

# Modelling the Return of Shariah with Underlying Indices of National Stock Exchange of India: A Case of 3SLS and GMM Estimation

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## Abstract

Shariah indices can be used to construct socially reliable investment products that are attractive for those, who do not wish to invest in undesired business. National Stock Exchange of India introduced Nifty 50 Shariah and Nifty 500 Shariah indices to provide alternative indices for Shariah compliant companies. The study is an attempt to reveal the relationship between Nifty 50 Shariah and Nifty 500 Shariah with their underlying indices, Nifty 50 and Nifty 500. For this purpose a period of 01/01/2007 to 31/12/2015 is taken. Based on various objectives, techniques like Descriptive statistics, Correlation, Co-integration test, 3SLS and GMM estimation are used.

It is concluded that return of Shariah Indices are better and risk is lesser, than underlying indices. These indices are the better option for portfolios.

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Keywords: NSE; Shariah Indices ; 3SLS ;GMM

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## 1. Introduction

A Shariah Index is an index of companies, which are compliant with the Shariah law. It is a measurement of the value of a section of the stock market, which deals with socially responsible investment products. Worldwide, Shariah indices are created on the foundation of an existing or an underlying index, whose constituents have been screened for compliance by a board, called Shariah board, which is well-versed in the principles of the Shariah. These products attract the investors, who do not like to invest their money in the share of companies that engage in activities which are against their belief. Islamic finance industry is introduced about mid 1970 globally. In this short span it has recorded unexpected

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achievements. Islamic banking Assets have increased by 17.6% from 2009 to 2013 annually. Ernst & Young has estimated a growth of 19.7% by the year 2018. This sector would grow between 15-20% annually and has become fastest growing sector of financial world. Various index providers including, Dow Jones, FTSE, S&P, Morgan Stanley have provided indices for Shariah compliant investment worldwide. The world's first Islamic index was introduced by Dow Jones in February 1999. In India National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) provide Shariah based indices. NSE started Nifty 50 Shariah and Nifty 500 Shariah on Feb 2008, with the base date of Dec 29, 2006. In India, financial institutions such as HSBC, TATAs, Taurus, UTI, Kotak, Reliance, Bajaj Allianz etc. have introduced or in process of introducing some kind of Shariah products.

In this research paper, an attempt has been made to analyze, the select Shariah indices with the underlying indices on various parameters, which may provide better understanding for the investments to be made in Shariah Indices, with reference to India. Results of the study may help the fund/ portfolio managers to develop suitable portfolios.

## **2. Review of literature**

Review of related literature is presented as under:

Rizvi and Arshad (2014) proved Islamic Indices have provided more risk averse alternatives. They employed DJIMI index family and covered 12 years from 3<sup>rd</sup> January 2000 to 30<sup>th</sup> December. Multivariate GARCH DCC methods were used. The study found that Islamic indices has negative correlation with conventional indices at the time of crisis period which means Islamic indices provides better alternative for credit crunch. Farooq and Reza (2014) attempted to find suitable technique to analysis the performance of shariah based indices. To get the result out, author took NDX (NASDAQ 100), INDU (Dow Jones Industrial index) and SPX(S&P 500) as benchmark indices and Dow Jones IMUS(Islamic market US) as shariah compliant index. The study employed TA (technical analysis) & FA (fundamental analysis) and simple B&H (buy and hold) strategy on both type of indices and found that there is no difference between suitability of TA on Shariah and non shariah indices. Furthermore the study also reveals that TA is more efficient tool then simple B&H strategy for taking decision regarding shariah based investment. Karim, Datip and Shukri (2014) enquired into the performance of Shariah stock market and their conventional counterparts of Malaysia. For their study, the period of January 2000 to October 2011 was taken. The analysis was done by using Treynor ratio, Adjusted Jensen Alpha Index, Sharpe ratio and modified Sharpe ratio, Granger Causality Test and Co-integration. The results of the study revealed that Shariah Compliant stocks earn more return, even at the time of economic crisis and the existence of significant bi-directional causality for short term between both indices. Ashraf and Deo (2014) studied linear dependency between shariah and conventional indices in the context of India by using daily closing values of some prominent indices viz. CNX Nifty, CNX500 and S&P BSE TATAS 50 for the period spanning from January 2008 to June 2013. The study says that volatility clustering leads IID (Identical independent Distribution) in indices and shariah market does not realize abnormal yield in specified period. Habib and Islam (2014) compared the efficiency of MSCI India Islamic Index and MSCI Malaysia Islamic Index with their respective conventional index for the period of 2003 to 2013. To measure the efficiency of these indices, they calculated monthly raw return, monthly risk-adjusted return and standard deviation for measuring risk involved in market. The study found that MSCI India Islamic index did not perform well but MSCI Malaysia Islamic index did well in comparison to their respective benchmark indices. But on the other hand both Islamic Indices performed very well at the time of declining phase. Reddy and Fu (2014) evaluated Shariah principle based Indices and compared it with standard Index composed by Australian Stock Exchange. They found that are Shariah principle based Indices are better investment alternatives for the period of 2001 to 2013. They measured the risk adjusted return, Sharpe ratio, Treynor ratio and Jensen alpha ration. Multiple Regression Analysis was taken as analyzing tool for the tendency of behavior of both stocks. The results showed that both indices tend to behave in same manner but Islamic indices show slightly higher return than conventional one. In 2014,

Khalichi, Humayun, Arouri and Teulon attempted to find out the opportunity of diversification by Comparing Islamic indices with their conventional Indices. They inspected four index families MSCI, FTSE, Dow Jones and S&P by employing co integration test and variance ratio test. The result reveals that Islamic indices are as efficient as conventional one in the case of MSCI and FTSE. But Dow Jones and S&P provide opportunity of diversification as their conventional indices are not co integrated with Islamic Indices. Miniaoui, Sayani and Chaibi (2014) studied the performance of Islamic and mainstream indices of the GCC for the credit crunch period and attempted to answer which one is riskier. Six GCC Market and Dow Jones Islamic Market index GCC used as sample and employed Augmented GARCH Model to examine mean and variance of all indices. The results show that financial crisis affected mean return only of Bahrain and other countries were unaffected. And on the other hand Volatility was affected only for three countries (Kuwait, Bahrain and UAE), and other GCC markets (Saudi Arabia, Oman and Qatar) and Islamic Index were significantly unaffected. The study concluded that Islamic indices are more volatile than Conventional counterparts. Khazali, Lean and Samet (2014) compared the performance of Islamic stock indices and their conventional counterparts by using nine Dow Jones significant indices namely Asia Pacific, Canadian, Emerging Markets, Developed Country, European, Global, Japanese, UK, and US DJI. The study employed the data for the period of the years 1996 to 2012, with stochastic dominance analysis technique. The study indicates that conventional indices stochastically dominate Islamic indices in all markets except European market. But on the other hand in financial crisis period 2007-2012 the global, European and US Islamic indices dominate their conventional counterparts. Study concluded that around the financial crisis period Islamic indices dominate their conventional counterparts. In same series Ho, Rahman, Yusuf and Zamzamin (2014) also gave a significant contribution in this subject by comparing 12 major Islamic Indices of 8 countries with their benchmark indices. To find out the result, various financial tools were used like CAPM, Sharpe ratio, Jensen alpha ratio, Treynor index etc. Authors focused on two major crisis phases: first one is Dotcom decline from 2000 to 2002 and the second one is Global crisis from 2007 to 2008. The study confirmed that Islamic investments are with lesser risk and performed well in crisis period in comparison of standard indices. Jawadi, Jawadi and WaëlLouhichi (2014) have compared the performance of Islamic stock exchanges and benchmark stock exchanges for the three main sections Europe, USA and World for the period of 2000 to 2011. Various financial ratios, GARCH model, and CAPM have been used to measure performance of indices. The study reveals that Islamic indices performed better at the time of crisis period in respect of conventional indices. Same as Arshad and Rizvi (2013) found out the effect of financial crisis on Islamic indices and Conventional Indices. The authors employed Wavelet techniques to find out co-movement of Islamic Indices in respect of select financial indices for world. They used the value from four indices for the period of 1997 to 2011. Islamic World Index, Islamic Asia Pacific Index and World Emerging Market Index were used as sample indices. The study revealed that Investment in Islamic Asia Pacific and World emerging market indices are partially protected from the risk of financial crisis and considered as good investment alternative. Thus, Indices based on Islamic belief, are considered as more stable because of their selection criteria. Haq and Rao (2013) compared conventional and shariah indices in the context of India by using daily closing prices of Sensex and Shariah 50 indices of BSE form march 2008 to December 2012. The study has deployed Wavelet analysis, Cointegration and Causality test of Granger. The result shows that both indices are cointegrated in long run and sharing bidirectional flow of information for 2-4 days. Setiawan and Oktariza (2013) studied the performance of Shariah and traditional Stock in Indonesia Stock Exchange. They attempted to analyse the difference in risk and outcome between Shariah stocks and traditional stocks of selected public companies which are listed on Indonesia Stock Exchange (IDX) for the period of 2009-2011; and stock returns of both. After employing the various techniques like Auto regression Model, Sharpe ratio, Treynor ratio, the result was that Shariah-compliant companies are equivalent to traditional companies since many of the factors have remarkable connection with the stock performance. Natarajan and Dharani (2012) checked the risk and return behaviour of Nifty Shariah index, Nifty index and Closing prices of selected BSE indices including conventional indices for the period of January 2007 to July 2011. Various tools like t-test, Co-efficient of correlation and CAPM were used. Research uncovered that both types of indices created comparable

return. The movement of Shariah Indices and Conventional indices looked like each other for this study period. Bhatt and Sultan (2012) examined the sensitivity of three types of stocks such as conventional, socially responsible and Islamic stocks from financial risk. To measure the sensitivity of stocks, leverage risk is taken as key component with having the hypothesis as shariah compliant stock is less sensitive to leverage risk. The time sample is taken from January 2000 to April 2009. It is revealed that socially responsible stock are less volatile or sensitive in comparison of conventional and shariah based stocks. Romli, Mohamad and Yusof (2012) compared the volatility of Islamic stock market and conventional stock market of Malaysia for the period of 2007 to 2009. To examine stability CAPM model and ARCH model are employed. The result showed that FTSE-BM Hijrah is more volatile than the composite index thus it provides high risk market for getting high returns for the investors. Tyagi and Rizwan (2012) examined relationship between Islamic index and conventional index of BSE. Islamic index data, BSE Tasis Shariah is employed for the period of January 2011 to June 2012. The study reveals that Tasis Shariah and Sensex tend to behave similarly for that particular period. Lean and Parsva (2012) analyzed the Islamic stock indices of Malaysian capital market and contrasted them with conventional indices. FTSE Bursa Malaysia KLCI Index, FTSE Bursa EMAS Index, and FTSE Malaysia 100 index were included to demonstrate statuses of business sector portfolio and FTSE Bursa Malaysia EMAS Shariah Index, FTSE Bursa Malaysia Hijrah Shariah Index were used for Islamic portfolio. March 2007 to February 2011 was taken as test time. To estimate the return and risk of portfolio, the study utilized Capital assets pricing model. The study uncovered that Islamic indices performed better in crisis period, however after financial crisis, these indices came in the business with high risk. Albaity and Mudor (2012) picked Hijra from Malaysia and DJIMI from US. KLCI was utilized as ordinary indices for Malaysia and DJINA for US. Duration of February 2007 to May 2011 was taken. The period was separated into four sub periods. They undertake Unit root test, Causality and co integration as statistical tools. The outcomes clarify that Islamic venture is lesser unstable and lesser risky in crisis period however it is not considered as a better speculation elective over the routine counterparts. Charles, Darne and Pop (2012) examined whether both Islamic and Conventional indices respond or not, causing major event internationally or domestically. They used an Iterative Cumulative Sum of Squares (ICSS) algorithm to Identify structural breaks in the volatility of several important Dow Jones and conventional indices for the period of 1996 to 2009. The results expose that both types of indices have been affected by changes in variance but Islamic indices are more sensitive and react causing major events. Albaity and Ahmad (2011) investigated three Islamic indices viz DJIMI for USA, FTSEGII for United Kingdom and KLSI for Malaysia. The study analysed the tendency of return and volatility of these indices. EGARCH and TGARCH models are employed on daily closing prices for the period of January 1999 to October 2007. The result showed that three Islamic indices moves in same manner, there is no significant difference among them, with the point of risk and return both. In 2011, Mansor and Bhatti evaluated the performance of the Shariah Mutual Fund and traditional portfolios in Malaysia. They took 128 mutual funds based on Islamic belief and 350 conventional mutual funds within the period of 1996 to 2009. The result showed that Islamic portfolio earns a little less return in respect of conventional counterparts. It further indicated that the Islamic portfolio is riskier than conventional one. Beik and Wardhana (2011) evaluated the performance and relationship between Islamic Indices and their conventional counterparts for the period of January 2006 to December 2008. Dow Jones Islamic Index for US, Jakarta Islamic Index (JII) for Indonesia, Dow Jones Islamic Index for Malaysia was taken for Shariah representative Indices. And for conventional Indices, Jakarta Composite Index from Indonesia, KLCI from Malaysia and Dow Jones Index from US, were employed. Co-integration test and Vector Autoregressive technique were used. Study revealed that there is no dynamic interaction between stock market of Indonesia and the Markets of Malaysia and US for long term time span. Jakarta Islamic Index is considered least risky alternative in respect of other market. Hassan and Girard (2010) attempted to analyses performance of seven Dow Jones Islamic indices namely world development index, World emerging market index, US index, Europe index, Asia/pacific index, Canada index and UK index with the comparison of same regional indices of MSCI. The study has used Jensen, Sharpe, Treynor and Fama's ratio to compare both types of indices on the basis of return. Furthermore study also focused on persistence of performance and Cointegration among the indices. The sample period is taken from January 1996 to December 2005, then

it has been split into two parts, one is from 1996 to 2000 and second one is from 2001 to 2006. The study concluded that there is no significant difference between both types of indices but shariah indices outperformed in first period but underperformed in second period. karim, kassim and Arip (2010) inspected integration and co-movement for identifying opportunity of diversification among some identical shariah indices of Dow Jones from Malaysia, Indonesia, Japan, UK and USA. The study have used daily closing values from February 2006 to December 2008 by classifying it into two period pre-crisis and crisis period. To catch out the long run co-movement, unit root and Cointegration test were used and the results is revealed as there is Cointegration existed among these shariah indices and provide better opportunity to get higher returns. Rahim, Ahmad and Ahmad (2009) examined the effect of transmission of news on significant indices namely Kualalampur syariah index and Jakarta Islamic index. The time period is used from pre-crisis period from July 2000 to December 2006 and bivariate VAR GJR-Garch was used as analytical tool. The study revealed that unidirectional transmission is existed from Kualalampur to Jakarta, means information of Jakarta Islamic index does not affect Kualalampur Syariah Index. Additionally the study also revealed low level correlation between the indices. Albaity and Ahmad (2008) have compared the result of KLSI and KLCI on the basis of risk and adjusted return measurements. The time period of 1999 to 2005 was used. They used three tools firstly unit root, Granger causality, Vector Auto regression and Impulse Response Analyses. The study revealed that there is no significant difference in risk-adjusted returns between standard stock market and Shariah stock market. Even KLSI had smaller return but also included lesser risk in comparison of KLCI. Sadeghi (2008) examined performance and liquidity of Malaysia stock market after introducing Shariah-compliant Index by Bursa Malaysia. He employed event study methodology to measure cumulative mean returns. The result reveals that introduction of Shariah compliant index causes significant negative return and decrease in the bid-ask over around 30 days of event (before 15 days to after 15 days). But for the longer period abnormal return increases over the time. Hussein and Omran (2005) examined the efficiency of the Islamic index in Dow Jones and the Dow Jones World Index by using the data from 1995 to 2003. They divided sample time into entire phase, the growing phase and decline phase. They used statistical tools to measure the performance like Sharpe ratio, Capital Assets Pricing Model and Treynor ratio. The study showed that Shariah indices positively over-performed for the entire time period and growing time phase but in contrast of this they could not perform well at decline phase. Ahmad and Ibrahim (2002) compared the Kuala Lumpur Shariah Index (KLSI) with Kuala Lumpur Composite index (KLCI) on the basis of risk and return for the period of 1999 to 2002. They divided this period into three parts; Bull, Bear and Average period. They used standard deviation, Relative return, and risk adjusted return to calculate the outcome of both indices. The study reveals that KLSI did not perform well at the time of average period and bearish period but it performed well at the time of growing period. Both indices are highly Co-related for the sample period.

It is found that the literature has produced contradictory results in relation to different indices for various countries. Thus, a clear picture of the relation between the Shariah and the underlying cannot be portrayed.

Earlier studies used Different methods like ordinary least square, DCC-GARCH, Treynor ratio, Jensen alpha, Fama ratio, cointegration test, granger causality, MRA, CAPM, VAR, impulse response etc. have been used by the previous researchers.

Studies included in review have been done on countries like, Japan, UK, US, Kuwait, Bahrain, UAE and GCC. Some Index family like, MSCI, FTSE and DJ have also been put to research, Literature also includes studies on stock markets like Nasdaq, Indonesia Stock Exchange, Malaysian stock exchange, National stock exchange and Bombay stock exchange of India, Australian Stock Exchange etc.

The significant contribution of the present study is the incorporation of advanced models like Three Stage Least Square (3SLS) and Generalized Method Of Moments (GMM), which take care of limitations of ordinary least square and other methods.

Apart from this, Simultaneous Equations (SE) is also used. SE was not used by the researcher earlier. Previous studies done on NSE and its Shariah indices also did not use advanced modeling techniques. So, it is needed, to study whether the underlying and Shariah indices are associated or not, in relation to National stock exchange of India, using advanced models.

### 3. Research method

#### 3.1 Data

As mentioned earlier, the data from NSE is used. As NSE is the largest stock exchange in India, with highest turnover, so it is worthwhile to study with reference to it. In this study, Nifty 500 Shariah and Nifty 50 Shariah are taken as Shariah indices and Nifty 500 and Nifty 50 are the underlying indices. The daily closing price data of the indices are taken from official website of NSE for the period of 01/01/2007 to 31/12/2015.

#### 3.2 Empirical framework

To measure co-movement and to analyse the return and risk, descriptive statistics have been used. The study further employs various statistical models of time series analysis like Unit Root Test, Co-integration Test, Three Stage Least Square (3SLS) and GMM estimation. Unit Root Test and Co-integration Test are standard methods. Applied to system equation environment, 3SLS can be more efficient than OLS. It uses Instrumental Variable (IV) procedure, which gives a consistent estimator (whereas OLS does not). It tends to reduce standard errors; further more it does not require a known distribution of error like OLS needs. GMM takes care of endogeneity bias. The problem of endogeneity occurs when the independent variable is correlated with the error term in a regression model. This implies that the regression coefficient in an Ordinary Least Squares (OLS) regression may be biased.

Indices under study

SN	Indices	Symbol	Log-differenced
1	Nifty 50	N	DN
2	Nifty 500	N5	DN5
3	Nifty 50 Shariah	NS	DNS
4	Nifty 50 Shariah	NS5	DNS5

#### 3.3 Objective of the study

To develop suitable models for forecasting the returns and volatility of NSE Shariah indices comparative to underlying indices, to advice various stake holders.

To achieve the broad goal, various precise objectives are:

1. To find out the comparative volatility of the Shariah and underlying indices.
2. To find out stationarity of the series, to prepare the series for further modeling.
3. To identify long term co-movement between the series of Shariah and underlying indices.
4. To pick the causal effect of Shariah and underlying indices over each other.
5. To model the returns of Shariah and /with underlying indices.

#### 3.4. Hypotheses

Following null hypotheses are proposed:

$H_{01}$ = Standard Deviation is lesser in Shariah than underlying indices.

$H_{02}$ = Shariah and underlying indices are not co-integrated in long run.

$H_{03}$ = Shariah and underlying indices do not granger cause each other.

- H<sub>04</sub>= Nifty 500 is insignificant in determining the return of Nifty 500 Shariah.  
 H<sub>05</sub>= Nifty 500 Shariah is insignificant in determining the return of Nifty 500.  
 H<sub>06</sub>= Nifty is insignificant in determining the return of Nifty Shariah.  
 H<sub>07</sub>= Nifty Shariah is insignificant in determining the return of Nifty.

#### 4. Analysis

##### 4.1 Descriptive statistics

Descriptive statistics provide core and basic attributes of a variables. In table 1, As compared to others, Nifty 500 is the most profitable index with the mean of 0.0004; all other indices earned almost same return for the specified period. Here we can see an interesting fact that Nifty 500 Shariah is a better investment alternative than its underlying index with reference to the mean of returns. With the risk point of view, Nifty 500 Shariah is also the least volatile with Standard Deviation (S.D.) 1.46% and Nifty 50 (1.59%) is considered as highest volatile index.

**Table 1: Descriptive statistics**

	DN	DN5	DNS	DNS5
Mean	0.0003	0.0003	0.0003	0.0004
S.D.	0.0159	0.0153	0.0154	0.0146
Skewness	0.0835	-0.1419	0.1873	-0.0381
Jarque-Bera	8296.83	7375.09	10294.41	10435.12
Probability	0.0000	0.0000	0.0000	0.0000

It can be noticed that Shariah indices are lesser volatile, when compared with respective underlying indices. These are having lesser standard deviation in returns. As Nifty 500 and Nifty 500 Shariah were negatively skewed, showing higher probability of large decrease in returns, on the other hand Nifty 50 and Nifty 50 Shariah are positively skewed. In JB Test, the null hypothesis of normality also stands rejected.

##### 4.2 Correlation

In table no. 2, correlation among the returns on Nifty 50, Nifty 50 Shariah, Nifty 500 and Nifty 500 Shariah is produced.

**Table 2: Correlation**

	D_N	D_N5	D_NS	D_NS5
D_N	1.0000	0.9853	0.9652	0.9691
D_N5	0.9853	1.0000	0.9470	0.9716
D_NS	0.9652	0.9470	1.0000	0.9883
D_NS5	0.9691	0.9716	0.9883	1.0000

Correlation analysis is the simplest way to determine the predictive ability of an indicator. It is indicated that values of correlation are ranging from 0.9470 to 1.000, which shows that all indices are highly correlated with each other. The direction of the variable's change is positive, that shows that the variables will move in the same direction.

#### 4.3 Unit root test

Unit root test is used for testing the stationarity of the variable, as non-stationarity is a necessary condition for co-integration and stationarity is further required for modelling. To test unit root, we have opted for Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) test in the study. For testing the stationarity, null hypothesis (Ho) is determined as Nifty 50, Nifty 50 Shariah, Nifty 500 and Nifty 500 Shariah have a unit root or the data are non stationary. Results are shown in table 3A and 3B.

**Table 3A: Augmented Dickey-Fuller Test (ADF Test)**

Symbol	Lag length	Level		First difference		
		ADF statistic	p-value	Lag length	ADF statistic	p-value
N	1	-0.821302	0.8124	0	-42.04458	0.0000
NS	1	-0.996894	0.7564	0	-42.47694	0.0000
N5	1	-0.698527	0.8452	0	-40.22808	0.0000
NS5	1	-0.317307	0.9200	0	-40.81334	0.0000

Exogenous: Constant, Lag Length: Automatic based on SIC, MAXLAG=25

\*MacKinnon (1996) one-sided p-values.

Deterministic terms: Intercept

**Table 3B: Phillips-Perron test (PP Test)**

Symbol	Band width	Level		First difference		
		PP statistic	p-value	Band width	PP statistic	p-value
N	10	-0.729324	0.8374	12	-41.9384	0.0000
NS	11	-0.894874	0.7903	14	-42.39325	0.0000
N5	02	-0.618770	0.8640	07	-40.12377	0.0000
NS5	03	-0.269693	0.9268	07	-40.72380	0.0000

MacKinnon (1996) one-sided p-values

Exogenous: constant, Bandwidth: Newey-West using Bartlett kernel

Deterministic Terms: Intercept

It is seen in tables 3A and 3B that the null hypothesis is accepted at level, as the values of probability are more than 5% for all variables. All the variables have unit root or Nifty 50, Nifty 50 Shariah, Nifty 500 and Nifty 500 Shariah are non stationary at level. After first difference, the variables have become stationary.

#### 4.4 Johansen Co-integration test:

To achieve one of the objectives, to measure the long term co-movement of the indices under study, Johansen Co-integration test is used. In this test, there are two statistics, trace and maximum Eigen values



to determine the number of equations, which show the existence or non-existence of co-integration. Table 4 is representing the same.

Starting with null hypothesis that there is no equation( $r=0$ ), showing co-integration among the variables, the above table shows that the trace test statistic (40.9946) is less than its critical value(47.85613) and value of probability(0.1889) is more than 5% thus the hypothesis is accepted and indicates no co-integrated equation. Additionally, in this study the result further shows that trace statistics (17.03708) is less than critical value (29.79707)and probability is 0.6373 which is more than 5% significant level.

**Table 4: Johansen Co-integration test**  
**Unrestricted Cointegration Rank Test (Trace)**  
 Series: N NS N5 NS5

Hypothesized		Trace		0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	
None	0.011574	40.9946	47.85613	0.1889	
At most 1	0.00458	17.03708	29.79707	0.6373	
At most 2	0.002683	7.589576	15.49471	0.5103	
At most 3	0.001001	2.060952	3.841466	0.1511	

Trace test indicates no cointegration at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

**Unrestricted Cointegration Rank Test (Maximum Eigenvalue)**

Hypothesized		Max-Eigen		0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**	
None	0.011574	23.95753	27.58434	0.1362	
At most 1	0.00458	9.447499	21.13162	0.7948	
At most 2	0.002683	5.528625	14.2646	0.6741	
At most 3	0.001001	2.060952	3.841466	0.1511	

Max-eigenvalue test indicates no cointegration at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Same as we have also checked with hypothesis on the different number of equations viz.  $r \leq 2$ ,  $r \leq 3$  and found the same result that trace statistics are less than critical values and values of probability are less than 5%, thus null hypothesis is accepted and indices are considered to be non co-integrated.

By the second statistics, Max Eigen value test, the results are same at null hypothesis ( $r = 0$ ), that critical value 27.58434 is greater than max Eigen value 23.95753 and the value of probability (0.1362) is more than 5% , thus null hypothesis is accepted, also we have computed on different levels of  $r$  like  $r \leq 1$ ,  $r \leq 2$ ,  $r \leq 3$ . we have got the same results showing that Max Eigen values are lower than critical values and the values of probability are more than 5% at 95% confidence level thus null hypothesis are accepted.

Therefore, test reveals that eventually the indices do not move together in long run or in other words, there is no co-integration or long term association among the indices.

#### 4.5 Granger Causality test

To test Granger causality, the Null Hypothesis ( $H_0$ ) is determined, as there is no causality between series. In Table 5, it is seen that for every series, value of Granger causal probability are more than 5% thus null hypotheses are accepted and result reveals that no cause and effect relationship exist among the returns of Nifty 50, Nifty 50 Shariah, Nifty 500 and Nifty 500 Shariah.

**Table 5 : Granger Causality test**

<i>Null Hypothesis:</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Prob.</i>
D_N5 does not Granger Cause D_N	2218	2.37711	0.0931
D_N does not Granger Cause D_N5		1.52301	0.2183
D_NS does not Granger Cause D_N	2218	0.1887	0.828
D_N does not Granger Cause D_NS		0.42081	0.6566
D_NS5 does not Granger Cause D_N	2218	1.47521	0.229
D_N does not Granger Cause D_NS5		1.44099	0.2369
D_NS does not Granger Cause D_N5	2218	0.03487	0.9657
D_N5 does not Granger Cause D_NS		0.32469	0.7228
D_NS5 does not Granger Cause D_N5	2218	0.17172	0.8422
D_N5 does not Granger Cause D_NS5		0.17597	0.8387
D_NS5 does not Granger Cause D_NS	2218	1.30171	0.2723
D_NS does not Granger Cause D_NS5		0.98428	0.3739

#### 4.6 3SLS and GMM Estimation:

In order to estimate this model, we use three stage least squares (3SLS) and Generalized Method of Moments (GMM) estimation. In order to verify the robustness of our results, we provide estimates based on both methodologies i.e.3SLS and GMM.

Simultaneous Equations used are as under:

$$d_{ns} = \alpha_1 + \beta_1 * d_n + \beta_2 * d_{n5} + \beta_3 * d_{ns5}$$

$$d_{ns5} = \omega_1 + \beta_4 * d_n + \beta_5 * d_{ns} + \beta_6 * d_{n5}$$

$$d_n = \varphi_1 + \beta_7 * d_{ns} + \beta_8 * d_{n5} + \beta_9 * d_{ns5}$$

$$d_{n5} = \rho_1 + \beta_{10} * d_n + \beta_{11} * d_{ns} + \beta_{12} * d_{ns5}$$

Following results have been obtained:

3SLS results show that all the variables are insignificant, except two ( $d_{n5}$  and  $d_{ns5}$ ) to estimate the value of independent variable, as the values of probability are greater than 0.05. Only Nifty 500 and Nifty 500 Shariah have significant effect on estimation of each other as the values of probability of coefficient  $\beta_6$  and  $\beta_{12}$  are 0.0113 and 0.0097 respectively. which are less than 0.05, which implies that 1% change in Nifty 500 will lead 0.56% change in Nifty 500 Shariah and 1% change in Nifty 500 Shariah will lead 1.55% change in Nifty 500. The values of coefficients  $\beta_2$  and  $\beta_{11}$  (-0.07747 and -0.08920) are negative, which show negative association between returns of Nifty 500 and Nifty 50 Shariah.

So, GMM model indicate that while determining Nifty 50, all the independent indices viz. Nifty 500, Nifty 50 Shariah and Nifty 500 Shariah are insignificant. Same as Nifty 50 Shariah cannot be determined by Nifty 50, Nifty 500 and Nifty 500 Shariah. Whereas Nifty 500 is only significant index in determining the returns of Nifty 500 Shariah as well as to determine Nifty 500, Nifty 500 Shariah is only significant index as systems equations.

**Table 6 Estimation Method: Three Stage Least Squires**

	Dependent	Endogenous	Coefficient	Std. Error	t-Statistic	Prob.
$\alpha_1$	$d_{ns}$	C	-0.0001	0.0001	-1.4374	0.1506
$\beta_1$		$d_n$	0.9162	0.8538	1.0730	0.2833
$\beta_2$		$d_{n5}$	-0.7747	0.5216	-1.4853	0.1375
$\beta_3$		$d_{ns5}$	0.9020	1.2656	0.7127	0.4761
$\omega_1$	$d_{ns5}$	C	0.0000	0.0001	0.2114	0.8326
$\beta_4$		$d_n$	0.1037	0.7931	0.1308	0.8959
$\beta_5$		$d_{ns}$	0.3709	0.5293	0.7007	0.4835

$\beta_6$		$d_{n5}$	0.5600	0.2210	2.5340	0.0113
$\varphi_1$	$d_n$	C	0.0001	0.0001	0.6489	0.5164
$\beta_7$		$d_{ns}$	0.5841	0.5544	1.0536	0.2921
$\beta_8$		$d_{n5}$	0.1667	0.7357	0.2267	0.8207
$\beta_9$		$d_{ns5}$	0.1705	1.2317	0.1385	0.8899
$\rho_1$	$d_{n5}$	C	-0.0001	0.0001	-0.6095	0.5422
$\beta_{10}$		$d_n$	0.3147	1.3011	0.2419	0.8089
$\beta_{11}$		$d_{ns}$	-0.8920	0.5999	-1.4868	0.1371
$\beta_{12}$		$d_{ns5}$	1.5585	0.6022	2.5878	0.0097

Table 7 Estimation Method: Generalised Methods of Moments

	Dependent	Endogenous	Coefficient	Std. Error	t-Statistic	Prob.
$\alpha_1$	$d_{ns}$	C	-0.0001	0.0001	-1.5380	0.1241
$\beta_1$		$d_n$	0.9724	0.8966	1.0846	0.2781
$\beta_2$		$d_{n5}$	-0.7245	0.5371	-1.3489	0.1774
$\beta_3$		$d_{ns5}$	0.8097	1.3316	0.6080	0.5432
$\omega_1$	$d_{ns5}$	C	0.0000	0.0001	0.2189	0.8267
$\beta_4$		$d_n$	0.0523	0.8314	0.0629	0.9498
$\beta_5$		$d_{ns}$	0.4110	0.5496	0.7478	0.4546
$\beta_6$		$d_{n5}$	0.5772	0.2272	2.5401	0.0111
$\varphi_1$	$d_n$	C	0.0001	0.0001	0.6498	0.5158
$\beta_7$		$d_{ns}$	0.5400	0.5767	0.9364	0.3491
$\beta_8$		$d_{n5}$	0.0976	0.7574	0.1289	0.8974
$\beta_9$		$d_{ns5}$	0.2639	1.2965	0.2036	0.8387
$\rho_1$	$d_{n5}$	C	-0.0001	0.0001	-0.6041	0.5458
$\beta_{10}$		$d_n$	0.4041	1.3728	0.2944	0.7685
$\beta_{11}$		$d_{ns}$	-0.9423	0.6264	-1.5041	0.1326
$\beta_{12}$		$d_{ns5}$	1.5198	0.6354	2.3919	0.0168

Similarly table 7 which is based on GMM , shows all the variable are insignificant, except the same two variables to estimate the value of indices, as the values of probability are greater than 0.05 but same as above  $d_{n5}$  and  $d_{ns5}$  indicate significant effect on each other because the values of probability of  $\beta_{\square}$  and  $\beta_{\square\square}$  are less than 0.05. Moreover, returns of Nifty 500 and Nifty 50 Shariah are negatively associated as value of  $\beta_{\square}$  and  $\beta_{11}$  are -0.7245 and -0.9423 respectively.

## 5. Conclusion and Implication

The main objective of the study was to develop a suitable model for forecasting the returns of NSE Shariah indices with its underlying indices. It is noticed that Shariah indices are lesser volatile in comparison to their respective underlying indices. It is interesting to note that the indices do not move together in long run or in other words, there is no co-integration or long-term association among the indices. Results further reveal that there are no causes and effect relationships exist among the returns of the indices under study. 3SLS and GMM model shows that the variable are insignificant, except the two variables Nifty 500 and Nifty 500 Shariah indicate significant effect on each other as systems equations.

The Null hypothesis,  $H_{01}$ , that Standard Deviation is lesser in Shariah than underlying indices is accepted, further,  $H_{02}$  that Shariah and underlying indices are not co-integrated in long run is also accepted .Third hypothesis that Shariah and underlying indices do not granger cause each other is also accepted.  $H_{04}$  that Nifty 500 is insignificant in determining the return of Nifty 500 Shariah is rejected, beside this,  $H_{05}$  that Nifty 500 Shariah is insignificant in determining the return of Nifty 500 is also rejected.  $H_{06}$  that Nifty is insignificant in determining the return of Nifty Shariah is accepted and same result we get with  $H_{07}$  where Nifty Shariah is insignificant in determining the return of Nifty.

The market of Shariah based financial assets is on the rise. This study is a step ahead in the direction of making optimum portfolios comprising of securities from Shariah indices. Results are expected to advice the fund managers in terms of diversification of their portfolios. Since, there is no long term co-integration and short term causality between Shariah and the underlying indices, so diversification objective is served. In addition Shariah indices, with relatively lesser risk, offer optimum portfolios.

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