. It measures the extent of fluctuations in the price of an asset. It allows the risk to be quantified. It also allows the distinction of a market with low volatility from a market with high volatility. One of the theories in finance is that regardless of the investor's risk/reward profile, an investor is willing to own a risky asset only if it is matched higher return.

Calculating Volatility

Since the purpose of this paper is to perform a comparison of conventional and Islamic stock indexes from 2011 to 2015, it makes sense to use historical volatility for our calculations. Historical volatility is the level of volatility achieved in the past and is calculated using the historical price of financial assets.

In other words, it corresponds to the unbiased standard deviation of changes in historical returns. Mathematically, the standard deviation results in the following formula:

$$\sigma_t = \sqrt{\frac{1}{n-1}\sum_{t=1}^{n}(\mathrm{R_t} - \overline{\mathrm{R}})} \quad (4)$$

Or :
σt: periodic standard deviation
Rt: profitability observed at time t
$\overline{R}$: average profitability
n: number of observations in the analysis period

Annualization of Volatility

Volatility relates to the risk of short, medium and long term variability, but it is customary to calculate it over a short period. Just like profitability and in order to allow a comparison of volatilities, their annualization is necessary. It is the product of periodic volatility times the square root of the number of periods in the year, under the assumption of no correlation between asset returns.
It is written as follows:

$$\sigma_A = \sigma p \sqrt{P} \quad (5)$$

Or:
σA: annualized volatility
σp: periodic volatility
P: the number of periods in the year

Sharpe Ratio

It was set up in 1966, by William Forsyth Sharpe, an American economist. Thus, unlike previous approaches that consisted in evaluating performance based on the risk premium or expected return, the Sharpe index measures the added performance of the portfolio per unit of portfolio risk. It makes it possible to determine the best performing investment by identifying the portfolio with the highest return for an identical level of volatility. Indeed, according to Sharpe, the average of the returns is not enough to make an exact measure of the performance.

The goal of this ratio is ultimately to be able to constitute the portfolio with the lowest possible rate of risk, for a maximum return.

The Sharpe ratio is the quotient of the excess return over the risk-free rate divided by the total risk of the portfolio. In other words, it allows to calculate the performance of an investment compared to that of a risk-free investment. For the risk-free asset rate, the rate at which AFD (note 1) issued a good bond rated AAA for the period 2008-2016 was taken as a proxy. This annual rate is 5.25%. Having weekly and monthly data, this rate was converted to a weekly and then monthly rate. Then the Sharpe Ratio is calculated using the following formula:

$$S_p = \frac{P_p - R_F}{\sigma_p} \quad (6)$$

Or:
Sp: Sharpe ratio of the risky P portfolio
Rp: Profitability of the risky portfolio P
RF: Risk free rate
σp: volatility of the risky portfolio P

From this formula emerges that:

- If the ratio is negative, we conclude that the portfolio is underperforming a risk-free investment and therefore it does not make sense to invest in such a portfolio.
- If the ratio is between 0 and 1, it means that the excess return over the risk-free rate is lower than the risk taken.
- If the ratio is greater than 1, then the portfolio outperforms a risk-free investment and therefore generates higher profitability.

Thus, we conclude that the higher the ratio, the more efficient the portfolio is.

We chose the Sharpe ratio for three reasons:

- He is educated to evaluate the performance of assets whose distribution of returns follows a roughly normal law.
- It allows to know the remuneration obtained by the investor who has chosen a risky asset rather than a risk-free asset. The benchmark index chosen for this ratio is therefore the same for all assets: the risk-free rate.
- A simple rule to use it: in positive case, the higher the ratio, the better the asset was valued.

RESULTS

After having calculated and annualized the logatithmic returns and the weekly and monthly volatilities of the imaginary portfolios of our sample, we will proceed to the comparison of the Islamic portfolios obtained using the filtering of the DJIMI index and those obtained with the filtering of the median note (2) (general and sectoral). Finally, we ompare these with the indexes of African markets.

Comparison Of Profitability And Risk In Pairs

We made a comparison in a weekly then monthly frequency of the Islamic portfolios with the African indexes (see appendix A). Our analysis focused on pairs of indexes to compare their respective profitability and risk.

The comparison of the profitability of each Islamic portfolio with the conventional indexes of the Africa zone is carried out by pairs of indexes. It measures the profitability gap between each pair of indexes.

A positive spread (AfriDJIMI vs JTOPI> 0) means that the profitability of Islamic stock indexes is higher compared to their conventional counterparts, while a negative gap (AfriDJIMI vs JTOPI <0) means lower profitability. Just as a positive volatility spread means Islamic portfolios are riskier, while a negative spread means less risk.

Weekly

In this part, we analyze the results of the weekly data in terms of profitability spreads and volatility. On the one hand, a comparison is made between Islamic portfolios and on the other hand between them with the classic indexes of the African stock market.

- **AfriDJIMI vs ImedSect**

From this comparison, we can see that the differnces in profitability and volatility are negative (see appendix B). This means that the portfolio obtained with the filtering method of the DJIMI index (AfriDJIMI) is less profitable than its counterpart obtained with that of median sector (note 2) (ImedSect). On the other hand, the “ImedSect” is more risky than the “AfriDJIMI”.

- **AfriDJIMI vs ImedGen**

Comparing these two Islamic portfolios allows us to see that the profitability gap is negative. On the other hand, the volatility difference is positive (see appendix B). In other words, the "AfriDJIMI" portfolio is less profitable than its "ImedGen" (note 3) counterpart. In terms of volatility, the latter is also less risky than the former.

- **ImedSect vs ImedGen**

Here, we have positive profitability and volatility spreads (see appendix B). This allows us to say that the "ImedGen" portfolio is more profitable and less volatile than the "ImedSect" portfolio.

- **AfriDJIMI vs CLASSICS INDEX**

By continuing the comparison analysis of the "AfriDJIMI" portfolio with African indexes, we recorded 11 positive profitability and volatility spreads against 2 negative profitability and volatility spreads (see appendix B). This means that the "AfriDJIMI" portfolio is more profitable and riskier than the JTOPI, DCIBT, BRVM10, BRVMCI, MDEX, MASI, NGSE30, NSE20, FTN098, DSEI and TUNINDES indexes in the Africa zone. On the other hand, it has a lower yield and less volatile than the ALSIUG and LASILZ index.

- **ImedGen vs CLASSICS INDEX**

The analysis of the result of this comparison tells us that the Islamic portfolio obtained with the filtering of the general median records: 12 positive profitability gaps compared to traditional indexes against a negative profitability gap compared to conventional indexes (see appendix B). . In other words, these 12 positive spreads mean that the profitability of "ImedGen" is higher than those of the JTOPI, DCIBT, BRVM10, BRVMCI, MDEX, NSE20, MASI, NGSE30, FTN098, ALSIUG, DSEI and TUNINDEX indexes, while the gap negative tells us that its profitability is lower than that of the LASILZ indexes. As for the difference in volatility, we notice that the spread is positive: 11 times and negative 2 times. This means that these classic indexes are less risky than the "ImedGen", while the 2 negative deviations mean that the ALSIUG indexes and LASILZ are more volatile than "ImedGen".

- **ImedSect vs CLASSICS INDEX**

Carrying out the analysis of the weekly comparison of "ImedSect" with conventional indexes in the African zone shows that the differences in profitability are positive in 12 cases, which means the stock market indexes JTOPI, BRVM10, BRVMCI, NSE20, NGSE30, FTN098, ALSIUG, DSEI, TUNINDEX and LASILZ have lower profitability than the "ImedSect" portfolio. They are negative in 1 case (see appendix B). The latter shows that the "ImedSect" index has a lower return than that with the LASALZ codes. Compared to the differences in volatility, we record 11 positive deviations against 2 negative deviations. This means that JTOPI, DCIBT, BRVM10, BRVMCI, MDEX, NSE20, MASI, NGSE30, FTN098, DSEI and TUNINDEX are less risky than the "ImedSect", while the two negative deviations mean that ALSIUG and LASILZ are more volatile than the "ImedSect".

Monthly

- **AfriDJIMI vs ImedSect**

The analysis of the monthly comparison between the Islamic portfolios "AfriDJIMI" and "ImedSect" allows us to note that the difference in profitability is positive (see appendix C), which means that the "ImedSect" is less profitable than the "AfriDJIMI". On the other hand, the variation in volatility is

negative (see appendix C), which is synonymous with the higher volatility of the "AfriDJIMI" portfolio than that of its counterpart "ImedSect".

- **AfriDJIMI vs ImedGen**

For this comparison, we notice that the profitability gap is positive while the volatility gap is negative (see Appendix C). This means that the "AfriDJIMI" portfolio is more profitable but also less risky than "ImedGen".

- **ImedSect vs ImedGen**

By observing the differences in profitability and monthly volatility between these two Islamic portfolios, we find a positive profitability and risk gap (see appendix C). This translates that the portfolio obtained with the filtering of the sectoral median is more profitable and riskier than its counterpart obtained with the filtering of the general median.

- **AfriDJIMI vs CLASSICS INDEX**

Carrying out the analysis of the monthly comparison of "AfriDJIMI" with conventional indexes for the African zone shows that the differences in profitability and risks are negative in 7 cases (see appendix C). This means that the "AfriDJIMI" portfolio is less profitable and less volatile than stock market indexes. These differences in profitability and volatility are positive in 6 cases. These reflect a higher yield and volatility of "AfriDJIMI" compared to stock market indexes with the codes MDEX, NSE20, NGSE30, FTN098, ALSIUG and DSEI.

- **ImedGen vs CLASSICS INDEX**

By continuing our monthly comparison analysis of Islamic and conventional indexes, we record 7 negative profitability and risk spreads with JTOPI, DCIBT, BRVM10, BRVMCI, MASI, TUNINDEX and LASILZ (see appendix C). This means that the latter have lower returns and risks than that of the "ImedGen" portfolio. And 6 spreads of profitability and positive risks, thus translating higher returns and volatilities of "ImedGen" compared to the indexes MDEX, NSE20, NGSE30, FTN098, ALSIUG and DSEI.

- **ImedSect vs CLASSICS INDEX**

The analysis of the difference between the Islamic portfolio obtained with the filtering of the sectoral median and the classic indexes allows us to list 7 negative profitability and volatility spreads against 6 positive yield and risk spreads (see appendix C). In other words, these 7 negative deviations mean that the profitability and volatility of "ImedSect" is lower than those of stock market indexes with the codes JTOPI, DCIBT, BRVM10, BRVMCI, MASI, TUNINDEX and LASILZ. On the other hand, the portfolio composed of companies close to Islamic principles has a profitability and a higher volatility than that of the stock market indexes MDEX, NSE20, NGSE30, FTN098, ALSIUG and DSEI

The separate analysis of profitability and risk allows us to observe contrasting situations, more profitable portfolios and others less profitable, riskier indexes and others less risky than their counterparts. Indeed, this separation of the analysis of profitability and risk gives us information about the different profiles of Islamic stock portfolios, but it does not allow us to draw clear conclusions on the performance of this type of portfolio or the other. To do this, it seems obvious to use a performance measure that takes into account profitability and risk jointly.

Performance Analysis With The Sharpe Ratio

To determine the risk-adjusted profitability, we chose the Sharpe ratio. It was calculated for all portfolio pairs. Each pair includes an Islamic portfolio and a classic index. The tables (see appendix D) show the deviations of the weekly and monthly Sharpe ratios.

- **AfriDJIMI vs ImedSect**

Observing this difference between these two portfolios allows us to record a negative and positive difference (see appendix D). This means that the portfolio obtained by filtering the Dow Jones Islamic Market Index underperforms its counterpart obtained by filtering the sectoral median at the weekly level, while at the monthly level it outperforms the latter.

- **AfriDJIMI vs ImedGen**

Continuing our analysis, we notice that the "AfriDJIMI" portfolio underperforms compared to its "ImedGen" counterpart with weekly data, while it outperforms with monthly data. Because we have a negative weekly Sharpe deviation and a positive monthly deviation respectively (see appendix D).

- **ImedSect vs ImedGen**

The analysis carried out on the deviations of the Sharpe ratio indicates an underperformance of the "ImedSect" portfolio compared to its counterpart obtained with the filtering of the general median (ImedGen) (see appendix D).

- **AfriDJIMI vs CLASSICS INDEX**

The performance differences between the 13 pairs of indexes are negative with weekly data and positive with monthly data (see Appendix D). In other words, the classic indexes outperform the Islamic portfolio "AfriDJIMI", while the latter outperforms these conventional indexes when the analysis is done with monthly data. Several reasons for this; first, in accordance with modern financial theory, the Islamic portfolio can be assumed to be riskier than conventional indexes because of the lack of diversification which would result in a lower risk/return ratio. Second, since Islamic filtering is also based on qualitative and quantitative criteria based on financial and accounting information, the "AfriDJIMI" portfolio could by the quality of their composition be more profitable than their counterparts. Third, the "AfriDJIMI" portfolio may have lower risk-adjusted returns than their conventional counterparts due to the exclusion of companies operating in sectors such as alcohol, tobacco or gambling. At the same time, "AfriDJIMI" contains shares of small capitalization companies which may have growth potential and companies with little debt due to their greater profitability. Finally, the differences in performance that exist can also be attributed to differences in management style.

- **ImedGen vs CLASSICS INDEX**

Among the 13 pairs of indexes (see appendix D), the Sharpe ratio deviations are all positive with both weekly and monthly data. This means that the "ImedGen" index outperforms all of the classic African indexes in this study. Indeed, the prudent nature of Islamic portfolio management could lead to a low risk and profitable portfolio. In addition, the "sharia" selection criteria effectively exclude heavily indebted companies and prohibit "gharar" activity and gambling. Therefore, managers of Islamic portfolios need to compare their profitability with that which does not conform to the principles of Islam.

- **ImedSect vs CLASSICS INDEX**

For the sectoral median index, the deviations calculated over the entire study period with weekly and monthly data show that the portfolio obtained with the filtering of the sectoral median outperforms the classic indexes of African stock markets (see appendix D). Indeed, the "ImedSect" portfolio is more diversified and includes more listed securities than the classic indexes of the Africa zone.

CONCLUSION

Our paper follows an application of a new filtering methodology in the process of creating an Islamic index in order to make the Africa zone more competitive in attracting Muslim and foreign capital. The study was carried out taking into account a set of stock exchanges from 16 countries and a regional stock exchange (BRVM) in Africa. For the indexes, this research focused on 16 pairs of indexes (3 Islamic and 13 conventional).

This work, devoted to the comparison of Islamic portfolios and classical indexes, allowed us to study in detail the Islamic portfolios in terms of the return performance of securities listed in the stock market area of Africa. First, we looked at the returns and volatilities of the weekly and monthly data of Islamic portfolios and classic indexes and compared the spreads of their returns and their risks.

We find the results to be quite divergent, although we can see a trend that Islamic portfolios are more profitable and riskier than conventional indexes; for both weekly and monthly data. We show with risk-adjusted performance analysis that Islamic portfolios outperform traditional indexes.

Finally, beyond the choice of filtering by the median (general or sectoral), it was necessary to trethink the relevant filtering process to take into account the specifics of African companies in terms of Islamic financial investment.

The value of applying a filter in the process of creating an Islamic stock portfolio in Africa's financial center does not only have a symbolic dimension aimed at sending a positive signal to African or foreign Muslim investors; but to prove that this index would have its own financial arguments.

Like many academic works, this research suffers from the same ailments, lack of theoretical support, methodological biases and those even more pronounced due to the youth of the field of research and the low openness of the African stock exchange to Islamic finance. Although the research questions between classical and Islamic finance differ markedly, the work on the performance of Islamic stock portfolios has as a backdrop the question of the economic and financial impact of the consideration of ethical and religious issues by individuals' companies.

The research perspectives raised by our paper are numerous. These perspectives can be established according to the limits mentioned above. But, we can also note tracks such as: Islamic finance and the growth of African stock markets, moral hazard problem in Islamic finance in the Africa zone. Other researchers could continue this research taking into account the stated limitations.

AUTHOR CONTRIBUTIONS

Conceptualization: Moustapha Balde, Mamadou A. Konte
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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

ACKNOWLEDGEMENT

All authors contributed equally to the conception and design of the study.

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NOTES

Note 1. Agence Française de Développement (AFD in French)

Note 2. In this approach, the quantitative median filter is applied by sector, after the qualitative filter (assets' main activities in accordance with Islamic principles). Then a reconstruction is made by cumulating the different assets selected by sector.

Note 3. In contrast to ImedSect, ImedGen is constructed by using once the quantitative median filter in all assets, after the qualitative filter.

APPENDICES

Appendix A: Index Table

Code	Definition
AfriDJIMI	Islamic portfolio obtained with DJIMI filtering
ImedGen	Islamic portfolio obtained by filtering the general median
ImedSect	Islamic portfolio obtained by filtering the sector median
JTOPI	South Africa Top 40
DCIBT	BSE Domestic Company
BRVM10	BRVM Top 10
BRVMCI	General index of the BRMV
MDEX	Main Index of the Stock Exchange of Mauritius
NSE20	Kenya Top 20
MASI	Main index of the Casablanca Stock Exchange
NGSE30	Nigeria Top 30
FTN098	Namibie Index global
ALSIUG	Ouganda All Share Index
DSEI	Tanzania All Share Index
TUNINDEX	Tunisia Stock Echange Index
LASILZ	LES All Share for Zambia

Source: Authors' Construction

Appendix B: Weekly Profitability and Volatility Gap

Index Pairs	Profitability Spread	Volatility Spread
AfriDJIMI vs ImedSect	***-0,00248286***	***-4,6492E-05***
AfriDJIMI vs ImedGen	***-0,00252748***	2,6921E-05
ImedSect vs ImedGen	4,46E-05	7,3413E-05
AfriDJIMI vs JTOPI	0,00189254	0,00313925
AfriDJIMI vs DCIBT	2,01290186	2,01414856
AfriDJIMI vs BRVM10	0,00421853	0,00546524
AfriDJIMI vs BRVMCI	0,00532863	0,00657533
AfriDJIMI vs MDEX	1,99881253	2,00005923
AfriDJIMI vs NSE20	0,0062379	0,0074846
AfriDJIMI vs MASI	2,00489238	2,00613909
AfriDJIMI vs NGSE30	1,99476899	1,9960157

AfriDJIMI vs FTN098	0,00400049	0,0052472
AfriDJIMI vs ALSIUG	***-0,00155129***	***-0,00030458***
AfriDJIMI vs DSEI	1,99412113	1,99536783
AfriDJIMI vs TUNINDEX	0,01688698	0,01813368
AfriDJIMI vs LASILZ	***-0,00951755***	***-0,00827084***
ImedGen vs JTOPI	0,00442002	0,00311233
ImedGen vs DCIBT	2,01542933	2,01412164
ImedGen vs BRVM10	0,00674601	0,00543832
ImedGen vs BRVMCI	0,0078561	0,00654841
ImedGen vs MDEX	2,00134	2,00003231
ImedGen vs NSE20	0,00876537	0,00745768
ImedGen vs MASI	2,00741986	2,00611217
ImedGen vs NGSE30	1,99729647	1,99598878
ImedGen vs FTN098	0,00652797	0,00522028
ImedGen vs ALSIUG	0,00097619	***-0,0003315***
ImedGen vs DSEI	1,9966486	1,99534091
ImedGen vs TUNINDEX	0,01941445	0,01810676
ImedGen vs LASILZ	***-0,00699007***	***-0,00829777***
ImedSect vs JTOPI	0,0043754	0,00318574
ImedSect vs DCIBT	2,01538471	2,01419506
ImedSect vs BRVM10	0,00670139	0,00551173
ImedSect vs BRVMCI	0,00781148	0,00662182
ImedSect vs MDEX	2,00129538	2,00010572
ImedSect vs NSE20	0,00872075	0,0075311
ImedSect vs MASI	2,00737524	2,00618558
ImedSect vs NGSE30	1,99725185	1,99606219
ImedSect vs FTN098	0,00648335	0,00529369
ImedSect vs ALSIUG	0,00093157	***-0,00025809***
ImedSect vs DSEI	1,99660398	1,99541432
ImedSect vs TUNINDEX	0,01936983	0,01818017
ImedSect vs LASILZ	***-0,00703469***	***-0,00822435***

Source: Authors' Construction

Appendix C: Monthly Profitability and Volatility Gap

Index Pairs	Profitability Spread	Volatility Spread
AfriDJIMI vs ImedSect	5,5464E-05	***-0,00043555***
AfriDJIMI vs ImedGen	0,00013407	***-0,00022306***
ImedSect vs ImedGen	7,8603E-05	0,00021248
AfriDJIMI vs JTOPI	***-0,01259923***	***-0,01338601***
AfriDJIMI vs DCIBT	***-0,039624***	***-0,04041078***
AfriDJIMI vs BRVM10	***-0,0078549***	***-0,00864167***
AfriDJIMI vs BRVMCI	***-0,03262952***	***-0,0334163***
AfriDJIMI vs MDEX	0,01218728	0,01140051

AfriDJIMI vs NSE20	0,004684	0,02762764
AfriDJIMI vs MASI	***-0,01921879***	***-0,02000557***
AfriDJIMI vs NGSE30	0,004684	0,00389722
AfriDJIMI vs FTN098	0,02598324	0,02519647
AfriDJIMI vs ALSIUG	0,05558971	0,05480294
AfriDJIMI vs DSEI	0,04611211	0,04532534
AfriDJIMI vs TUNINDEX	***-0,01354499***	***-0,01433177***
AfriDJIMI vs LASILZ	***-0,05735698***	***-0,05814376***
ImedGen vs JTOPI	***-0,0127333***	***-0,01316295***
ImedGen vs DCIBT	***-0,03975807***	***-0,04018772***
ImedGen vs BRVM10	***-0,00798897***	***-0,00841861***
ImedGen vs BRVMCI	***-0,03276359***	***-0,03319324***
ImedGen vs MDEX	0,01205322	0,01162357
ImedGen vs NSE20	0,00454993	0,0278507
ImedGen vs MASI	***-0,01935286***	***-0,01978251***
ImedGen vs NGSE30	0,00454993	0,00412029
ImedGen vs FTN098	0,02584918	0,02541953
ImedGen vs ALSIUG	0,05545565	0,055026
ImedGen vs DSEI	0,04597805	0,0455484
ImedGen vs TUNINDEX	***-0,01367906***	***-0,01410871***
ImedGen vs LASILZ	***-0,05749105***	***-0,0579207***
ImedSect vs JTOPI	***-0,0126547***	***-0,01295047***
ImedSect vs DCIBT	***-0,03967947***	***-0,03997524***
ImedSect vs BRVM10	***-0,00791036***	***-0,00820613***
ImedSect vs BRVMCI	***-0,03268499***	***-0,03298075***
ImedSect vs MDEX	0,01213182	0,01183605
ImedSect vs NSE20	0,00462854	0,02806318
ImedSect vs MASI	***-0,01927426***	***-0,01957002***
ImedSect vs NGSE30	0,00462854	0,00433277
ImedSect vs FTN098	0,02592778	0,02563201
ImedSect vs ALSIUG	0,05553425	0,05523848
ImedSect vs DSEI	0,04605665	0,04576088
ImedSect vs TUNINDEX	***-0,01360046***	***-0,01389622***
ImedSect vs LASILZ	***-0,05741245***	***-0,05770822***

Source: Authors' Construction

Appendix D: Sharpe Ratio Deviation

Index Pairs	Weekly Difference	Monthly Difference
AfriDJIMI vs ImedSect	***-10,0499391***	1,32532898
AfriDJIMI vs ImedGen	***-12,3238326***	1,03571275
ImedSect vs ImedGen	***-2,27389349***	***-0,28961623***
AfriDJIMI vs JTOPI	***-4,71491734***	2,42358546

AfriDJIMI vs DCIBT	***-4,87774155***	3,22443151
AfriDJIMI vs BRVM10	***-4,73009941***	2,47101581
AfriDJIMI vs BRVMCI	***-4,80314641***	2,34663867
AfriDJIMI vs MDEX	***-4,54346837***	2,7724496
AfriDJIMI vs NSE20	***-4,62101681***	2,65334371
AfriDJIMI vs MASI	***-4,52235894***	2,84432506
AfriDJIMI vs NGSE30	***-4,63131415***	2,61517264
AfriDJIMI vs FTN098	***-4,61913415***	2,64950321
AfriDJIMI vs ALSIUG	***-4,67229278***	2,52607032
AfriDJIMI vs DSEI	***-4,78408216***	2,30449839
AfriDJIMI vs TUNINDEX	***-4,60362607***	2,51621985
AfriDJIMI vs LASILZ	***-4,70786707***	2,45351742
ImedGen vs JTOPI	7,60891522	1,38787271
ImedGen vs DCIBT	7,44609102	2,18871876
ImedGen vs BRVM10	7,59373315	1,43530307
ImedGen vs BRVMCI	7,52068615	1,31092592
ImedGen vs MDEX	7,78036419	1,73673685
ImedGen vs NSE20	0,09390053	1,61763096
ImedGen vs MASI	7,80147362	1,80861232
ImedGen vs NGSE30	7,69251841	1,57945989
ImedGen vs FTN098	7,70469841	1,61379046
ImedGen vs ALSIUG	7,65153978	1,49035757
ImedGen vs DSEI	7,5397504	1,26878564
ImedGen vs TUNINDEX	7,72020649	1,4805071
ImedGen vs LASILZ	7,61596549	1,41780467
ImedSect vs JTOPI	5,33502173	1,09825648
ImedSect vs DCIBT	5,17219753	1,89910253
ImedSect vs BRVM10	5,31983966	1,14568683
ImedSect vs BRVMCI	5,24679266	1,02130969
ImedSect vs MDEX	5,5064707	1,44712062
ImedSect vs NSE20	5,42892227	1,32801473
ImedSect vs MASI	5,52758013	1,51899608
ImedSect vs NGSE30	5,41862492	1,28984366
ImedSect vs FTN098	5,43080492	1,32417423
ImedSect vs ALSIUG	5,37764629	1,20074134
ImedSect vs DSEI	5,26585691	0,97916941
ImedSect vs TUNINDEX	5,446313	1,19089087
ImedSect vs LASILZ	5,342072	1,12818844

Source: Authors' Construction

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