CONSTRUCTION OF AN ISLAMIC INDEX USING THE MEDIAN CRITERION OF QUANTITATIVE FILTERS: APPLICATION TO THE AFRICAN STOCK EXCHANGE

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ABSTRACT

Many techniques, combining qualitative and quantitative filters, have been proposed in the literature to construct an Islamic index on financial stock exchange. These are often based on fixed thresholds to define quantitative filters. However, as companies do not have the same characteristics from one sector to another, it is necessary to have heterogeneous thresholds for filtering purposes. Our contribution, here, is to propose a methodology which integrates this fact by using the median (statistic) criterion which is much more robust than the average criterion (vis-à-vis the presence of extreme values) but also the median statistic is consistent with the Wassatiya principle (50% of the way) than the 33% fraction used by many studies.

Keywords: Islamic Finance, Median Filtering, Qualitative Filtering, Quantitative Filtering, Stock Market Index.

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

INTRODUCTION

Islamic finance is based on the principles of "sharia". It has established itself as a financing alternative to the conventional system. Its evolution has led to the creation of new index.

A stock exchange index is defined as an indicator that measures the evolution over time of the performance of a stock market, a sector of activity or a sampled portfolio, Topsacalian (2000). In other words, it is the weighted or unweighted average of the prices of the panels of stocks, grouped on the basis of 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 stock market indices.

The strong demand for Islamic index has accelerated the launch of other Islamic index by other operators with more or less extensive coverage of geographic areas outside Africa.

The specificity of Africa in Islamic finance is mainly due to the importance of its Muslim community. It turns out that there are wealthy Muslims in Africa who respect Islamic injunctions in financial transactions (Koita & Diaw, 2014). However, there are no "Sharia" compliant clues. This African characteristic constitutes one of the major symbolic arguments in favor of the development of African-style Islamic finance. Thus, the creation of an Islamic sector stock exchange index would be one of the necessary adjustments to strengthen its competitiveness in this sector.

The Islamic index most covered in articles are American, European and Asian indices. In our research, we only encountered three studies in Africa. Koita and Diaw (2014) investigated the possibility of investing in BRVM using the filtering method of the Islamic FTSE Global Shariah Equity Index. Mbengue (2017) proposed an index from the stock exchanges of Ghana, Nigeria and the BRVM using the S&P methodological guide. Ndiaye (2019) studied the possibility of attracting the investment of Gulf countries in the financial centers of Ghana, Nigeria, Morocco by applying the filtering of the DJIMI index.

Our study proposes to use the statistic of median as a filtering method. To the best of our knowledge, this is a first paper that uses the median statistic. 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. Our contribution, here, is to propose a methodology which integrates this fact by using the median statistic criterion which is much more robust than the average/mean statistic but also the median is in coherence with the principle of "wassatiya" (golden mean) than the fraction of 33 % used by many studies.

In view of the initiatives taken by the Central Bank of West African States (CBWAS) to adapt banking regulations in order to take charge of the specificities of Islamic finance, the efforts made by the Islamic Bank of Development (IBD), applying the Islamic filtering in the creation of a stock market index is appropriate.

In the rest of this research, we will first present the data and the new methodology. Finally, we will present the findings and the comparison with another the existing methodology: DJIMI.

**DATA AND METHODOLOGY TO CONSTRUCT A FINANCIAL INDEX**

**Data**

In the selection of “Sharia-compatible” shares, we use as a pool of values the 1442 companies making up the 17 stock exchanges (South Africa, Botswana, BRVM, Egypt, Ghana, Keyna, Malawi, Morocco, Mauritius, Namibia, Nigeria, Uganda, Rwanda, Tanzania, Tunisia, Zambia and Zimbabwe).

To calculate the ratios, it was necessary to take into account the annual standardized balance sheets over seven financial years (2009 to 2015), the average monthly stock market price over 84 months of study as well as the number of shares of each of the listed companies.

The number of shares multiplied by the average monthly price (from 01/01/2009 to 12/31/2015) is used to calculate the market capitalization. This gives us three annual values, one for each of the three ratios. A company integrates the Islamic index over the seven years as long as it scrupulously respects each of the filters associated with the three ratios.
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 Khamlichi (2012), 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 statistic over all the companies that have passed the qualitative filter. The second is to calculate the median statistic by business sector that has passed the first filter. Finally, for both approaches, an asset is selected if the value of its ratio is less than or equal to the median statistic of the ratios of selected companies (either all or by sector).

We use the median statistic 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 statistic 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 statistic 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) | total debts AMC 24 last months < 33% | 70%            | 33%             |
| Liquidity Ratio (RL) | total cash and interest AMC 24 last months < 33% | 10%            | 70%             |
| Debt Ratio (RC) | total receivables AMC 24 last months < 33% | 18%            | 70%             |

Nb: AMC = Average Market Capitalisation
Total cash and interest-bearing securities (1)

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

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

**FINDINGS AND ANALYSIS**

**The Result of The Extra-Financial Filter**

The initial goal was to carry out a comprehensive analysis of 37 stock exchanges, due to lack of data, 17 stock markets were studied.

The original purpose was to perform a comprehensive analysis of the thirty-seven (37) stock exchanges in Africa, but the research limit confined us to seventeen (17) stock markets. Of these, three (Mauritius (SEM), Uganda (USE) and Rwanda (RSE)) were automatically eliminated due to a lack of data. Unfortunately, all the companies that make up the fourteen (14) remaining exchanges that passed the first test could not be analyzed in the second screening. This is due to the unavailability of financial statements and also to the absence of detailed items (financial result) from the companies' financial statements.

Of the 1442 companies listed on the 17 stock exchanges, only 418 have passed the first test where 29% of companies are potentially compatible with "Sharia". This is the most restrictive filter in this study.

![Figure 1. Finding of the extra-financial filter](image)

The 71% are made up of companies whose activities are related to finance, insurance and / or leisure as being the most "illicit" sectors from the point of view of compatibility with the requirements of "Sharia". Although this configuration is not surprising, it can be explained by the very nature of their activities and therefore by their instinctive propensity to expose themselves to "riba".

**Finding of the Quantitative Filter (Or Financial)**

Table 2. Findings by sector

| Sectors          | DJIM | General Median statistic | Sectoral Median statistic |
|------------------|------|--------------------------|--------------------------|
| Agricultural     | 0    | 0                        | 1                        |
| Finance          | 7    | 9                        | 8                        |
| Industry         | 24   | 30                       | 24                       |
| Services         | 18   | 16                       | 20                       |
| Telecommunication| 3    | 3                        | 1                        |
Among the 373 companies submitted to the financial test, 14.21% (or 53) passed the DJIMI filter, 15.82% (or 59) for the general median filter and 15.3% (or 57) for the sectoral median filter. This represents approximately 3.67%, 4.1% and 4% respectively of listed companies overall.

![Figure 2. Standard Islamic filter from DJIM](image1)

With DJIM filtering, we have five lines of business. The industrial and service sectors represent 79% of listed companies having passed both tests, i.e., 24 and 18 companies respectively. The remaining 21% (11 companies) are split between the finance (13%), telecommunications (6%) and transport (2%) sectors.

![Figure 3. Global median filter](image2)

Regarding the filtering of the general median, we end up with five sectors. They break down as follows in terms of the number of listed companies: 30 companies in the industrial sector,
or 51%. It is followed by the service sector with 16 companies, or 27% of the 59 selected, followed by the finance sector with 15% or 9 companies. The telecommunications and transport sectors accumulate only 7%, i.e., 04 and 01 companies respectively.

For the sectoral median filter, the industrial sector records 42% of the companies which passed both tests. It is followed by the service sector with 35% of companies among the 57 retained by the second filter. The finance sector occupies the third position with 14%. The remaining sectors (agriculture, telecommunications, transport and others) account for only 9% of companies.

The ones that failed the second quantitative filters represent approximately 22.2% for the DJIMI, 21.77% for the general median and 21.9% for the sectoral median, or respectively 320; 314 and 316 companies.

![Figure 4. listed companies by geographic area](image)

In terms of geographical distribution for the three methods (respectively DJIMI, general median and sectoral median), South Africa dominates with 47%, 48% and 49% of the companies among those which have passed the qualitative and quantitative filters. The second place is occupied by North Africa with 28%, 32% and 33%, of the lot of values retained. West Africa is third with 19%, 14% 14% of companies that have passed the filters. Southern Africa records 6%, 3% and 2%. On the other hand, East Africa does not register any company for the DJIMI filter. Nevertheless, it 3% and 2% by general and sectoral medians.

**CONCLUSION**

Our paper aimed at applying 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 has been carried out taking into account a pool of stock exchanges from 16 countries and a regional stock exchange (BRVM) in Africa.

We have applied the qualitative and quantitative filters. For the quantitative filter, we have adopted three methods: the DJIMI method, filtering by general median statistic and filtering by sectoral median statistic. This approach produced a number of results.

The qualitative filtering has led to the exclusion of 71% of the stocks making up the 17 African financial markets covered by the study. Quantitative filtering has resulted in the exclusion of 22.2% for the DJIMI, 21.77% for the general median and 21.9% for the sectoral median of listed companies. Those who have passed this quantitative filter respectively represent 14.21%, 15.82% and 15.3% of the companies subjected to this test.
South Africa leads the way in terms of the geographic distribution of businesses. The second place is occupied by North Africa. Next comes West Africa. Finally, Southern Africa and East Africa each of these zones counts a company and this, for the three methods.

The study has proven that the African stock exchange is a market where Muslims could invest in at least 53, 59 and 57 listed companies during the study period (2009-2015) with respectively the methods of DJIM, from the statistic of median in general and sectoral case.

In addition, we can retain that the financial index with the sectoral median (statistic) method constitutes the most diversified portfolio compared to the others. On the other hand, the general median statistic counts more listed values.

Finally, beyond the choice of filtering by the median (general or sectoral), it is necessary to rethink the relevant filtering process to take into account the specifics of African companies in terms of Islamic financial investment. The interest of applying a filter in the process of creating an Islamic stock index 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 once available, would have financial arguments of its own.

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## APPENDICES

### Appendix A: DJIMI

| FIRMS                              | SECTORS |
|------------------------------------|---------|
| Reunert Ltd (RLO SJ)               | Finance |
| Oceana Group Ltd (OCE SJ)          | Finance |
| Assore Ltd (ASR SJ)                | Finance |
| Anglo American Platinum Ltd (AMS SJ) | Finance |
| Impala Platinum Holdings Ltd (IMP SJ) | Finance |
| Shoprite Holdings Ltd (SHP SJ)     | Finance |
| Truworths Internationa Ltd (TRU SJ) | Finance |
| Bauba Platinul Ltd (BAU SJ)        | Industry |
| Mazor Group Ltd (MZR SJ)           | Industry |
| Nutritional Holding Ltd (NUT SJ)   | Industry |
| SacOil Holdings Ltd (SCL SJ)       | Industry |
| Northam Platinum Ltd (NHM SJ)      | Industry |
| AVI Ltd (AVI SJ)                   | Industry |
| African Rainbow Minerals Ltd (ARI SJ) | Industry |
| Société des Caoutchoucs de Grand-Bereby (SOGC BC) | Industry |
| Société Africaine de Plantations d'Heveas SA (SPHC BC) | Industry |
| Paints & Chemical Industry Co (PACH EY) | Industry |
| South Valley Cement (SVCE EY)     | Industry |
| Societe Metallurgique D'imiter (SMI MC) | Industry |
| Centrale Danone (CDA MC)           | Industry |
| Cie Miniere de Touissit (CMT MC)   | Industry |
| NASCO Allied Indutdries PLC (NASCON NL) | Industry |
| Nestle Nigeria PLC (NESTLE NL)     | Industry |
| Morison Industries PLC (MORISON NL) | Industry |
| Unilever Nigerian PLC (UNILEVER NL) | Industry |
| PZ Cussons Nigeria PLC (PZ NL)     | Industry |
| Societe Industrielle d'Appareillage et de Materiels Electriques (SIAME TU) | Industry |
| GIF Filter SA (GIF TU)             | Industry |
| Societe de Production Agricole Tzboulba (SOPAT TU) | Industry |
| Lafarge Cement Zambia PLC (LAFA ZL) | Industry |
| Zambia Sugar PLC (ZMSG ZL)         | Industry |
| Mr Price Group Ltd (MRP SJ)        | Services |
| Tiger Brands Ltd (TBS SJ)          | Services |
| ISA Holding Ltd (ISA SJ)           | Services |
| Italtile Ltd (ITE SJ)              | Services |
| FIRMS                                      | SECTORS |
|-------------------------------------------|---------|
| Adcock Ingram Holdings Ltd (AIP SJ)       | Services|
| Advtech Ltd (ADH SJ)                     | Services|
| Woolworths Holdings Ltd/South Africa (WHL SJ) | Services|
| Famous Brands Ltd (FBR SJ)                | Services|
| ARB Holdings Ltd (ARH SJ)                 | Services|
| Spur Corp Ltd (SUR SJ)                    | Services|
| Engen Botswana Ltd (ENGN BG)              | Services|
| Servair Abidjan ABJCCI BC                 | Services|
| CFAO motors Cote d'Ivoire (CFAC BC)       | Services|
| Alexandria Containers & Goods (ALCN EY)   | Services|
| Assiut Islamic Trading (AITG EY)          | Services|
| Auto Hall (ATH MC)                        | Services|
| Automobile Reseau Tunisien et Services (ARTES TU) | Services|
| Essoukna (SOKNA TU)                       | Services|
| Caxton and CTP Publishers and Printers Ltd (CAT SJ) | Telecommunication|
| Sonatel (SNTS BC)                         | Telecommunication|
| Maroc Telecom (IAM MC)                    | Telecommunication|
| Societe de Transport Hydrocarbures par Pipelines (STPIL TU) | Transport|

**Appendix B: General Median**

| FIRMS                                      | SECTORS |
|-------------------------------------------|---------|
| Massmart Holding Ltd (MSM SJ)             | Finance |
| Aspen Pharmacare Holding Ltd (APN SJ)     | Finance |
| PPC Ltd (PPC SJ)                           | Finance |
| Oceana Group Ltd (OCE SJ)                 | Finance |
| Anglo American Platinum Ltd (AMS SJ)      | Finance |
| Impala Platinum Holdings Ltd (IMP SJ)      | Finance |
| Shoprite Holdings Ltd (SHP SJ)             | Finance |
| Truworths Internationa Ltd (TRU SJ)       | Finance |
| Metrofile Holdings Ltd (MFL SJ)           | Finance |
| Bauba Platinul Ltd (BAU SJ)               | Industry|
| Petmin Ltd (PET SJ)                       | Industry|
| Astral Foods Ltd (ARL SJ)                 | Industry|
| Nutritional Holding Ltd (NUT SJ)          | Industry|
| Harmony Gold Mining Co Ltd (HAR SJ)        | Industry|
| Incitec Pivot Ltd (IPL SJ)                | Industry|
| Northam Platinum Ltd (NHM SJ)             | Industry|
| AVI Ltd (AVI SJ)                          | Industry|
| African Rainbow Minerals Ltd (ARI SJ)     | Industry|
| Company Name                      | Industry/Telcom/Transport |
|----------------------------------|---------------------------|
| African Oxygen Ltd (AFX SJ)      | Industry                  |
| Gold Fields Ltd (GFI SJ)         | Industry                  |
| Société des Caoutchoucs de Grand-Bereby (SOGC BC) | Industry |
| Ismailia Misr Poultry Co (ISMA EY) | Industry          |
| Lecico Egypt SAE (LCSW EY)       | Industry                  |
| Upper Egypt Flour Mills (UEFM EY) | Industry          |
| ElSewedy Electric Co (SWDY EY)   | Industry                  |
| South Valley Cement (SVCE EY)    | Industry                  |
| Carbacid Investments Ltd (CBIL KN) | Industry       |
| Sonasid (SID MC)                 | Industry                  |
| Societe Metallurgique D’imiter (SMI MC) | Industry       |
| Centrale Danone (CDA MC)         | Industry                  |
| Cie Miniere de Touissit (CMT MC) | Industry                  |
| Lesieur Cristal (LES MC)         | Industry                  |
| Nestle Nigeria PLC (NESTLE NL)   | Industry                  |
| Morison Industries PLC (MORISON NL) | Industry     |
| Unilever Nigerian PLC (UNILEVER NL) | Industry     |
| Tripple GEE and Co PLC (TRIPPLEG NL) | Industry |
| PZ Cussons Nigeria PLC (PZ NL)   | Industry                  |
| GIF Filter SA (GIF TU)           | Industry                  |
| Zambia Sugar PLC (ZMSG ZL)       | Industry                  |
| Mr Price Group Ltd (MRP SJ)      | Services                  |
| Tiger Brands Ltd (TBS SJ)        | Services                  |
| Adcock Ingram Holdings Ltd (AIP SJ) | Services        |
| Advtech Ltd (ADH SJ)             | Services                  |
| Famous Brands Ltd (FBR SJ)       | Services                  |
| Pioneer Foods Group Ltd (PFG SJ) | Services                  |
| Clicks Group Ltd (CLS SJ)        | Services                  |
| Spur Corp Ltd (SUR SJ)           | Services                  |
| Servair Abidjan ABJCCI BC        | Services                  |
| Alexandria Containers & Goods (ALCN EY) | Services   |
| Assiut Islamic Trading (AITG EY) | Services                  |
| El Kahera Housing (ELKA EY)      | Services                  |
| Maridive & Oil Services SAE (MOIL EY) | Services |
| Lafarge Africa PLC (WAPCO NL)    | Services                  |
| Automobile Reseau Tunisien et Services (ARTES TU) | Services |
| Essoukna (SOKNA TU)              | Services                  |
| Safaricom Ltd (SAFCOM KN)        | Telecommunication         |
| Telekom Networks Malawi Ltd (TNM MW) | Telecommunication |
| Maroc Telecom (IAM MC)           | Telecommunication         |
| Societe de Transport Hydrocarbures par Pipelines (STPIL TU) | Transport |
## Appendix C: Sectoral Median

| FIRMS                                      | SECTORS   |
|--------------------------------------------|-----------|
| Northern Upper Egypt Development (NEDA EY) | Agricultural |
| Stockis Nord Afrique (SNA MC)              | Other     |
| Massmart Holding Ltd (MSM SJ)              | Finance   |
| PPC Ltd (PPC SJ)                           | Finance   |
| Oceana Group Ltd (OCE SJ)                  | Finance   |
| Anglo American Platinum Ltd (AMS SJ)       | Finance   |
| Impala Platinum Holdings Ltd (IMP SJ)      | Finance   |
| Shoprite Holdings Ltd (SHP SJ)             | Finance   |
| Truworths Internationa Ltd (TRU SJ)        | Finance   |
| Metrofile Holdings Ltd (MFL SJ)            | Finance   |
| Bauba Platinul Ltd (BAU SJ)                | Industry  |
| Astral Foods Ltd (ARL SJ)                  | Industry  |
| Nutritional Holding Ltd (NUT SJ)           | Industry  |
| Harmony Gold Mining Co Ltd (HAR SJ)        | Industry  |
| Incitec Pivot Ltd (IPL SJ)                 | Industry  |
| Northam Platinum Ltd (NHM SJ)              | Industry  |
| AVI Ltd (AVI SJ)                           | Industry  |
| African Rainbow Minerals Ltd (ARI SJ)      | Industry  |
| African Oxygen Ltd (AFX SJ)                | Industry  |
| Ismailia Misr Poultry Co (ISMA EY)         | Industry  |
| Lecico Egypt SAE (LCSW EY)                 | Industry  |
| ElSewedy Electic Co (SWDY EY)              | Industry  |
| South Valley Cement (SVCE EY)              | Industry  |
| Carbacid Investments Ltd (CBIL KN)         | Industry  |
| Societe Metallurgique D'imiter (SMI MC)    | Industry  |
| Centrale Danone (CDA MC)                   | Industry  |
| Cie Miniere de Touissit (CMT MC)           | Industry  |
| Nestle Nigeria PLC (NESTLE NL)             | Industry  |
| Morison Industries PLC (MORISON NL)        | Industry  |
| Unilever Nigerian PLC (UNILEVER NL)        | Industry  |
| Tripple GEE and Co PLC (TRIPPLEG NL)       | Industry  |
| PZ Cussonas Nigeria PLC (PZ NL)            | Industry  |
| GIF Filter SA (GIF TU)                     | Industry  |
| Zambia Sugar PLC (ZMSG ZL)                 | Industry  |
| Mr Price Group Ltd (MRP SJ)                | Services  |
| Tiger Brands Ltd (TBS SJ)                  | Services  |
| Company Name                                      | Industry   |
|--------------------------------------------------|------------|
| Adcock Ingram Holdings Ltd (AIP SJ)              | Services   |
| Advtech Ltd (ADH SJ)                             | Services   |
| Famous Brands Ltd (FBR SJ)                       | Services   |
| Pioneer Foods Group Ltd (PFG SJ)                 | Services   |
| Crookes Brothers Ltd (CKS SJ)                    | Services   |
| Clicks Group Ltd (CLS SJ)                        | Services   |
| Spur Corp Ltd (SUR SJ)                           | Services   |
| Servair Abidjan ABJCCI BC                        | Services   |
| CFAO motors Cote d'Ivoire (CFAC BC)              | Services   |
| Palm Hills Developments SAE (PHDC)               | Services   |
| Alexandria Containers & Goods (ALCN EY)          | Services   |
| Assiut Islamic Trading (AITG EY)                 | Services   |
| El Kahera Housing (ELKA EY)                      | Services   |
| Maridive & Oil Services SAE (MOIL EY)            | Services   |
| Auto Hall (ATH MC)                               | Services   |
| Lafarge Africa PLC (WAPCO NL)                    | Services   |
| Automobile Reseau Tunisien et Services (ARTES TU)| Services   |
| Essoukna (SOKNA TU)                              | Services   |
| MTN Group Ltd (MTN SJ)                           | Telecommunication |
| Grindrod Ltd (GND SJ)                            | Transport  |
| Societe de Transport Hydrocarbures par Pipelines (STPIL TU) | Transport  |

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