

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 sector 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, Kenya, 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)	$\frac{\text{total debts}}{\text{AMC 24 last months}} < 33\%$	70%	33%
Liquidity Ratio (RL)	$\frac{\text{total cash and interest}^1}{\text{AMC 24 last months}} < 33\%$	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 (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 complete 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.

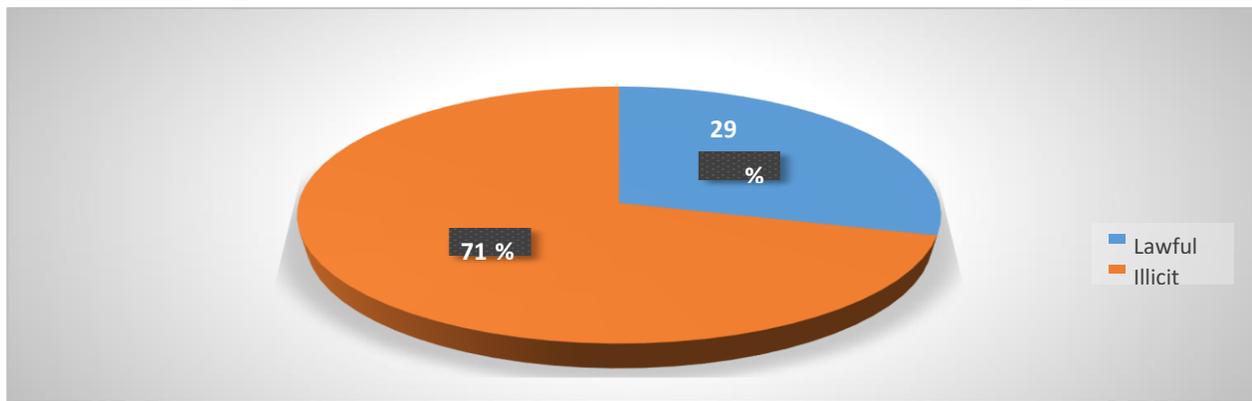


Figure 1. Finding of the extra-financial filter

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

Transport	1	1	2
Other	0	0	1
Total	53	59	57

Source: Construction of the authors from the financial database

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.

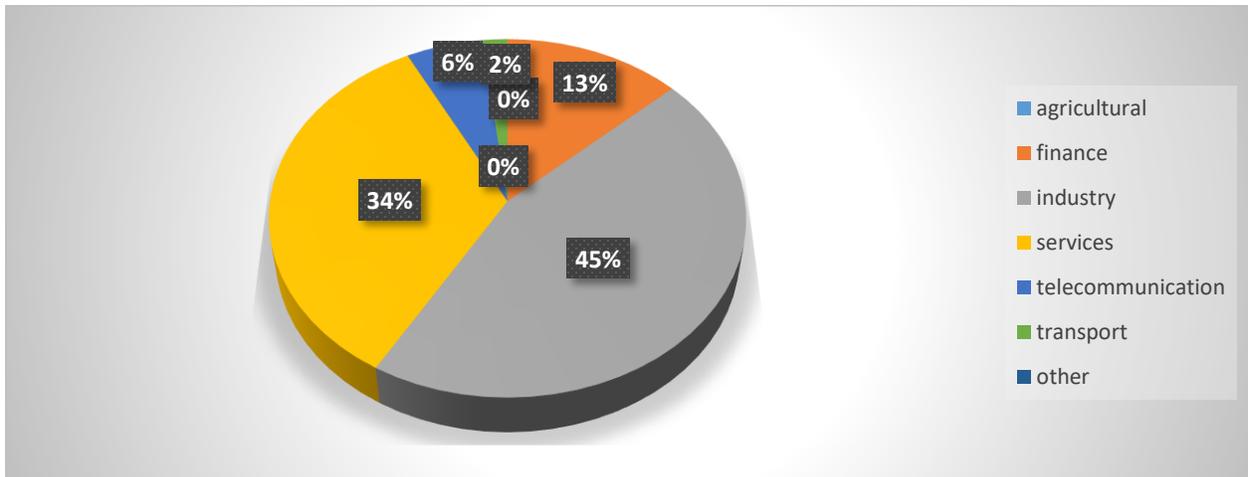


Figure 2. Standard islamic filter from DJIM

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.

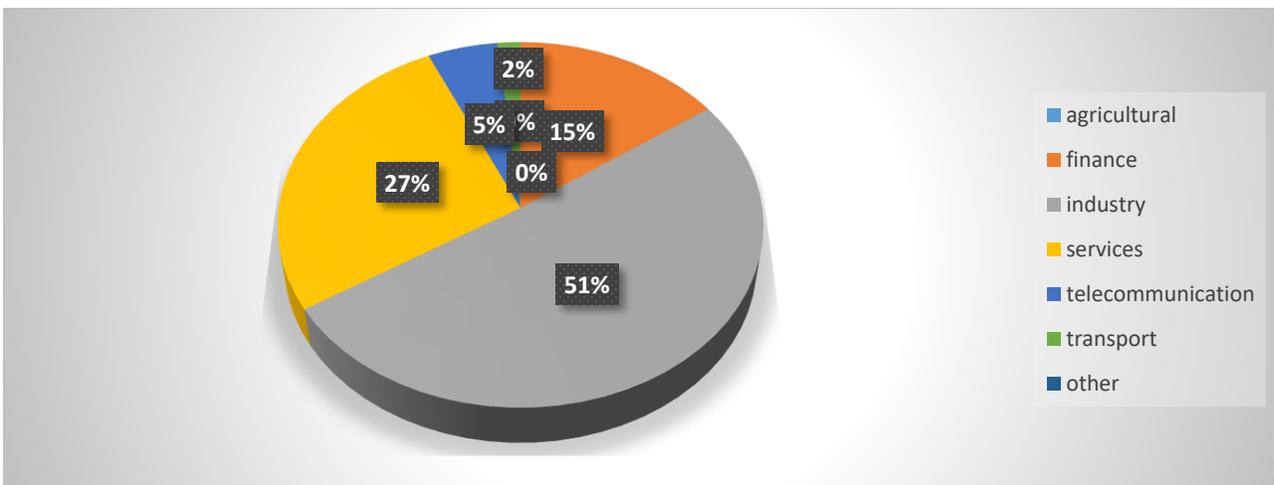


Figure 3. Global median filter

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.

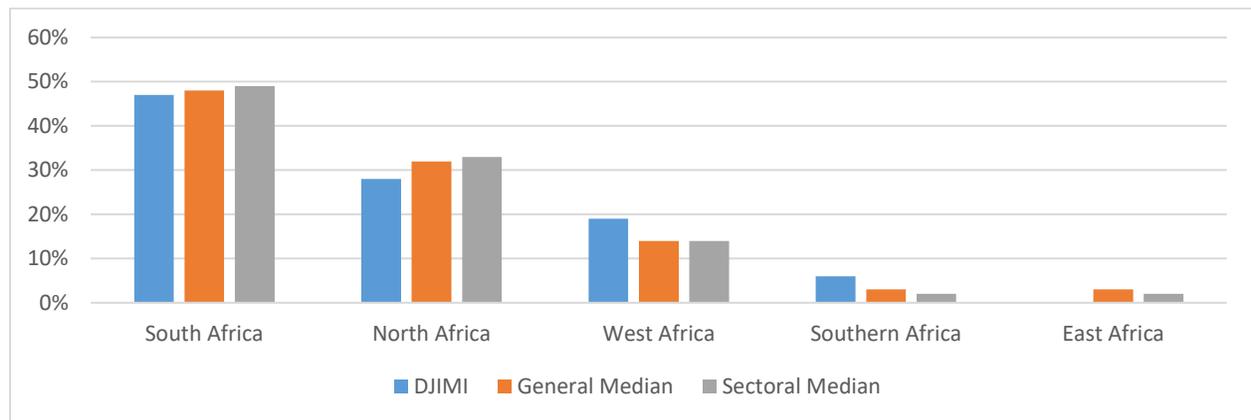


Figure 4. listed companies by geographic area

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.

AUTHOR CONTRIBUTIONS

Conceptualization: Moustapha Balde, Mamadou A. Konte

Data Curation: Moustapha Balde, Mamadou A. Konte

Formal Analysis: Moustapha Balde, Mamadou A. Konte

Funding Acquisition: Moustapha Balde, Mamadou A. Konte

Investigation: Moustapha Balde, Mamadou A. Konte

Methodology: Moustapha Balde, Mamadou A. Konte

Project Administration: Moustapha Balde

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Software: Mamadou A. Konte

Supervision: Moustapha Balde, Mamadou A. Konte

Validation: Moustapha Balde, Mamadou A. Konte

Visualization: Moustapha Balde, Mamadou A. Konte

Writing – Original Draft: Moustapha Balde, Mamadou A. Konte

Writing – Review & Editing: Moustapha Balde, Mamadou A. Konte

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

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All authors contributed equally to the conception and design of the study. We thank Professor Lamine Mbengue, Dr. Alioune Badara Mbengue and Mr. Bassirou Goudiaby for their comments and suggestions that helped to improve the quality of this paper.

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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 Indudtries 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
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
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 Electic 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 Electric 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 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
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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