**When It Comes to Risk, is Sukuk Better than Conventional Bonds? A Comparative Study of NASDAQ Securities**

**Abstract**

We analyse the risk levels of sukuk portfolio compared to conventional bonds, using a sample data that is extracted from daily closing prices of *Sukuk* and bonds that are traded in Nasdaq Dubai’s security market. The recent data show that global interest in Sukuk instruments as an alternative source of financing has risen, due to its asset back structure. Whereas, discussion founded on the distinct riskiness of *Sukuk*, when compared to conventional bonds, remains a contentious topic. We conduct a comparative analysis on the risks associated with Sukuk and conventional. We examine the risk levels by measuring and comparing VaR values of both *Sukuk* and traditional bonds. We also conduct historical and Monte Carlo simulation by incorporating the daily returns of 15 *Sukuk* and 15 conventional bonds sampled from the Nasdaq Dubai's security market. Results highlight that the daily returns of *Sukuk* and conventional bonds are significantly different as *sukuk* are exposed to daily losses compared to conventional bonds leading to the conclusion that a *Sukuk* portfolio is riskier than conventional bonds.

**Keywords:** *Sukuk market, conventional bond, Value at Risk (VaR)*

1. **INTRODUCTION**

*Sukuk* provides an alternative source of funding, especially for large-scale projects and investments. Here, differences in Sukuk financing modes in comparison to conventional instruments are considered regarding the extent to which risk levels yield significant similarities. The investors of *Sukuk* possess undivided beneficial ownership of the underlying assets, which entitles the certificate holders to shares in revenues generated from them (Afshar, 2013). Whereas, conventional bonds represent a contractual debt obligation in which the issuer is obliged to pay interest to the debt holder at an appointed date (Thomas *et al*., 2005).

The first convertible Sukuk was issued in Dubai in 2007, in the same year, Malaysia's Khazanah National issued exchangeable *Sukuk* with an option to exchange them for the existing shares of the originator's subsidiaries. These issues attracted high interest both from investors as well as potential issuers of *Sukuk*, due to a narrative of risk reduction alternatives. Financial experts discussed the possibility of further innovation in *Sukuk*, such as contingent convertible *Sukuk* and reserve convertible *Sukuk*. Nevertheless, most of Shari’ah scholars have restricted these kinds of innovations due to their similarity with derivatives and excessive uncertainty (Al-Sayed, 2013).

Since the zero-coupon *Sukuk* is not tradeable in an Islamic secondary market, *Sukuk* investors hedge risk exposures applying embedded options by converting the *Istisna* *Sukuk* into real assets or usufructs. Investors are not forced to wait for the *Sukuk's* maturity before converting the *Sukuk* into cash. Whereas, investors avoid exposing the following market risks, such as, re-investment, credit, and interest-rate risks, particularly, where market volatility exists.

This study aims at empirically analysing the risk levels of sukuk portfolio compared to conventional bonds, using a sample data that is extracted from daily closing prices of *Sukuk* and bonds that are traded in Nasdaq Dubai’s security market. In doing so, this study employs Value at Risk (VaR) method to analyse and compare the risk level of *Sukuk* and conventional bonds portfolio.

This paper contributes to the literature on comparative analysis of *Sukuk* and conventional bonds by elaborating on their risk elements and challenges of *Sukuk* and bonds in the light of risk management. In the light of available large literature, this paper provides the insight to riskiness of *Sukuk* for potential investors as an alternative financial tool.

The rest of the paper is organised as follows: the section 2 presents a literature review to contextualise the subject matter, followed by the previous studies about the implementation of VaR models in portfolio risk measurements. The following section highlights the method of the research and data analysis, followed by VaR model application to *Sukuk* and conventional bonds and discussion on the empirical results. Finally, conclusion presents the summary of the findings and emphasizes recommendations for future research on the same characteristic studies.

1. **LITERATURE REVIEW**

Sukuk acts as a vital tool for resource mobilization and a key instrument within the developing Islamic financial industry. Few studies have empirically focused on the specific characteristics or stock market reactions to their issuance (Alam, Hassan and Haque, 2013). However, [Jobst *et* *al*. (2008)](http://www.sciencedirect.com/science/article/pii/S2214845013000112#bib22) in their seminal paper summarised key issues encompassing the *Sukuk* market. Mentioning, despite the global fiscal crisis, a strong demand prevails from both Islamic countries and conventional financial institutions for Shari’ah compliant securities, like *Sukuk* instruments. *Sukuk* remain criticized on the precepts that they are commonly structured along similar lines of asset securitization as arising in conventional finance, thus, raising doubts over the uniqueness of *Sukuk* as innovative financial instruments. Such a contention, is further supported by Miller, Challoner, and Atta (2007) and Wilson (2008) who argue that issuers apply special attention to issue those *Sukuk*, which are identical to conventional bonds to simplify investors’ risk assessment of *Sukuk* and its returns, therefore, *Sukuk* return structure replicates conventional bonds and falls behind in areas of product innovation and pricing risk characteristics (Zulkhibri, 2015).

Tariq and Dar (2007) and Zaidi (2009) discussed Sukuk structures and investigated risks associated with it.  Zaidi (2009) concluded that the risk of *Sukuk* are broader than those of its conventional counterpart because it inherited other risk factors aside from credit risk, namely, market risk, underlying asset risk, and regulatory risk. However, Tariq *et al*. (2007) introduced unique types of derivatives mitigating *Sukuk* risk management and compliance with Shari’ah principles. Arguing that introducing embedded options can form part of Islamic financial contracts, like leasing, instalments sale and *Salam* contracts. Noting, such options are not derivatives since they cannot be separated and sold independently as instruments. In addition, observing that swapping between a floating rate *Sukuk* and a fixed rate zero-coupon embedded *Sukuk* allows for creative Shari’ah compatible financial engineering, thereby, *Sukuk* can become highly competitive in the market and more accessible to investors.

Godlewski, *et al.* (2013) examined reactions of Malaysian market investors to *Sukuk* announcements when compared to conventional bonds issues, using an event study methodology based on a sample of Malaysian listed companies. Results show that the stock market remains neutral to announcements of conventional bond issues but reacts negatively to broadcasting *Sukuk* issues. Such variant responses are attributed to high demands for Islamic investment certificates and adverse selection endorsing *Sukuk* issuance by lower-quality debtor companies.

Similarly, Alam *et al.* (2013) studied the impact of Sukuk and conventional bonds announcements on shareholder wealth and their determinants analysing 79 Sukuk and 87 conventional bonds between 2004 to 2012 in six developed Islamic financial markets. The overall time frame is divided into three parts: 2004 -2006 (before the crisis); 2007-2009 (during the crisis); and 2010-2012 (after the crisis). The study shows that the market reaction is negative for *Sukuk* announcements before and during the 2007 global fiscal crisis. Market reaction remains positive for conventional bond pronouncements before the crisis period and negative during and after crisis periods. The size of bonds offered seems to have a negative impact on the cumulative abnormal return for *Sukuk*, whereas, it is positive for conventional bonds.

On the other hand, [Ariff and Safari (2012)](http://www.ccsenet.org/journal/index.php/ijef/article/viewFile/32323/19381) studied *Sukuk* performance by examining the causal link between the performance of *Sukuk* and conventional bonds with the same performance and rating. Their results found no causal link between *Sukuk* performance and conventional bonds.

More recently, a study conducted by Boutti and Mosaid (2014) considered *Sukuk* and conventional bonds’ performance in Malaysia, comparing portfolios’ return by employing t-tests for paired samples, subsequently, testing the correlation between those returns. The results of the t-test for paired samples of *Sukuk* portfolios show that only one of the 10 portfolios are significant where the portfolio of bonds was not significant. On the other hand, both portfolios return show a positive correlation between that of Sukuk and bonds.

It is worth mentioning that the most relevant research in literature investigating the risk level of sukuk and conventional bonds was presented by Cakir and Raei (2007). The authors purposed that sukuk are truly different from conventional bonds when it comes to the risk reduction benefits. Work on VaR portfolios using samples of sovereign *Sukuk* and Eurobonds by the same issuer was conducted. In the study, they constructed two hypothetical portfolios. The first portfolio consists only of Eurobonds, while the other contains *Sukuk* and Eurobonds applying VaR methods of Delta-normal and Monte Carlo simulation. Results indicated that VaR is reduced for the portfolio containing *Sukuk* and Eurobonds compared to only Eurobonds, leading the authors to conclude that *Sukuk* does have some diversification advantages for investors, compared to conventional bonds.

Secondly, Hassan (2012) assessed potential differences between Sukuk and conventional bonds by capturing variances related to the diversification benefit that can be gained by adding *Sukuk* into conventional fixed income portfolios. Further, evaluation is offered concerning value at risk (VaR) of *Sukuk* compared with VaR of conventional bonds of the same issuer in two separate portfolios where the Delta-Normal Value at Risk approach to the sample is applied. Findings imply that *Sukuk* and conventional bonds prices have different behaviour in a secondary market. Further conclusions note, a presence of diversification gains when *Sukuk* is added to bond portfolios, in line with previous literature by Cakir and Raei (2007). In addition, the results show that a pure *Sukuk* portfolio is significantly riskier than a pure bond. These findings reflect those of Cakir and Raei (2007). However, he has incorporated bonds undertaken, and compared the risk level of *Sukuk* portfolios to conventional bonds, finding pure *Sukuk* portfolios significantly riskier than purely conventional bonds.

Most of these studies attempt to compare *Sukuk* and conventional bonds in terms of their features, structures and market perceptions of them as alternative investments. However, the debate concerning whether *Sukuk* provides an efficient investment are still ongoing and there is insufficient empirical support favouring *Sukuk* as an efficient alternative investment to conventional bonds.

Literature has also drawn on the usage of VaR in portfolio risk analysis for *Sukuk* and conventional bonds where it has provided a set of empirical studies, despite its results and variation in conclusions it contends in general that VaR methods are accurate and suitable as portfolio risk management tools under certain conditions regarding data statistical properties.

Other literature, however, contends that further models estimate the volatility of returns more accurately at extreme volatile periods than VaR analysis. To date, only one published paper appears to implement Value at Risk (VaR) analysis measuring risk diversification on *Sukuk* when compared to conventional bonds presented by Cakir and Raei (2007). Therefore, this paper aims to bridge the gap in *Sukuk* risk analysis compared to conventional bonds.

1. **DATA AND METHOD**

Quantitative research methodology is applied, creating a statistical model analysing data through the Value at Risk method. A case study on United Arab Emirates’ *Sukuk* and conventional bonds issuances listed on Nasdaq Dubai's financial market is analysed. Secondary data is obtained from listed *Sukuk* and conventional bonds issuance in Nasdaq Dubai's financial market. The data details daily closing prices of *Sukuk* and conventional bonds for a period of one-year from 18th January 2016 to 17th January 2017. Relevant data used for analysis, the *Sukuk* and conventional bonds issuance satisfies the following two criteria: firstly, data excludes any *Sukuk* and bonds issuances traded in the market for less than one year. Secondly, it only considers a maturity period of 3 to 10 years from the listed *Sukuk* and conventional bonds issuances. Sale based *Sukuk* were purposly excluded from the analysis, as they have very short maturity, and therefore they does not align for the comparitive analysis with the bonds. The sample data of 30 (15 *Sukuk* and 15 bonds) *Sukuk* and conventional bonds are selected randomly from a listed 70 Sukuk and conventional bonds that have satisfied those criteria. For example, there were only 15 samples of traditional bonds which satisfied the above-mentioned criteria. Therefore, we selected equal samples of 15 from each site.The lists of *Sukuk* and conventional bonds and their descriptions are illustrated in Table 1 and Table 2 below:

Table 1: List of Sukuk instruments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **List of Sukuk** | **Issue date** | **Maturity** | **Tenor** | **Amounts** | **Type** |
| Dar Al Arkan Sukuk Co | 18.05.2014 | 24.05.2018 | 5 | USD450 mln | Wakala |
| DIB Sukuk Limited | 0/06/2015 | 03.06.2020 | 6 | USD750 mln | Ijarah |
| DIB Tier 1 Sukuk Ltd | 02.04.2013 | 20.03.2019 | 6 | USD1 bln | Mudarabah |
| DIB Tier 1 Sukuk 2 Ltd | 15.01.2015 | 20.01.2021 | 6 | USD1 bln | Mudarabah |
| DIP Sukuk Ltd | 23.02.2014 | 20.02.2019 | 5 | USD300 mln | Ijarah |
| DP World Sukuk Ltd | 03.07.2007 | 02.07.2017 | 10 | USD1.5 bln | Mudarabah |
| EMG Sukuk Limited | 19.06.2014 | 18.06.2024 | 10 | USD750 mln | Wakala |
| Hong Kong Sukuk Ltd | 04.06.2015 | 03.06.2020 | 5 | ISD1 bln | Ijarah |
| Hong Kong Sukuk Ltd-Reg S | 21.09.2014 | 18.09.2019 | 5 | USD980 mln | Ijarah |
| ICD Sukuk Co. Ltd | 22.05.2014 | 21.05.2020 | 6 | USD700 mln | Ijarah |
| IDB Trust Services Ltd | 25.02.2014 | 26.06.2017 | 3 | USD800 mln | Wakala |
| INDONESIA III-144A | 31.05.2015 | 10.09.2024 | 10 | USD178.1 mln | Ijarah |
| INDONESIA III | 31.05.2015 | 10.09.2024 | 10 | USD1.32 bln | Ijarah |
| JAFZ Sukuk Limited | 20.06.2012 | 19.06.2019 | 7 | USD650 mln | Wakala |
| RAK Capital | 01.04.2015 | 31.03.2025 | 10 | USD1 bln | Ijarah |

Sources: Nasdaq Dubai; http://www.nasdaqdubai.com/listing/listed-securities

As demonstrated in the above Table 1, the range of Sukuk issue size differs between the amount of USD 178.1 million to USD 1.5 billion, while the total combined amount of *Sukuk* issuance is USD 12.38 billion. The *Ijarah* finance model was the most popular mode of financing a total of USD 6.23 billion, presenting a total percentage of 50.3% when compared to other financing modes. Secondly, the largest *Sukuk* issuances was the *Mudarabah* model offering a value of 28.3%, a total amount of USD 3.5 billion, and *Wakalah* asset financing was a percentage of 21.4%.

Table 2: List of Conventional Bonds

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| List of Bonds | **Issue date** | **Maturity** | Tenor | **Amounts** | **Type** |
| Agri Bank of China | 15.09.14 | 11.9.17 | 3 | USD15 bln | Medium Term Notes |
| Bank of China Ltd AD | 01.07.15 | 30.6.17 | 3 | USD20 bln | Notes |
| DP World Ltd GMTN - RegS | 10.06.15 | 18.05.20 | 5 | USD375.1 mln | Bond |
| DP World Ltd- 144A | 10.06.15 | 18.05.20 | 5 | USD124.9 mln | Bond |
| Dubai Holding C.O. Ltd | 01.02.07 | 01.02.17 | 10 | USD500 mln | Notes |
| Emirates NBD PJSC2015 | 24.03.15 | 23.3.22 | 6 | USD550 mln | Euro Medium Notes |
| Emirates NBD PJSC 2015 | 07.05.15 | 06.05.20 | 5 | USD350 mln | Euro Medium Notes |
| Emirates NBD PJSC 2014 | 20.11.14 | 19.11.19 | 5 | USD1 bln | Euro Medium Notes |
| Emirates NBD PJSC 2013 | 31.03.13 | 28.03.23 | 10 | USD750 mln | Euro Medium Notes |
| Emirates NBD PJSC 2014 | 20.11.14 | 19.11.19 | 5 | USD1 bln | Euro Medium Notes |
| Emirates NBD Tier 1 Ltd - PRP | 02.06.13 | 30.5.19 | 6 | USD1 bln | Perpetual Security |
| ICD Funding Ltd | 22.05.14 | 21.5.24 | 10 | USD300 mln | Euro Medium Notes |
| Ind. & Com. Bank of China | 27.05.15 | 26.05.2020 | 5 | USD400 mln | Euro Medium Notes |
| MAF Global Securities-14 | 08.05.14 | 7.5.2024 | 10 | USD800 mln | Medium Notes |
| MAF Global Securities- 2013 | 31.07.13 | 5.7.2019 | 6 | USD800 mln | Medium Notes |

*Source:* Nasdaq Dubai

As shown in Table 2 above, the range of conventional bonds issue size varies between USD 124.9 million to USD 20 billion, a total of USD 43.1 billion altogether. Whereas, Bonds and Notes amount to a value of 48.8% equating to a total of USD 21 billion, while the second largest issued conventional bonds are Medium Terms Note at 38.6%. Euro Medium Notes was 10.3% and Perpetual Security has a value of 2.3%.

*Sukuk* and conventional bonds have a limited range of maturity from 3 to 10 years, except Emirates NBD Tier 1 Ltd- PRP, which is a perpetuity security with no limited time of maturity. Since there is limited available information on firms issuing both *Sukuk* and conventional bonds, attempts were made to find the *Sukuk* and bonds issuances from the same country to give an adequate comparison while eliminating state and industry risks. 

## Data Analysis

As previously mentioned, data analysis applied is quantitative in nature and involves several research methods. The study uses the Value at Risk (VaR) method as a main statistical tool by employing the Historical simulation and Monte Carlo simulation models to analyse risk levels of *Sukuk* and conventional bonds. An F-test is used to evaluate any differences between *Sukuk* and conventional bonds. Firstly, the log-normal daily returns are calculated from the daily closing prices of Sukuk and conventional bonds, and descriptive analysis through Excel calculating the expected average returns, variance, standard deviation, and skewness is applied. This descriptive statistic measures the central tendency and spread of data which allows a summary of data analysis. Historical simulation is then applied to examine the risk level of Sukuk and conventional bonds for the holding period of one year.

Secondly, the Monte Carlo simulation (MCS) model is applied to simulate the expected future returns distribution randomly to analyse possible losses of portfolio for *Sukuk* and conventional bonds. However, due to the literature recommendations and limited information on *Sukuk* and conventional bonds in the UAE’s financial market, the MCS is a more effective method to check the VaR risk level of *Sukuk* and conventional bonds since it allows the repeated simulations of daily returns of portfolios, using a random process of NORMSINV(RAND) function of Excel. The study employs two VaR estimates of MCS; firstly, the 10 days holding period of the VaR estimates with 99% confidence level, as per recommendations of the Basel Committee. Another reason behind the 10 days VaR estimates is because *Sukuk* are not very liquid products and require enough time to be traded on security markets. Secondly, the study generates (5000 repetitions) possible paths for the VaR estimates using randomly generated numbers to analyse the risk level of *Sukuk* and conventional bonds over the holding period.

### Value at Risk Method

The Historical simulation method uses real data and reflects actual behaviour of the sample data. It provides a more reliable level of VaR estimation if the real distributions of sample data are ‘at tails’. In addition, it is easier to estimate unlike other methods of VaR models (Mentel, 2013). Drawbacks to the model include: it assumes the historically simulated distribution can represent the future distributions; it possesses higher variation compared to other models; and needs considerable number of data to estimate the quantiles of the empirical distribution (Hassan, 2012).

Whereas, the Monte Carlo simulation (MCS) model simulates the risk factors randomly rather than being analytically obtained, such as, in the Delta-Normal model. The MCS has several advantages making it the most comprehensive model to measure market risks, if accurately implemented including: it is flexible to incorporate time variations in the returns or the volatility of the returns and can be implemented in the presence of fat tails; it can also be applied to any type of portfolios. On the other hand, the MCS details disadvantages such as: it is more complex to compute, and system implementation is costly; and it relies on specific stochastic processes for the risk factors, which can lead to inaccurate results when the stochastic process used are wrong (Hassan, 2012).

### VaR Calculations

In this section, the study derives general formulas of VaR models, including both Historical and Monte Carlo simulations. The basic concept of calculating VaR along with its probability and density function is shown in Table 3, which demonstrates the maximum loss of portfolios over a given time span where the chosen confidence level of VaR lies on a horizontal axis in a particular time. If the returns are normally distributed, the VaR confidence level of 95%’s Z-value is 1.645; and VaR at 99% confidence level, Z-value is 2.326. For example, the maximum loss of portfolio over a given time horizon is an amount of y-axis with a probability of 95% (see Boxed section) as shown in Figure 1 (Ahmed and Khan, 2001, p. 43-44).

|  |
| --- |
| Figure 1: VaR confidence level  Sources: Ahmed *et al*., (2000, p. 44) |

In calculating historical simulation, the model uses the calculated log-normal daily returns of Sukuk and conventional bonds over the holding period of 250 trading days and the daily returns are calculated as follows:

Daily returns = LN (Pt/Pt-1) (1)

Where P1 is the price for today on Sukuk and conventional bonds and P0 is the price of Sukuk and conventional bonds for day before, and 0, 1…t, is the holding period of portfolios. Here, to calculate the VaR using the Historical simulation model with 99% of confidence level, the Excel function of Percentile on daily returns are applied as follows:

VaR = PERCENTILE(r1…t), Zα) (2)

VaR = PERCENTILE(RETURNS RANGE, 1%) (3)

Where r1...t is the periodic daily returns of Sukuk and conventional bonds in “t” for holding period over the time, Zα is the VaR confidence level of 99%.

In the case of Monte Carlo simulation, the study uses a geometric Brownian motion process to describe future returns on Sukuk and conventional bonds. The method uses two component parameters; drift which is a constant directional movement and random shock that presents the market volatility as shown below:

Future daily returns = drift + σ \* Z (4)

Future daily returns = (µ – (σ2/2)\*t + σ \* Z (5)

The drift is calculated from the mean (µ) minus half of the variance over time as shown in equation 5, σ is the volatility, and Z is the random variable from standard normal distribution N (0.1) using Excel function of NORMSINV(RAND), which will generate a simulated value of normal random variables having the parameters of mean (μ) and standard deviation (σ). Hence, the future expected daily returns are calculated by employing Monte Carlo simulation as follows:

Future daily returns = NORMINV(RAND(), μ, σ) (6)

In this study, future daily returns are simulated using the above formula and the simulated daily returns use as 10days for a holding period with a 99% confidence level of VaR estimates to analyse the risk level of *Sukuk* and conventional bonds portfolios. Also, to increase the accuracy of calculations 5000 simulations of *Sukuk* and conventional bonds daily returns will be run. According to Dowd (2005), ‘Monte Carlo simulation procedures, accuracy will vary with square root of number of trial’, so the more simulation, the better the result outcomes. In addition, the study presents the expected daily returns of *Sukuk* and conventional bonds in line chart and frequency, Histogram, to plot the simulated future returns to examine the normality distribution of the expected returns both *Sukuk* and conventional bonds.

### F-Test Analysis

F-Test is used to test if the variance of two populations are equal. The test can be a two-sided test or one-tailed test. Whereas, the two-tailed version tests against the alternative hypothesis that the variances are not equal. On the other hand, the one-tailed version only tests in one direction that is the variance from the first population is either greater than or less than (but not both) the second population variance. Also, the F-test uses the Chi square test as combined method to find the p-value. Therefore, the F-test hypothesis is defined for a two-tailed test as follows (NIST, 2013):

H0 =

H1=

F =  (7)

Where  and  are the sample variances. The more this ratio deviates from 1, the stronger the evidence for unequal population variances. The study will apply the two-tailed test, which tests against the alternative that the variance is not equal with a 99% confidence level. Therefore, this method will test if there is difference between *Sukuk* and conventional bonds risk level.

1. **FINDINGS**

The study presents VaR application to *Sukuk* and conventional bonds and discusses the empirical results that are obtained from the Historical and Monte Carlo simulation models and then presents the assessment and discussion of the results.

## Descriptive Statistics of Sukuk and Conventional Bonds

As illustrated in Table 3 and Figure 4, they report the descriptive statistics for the sample data of *Sukuk* and conventional bonds, using the Excel data tool which calculates daily returns’ mean of 250 daily returns, variance, standard deviation, and skewness of the returns distribution for *Sukuk* and conventional bonds.

Table 3: Descriptive Characteristics of Sukuk Daily Returns

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **List of Sukuk** | **Mean of daily returns** | **Variance** | **Standard deviation** | **Skewness** |
| Dar Al Arkan Sukuk Co | 0.035% | 0.008% | **0.899%** | -124% |
| DIB Sukuk Ltd | 0.030% | 0.005% | **0.722%** | 156% |
| DIB Tier 1 Sukuk Ltd | 0.025% | 0.002% | 0.445% | 57% |
| DIB Tier 1 Sukuk 2 Ltd | 0.017% | 0.004% | **0.643%** | -1% |
| DIP Sukuk Ltd | 0.006% | 0.000% | 0.123% | -231% |
| DP World Sukuk Ltd | -0.010% | 0.000% | 0.221% | -59% |
| EMG Sukuk Limited | 0.021% | 0.004% | 0.603% | -73% |
| ICD Sukuk Co. Ltd | 0.002% | 0.000% | 0.169% | -30% |
| IDB Trust Services Ltd | -0.002% | 0.000% | 0.083% | 199% |
| INDONESIA III -144A | 0.011% | 0.003% | 0.553% | -275% |
| INDONESIA III | 0.029% | 0.001% | 0.374% | -19% |
| JAFZ Sukuk Ltd | 0.001% | 0.008% | **0.882%** | -3% |
| Hong Kong Sukuk Ltd | -0.005% | 0.000% | 0.164% | -76% |
| Hong Kong Sukuk Ltd -Reg S | 0.000% | 0.001% | 0.276% | 17% |
| RAK Capital | 0.016% | 0.001% | 0.321% | -64% |
| Average | **0.012%** | **0.003%** | **0.432%** | **-35%** |

As shown in the Table 3, most of the Sukuk issuances have a positive mean 0.012%, except for DP World *Sukuk* Ltd IDB Trust Services Ltd, and Hong Kong *Sukuk* Ltd which shows a negative of expected daily returns. Also, Dar Al-Arkam *Sukuk* and JAFZ *Sukuk* Ltd dispense the highest volatility of 0.899% and 0.882% in which their daily returns are more volatile than the others. In addition, DIB *Sukuk* Ltd has a higher volatility of 0.722% too.

Figure 2: Distribution of Average Daily Returns for Sukuk

Furthermore, the above Figure 2 indicates that the expected daily returns are not normally distributed around the mean but inclined more towards negative values in the left tail. Whereas, the return distribution of *Sukuk* are skewed and falls in the left tail. Also, there are some extreme daily return outliers that effects overall daily return distributions. More precisely, the expected returns of *Sukuk* are more left skewed as presented in Figure 2. This means that daily returns of *Sukuk* are in negative outcome which clusters more in left tail.

As shown in Table 4, most of the conventional bonds also have a positive mean, except for Dubai Holding C.o. Ltd, Emirates NBD PJSC 2015, and ICD Funding Ltd that shows a negative mean of daily returns as well as ICD Funding Ltd which provides a higher standard deviation of 0.760%, this shows that the expected of ICD Funding has a higher spread of returns when compared to other bonds. In general, conventional bonds daily returns are less volatile compared to Sukuk except ICD Funding Ltd and MAF Global Securities 2014.

Table 4: Descriptive Characteristics of Conventional Bonds Daily Returns

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **List of Bonds** | **Mean of daily returns** | **Variance** | **Standard deviation** | **Skewness** |
| Agri Bank of China | 0.002% | 0.000% | 0.105% | -68% |
| Bank of China Ltd | 0.004% | 0.000% | 0.090% | 22% |
| DP World Ltd GMTN- RegS | 0.018% | 0.000% | 0.198% | 172% |
| DP World Ltd- 144A | 0.008% | 0.001% | 0.245% | -48% |
| Dubai Holding C.O. Ltd | -0.002% | 0.001% | 0.273% | 16% |
| Emirates NBD PJSC2015 | 0.011% | 0.000% | 0.148% | -150% |
| Emirates NBD PJSC 2015 | -0.004% | 0.000% | 0.131% | -23% |
| Emirates NBD PJSC 2014 | 0.028% | 0.000% | 0.203% | -31% |
| Emirates NBD PJSC 2013 | 0.008% | 0.000% | 0.084% | -78% |
| Emirates NBD PJSC 2014 | 0.009% | 0.000% | 0.101% | -264% |
| Emirates NBD Tier 1 Ltd- PRP | 0.012% | 0.000% | 0.165% | -90% |
| ICD Funding Ltd | -0.004% | 0.006% | **0.760%** | -9% |
| Ind. & Com. Bank of China | 0.035% | 0.001% | 0.309% | 514% |
| MAF Global Securities 2014 | 0.017% | 0.004% | 0.606% | -26% |
| MAF Global Securities 2013 | 0.004% | 0.000% | 0.098% | -122% |
| **Average** | **0.010%** | **0.001%** | **0.235%** | **-12%** |

On the other hand, the overall mean of returns on Sukuk is 0.012% is slightly higher than conventional bonds’ mean of 0.010% were as the descriptive statistics result points out that *Sukuk* instruments are more volatile and riskier than conventional bonds.

Figure 3: Distribution of Average Daily Returns for Conventional Bonds

The sample skewness of conventional bonds shows that daily returns are not distributed equally around the mean and there are some outliers of daily returns as illustrated the above Figure 3. Also, the chart shows that the average daily returns of conventional bonds are skewed to the left tail. However, the expected daily returns are more skewed to the left tail but it shows that they are slightly less skewed compared to Sukuk daily average returns as presented in the histogram charts of Figures 2 and 3. This means that daily returns of *Sukuk* are in negative outcome which clusters more in left tail.

## Historical Simulation Results

Historical simulation is implemented by using log-normal daily returns of *Sukuk* and bonds issuances taking 250 trading days in a year. The VaR with confidence of 99% is simply calculated as 1% percentile of hypothetical loss or gain of probability density function, but mainly we concern the left tail of the bell curve values which are the worst loss in a time.

Table 4: Historical Simulation for Sukuk and Conventional Bonds at 99% of VaR Confidence

|  |  |  |  |
| --- | --- | --- | --- |
| **List of Sukuk** | **VaR** | List of Bonds | **VaR** |
| Dar Al Arkam Sukuk Co | **-3.54%** | Agri Bank of China | -0.35% |
| DIB Sukuk Limited | -1.17% | Bank of China Ltd AD | -0.22% |
| DIB Tier 1 Sukuk Ltd | -0.62% | DP World Ltd GMTN- RegS | -0.60% |
| DIB Tier 1 Sukuk 2 Ltd | -1.27% | DP World Ltd- 144A | -0.41% |
| DIP Sukuk Ltd | -0.33% | Dubai Holding C.O. Ltd | -0.75% |
| DP World Sukuk Ltd | **-0.20%** | Emirates NBD PJSC2015 | -0.53% |
| EMG Sukuk Limited | -0.62% | Emirates NBD PJSC 2015 | -0.19% |
| ICD Sukuk Co. Ltd | -0.28% | Emirates NBD PJSC 2014 | -0.19% |
| IDB Trust Services Ltd | -0.22% | Emirates NBD PJSC 2013 | -0.25% |
| INDONESIA III -144A | -2.04% | Emirates NBD PJSC 2014 | -0.39% |
| INDONESIA III | -1.14% | Emirates NBD Tier 1 Ltd- PRP | -0.52% |
| JAFZ Sukuk Ltd | -0.41% | ICD Funding Ltd | **-0.73%** |
| Hong Kong Sukuk Ltd | -0.51% | Ind. & Com. Bank of China | -0.61% |
| Hong Kong Sukuk Ltd -Reg S | -0.26% | MAF Global Securities-14 | -1.12% |
| RAK Capital | -0.88% | MAF Global Securities-13 | -0.39% |
| **Average** | **-0.90%** | **Average** | **-0.48%** |

Table 4 illustrates the value of VaR on *Sukuk* and conventional bonds with the VaR confidence of 99% level over a period of a given time. Whereas, the riskiest *Sukuk* are Dar al-Arkam *Sukuk* with the VaR of (-3.54%) and Indonesia III-144A with VaR of (-2.04), while the lowest VaR is the DP World *Sukuk* (-0.20%). On the other hand, the average VaR on *Sukuk* is (-0.90%), while the conventional bonds average VaR is (-0.48). This shows that *Sukuk* are twice as risky as conventional bonds detailed in the above table. In addition, the riskiest bonds are from MAF Global Securities-14 and Dubai Holding Co. VaR values of (-1.12% and -0.75%), while the lowest VaR on bonds is Emirates NBD PJSC 2014 for (-0.19).

Figure 4: VaR of Sukuk and Bonds Using Confidence Level of 99%

As illustrated the above in Figure 4, Sukuk has a higher risk level of daily returns than conventional bonds which shows that bonds are less risky than a *Sukuk*. Whereas, the average VaR on *Sukuk* is almost twice as high as the average VaR on conventional bonds as shown in Figure 4. Furthermore, the bonds daily returns are more stable than the *Sukuk* over the period. Therefore, this shows that *Sukuk* daily returns are more volatile and riskier than conventional bonds.

## Monte Carlo Simulation Method

Here, the risk level of *Sukuk* and bonds using Monte Carlo simulation (MCS) model with the VaR 99% confidence level are described. To compute VaR, the study applies two VaR estimations: firstly, the study estimates 10 business days of holding period for randomizing daily returns, as per recommendations of the Basel Committee. In addition, *Sukuk* are not very liquid products and require time to be traded. Secondly, the study estimates randomly the VaR by simulating daily returns into (5000 repetitions) where the model applies to two parameters: drift which is a constant directional movement and random shock for volatility as presented in equation 3. Table 5 presents the value of VaR on *Sukuk* and conventional bonds using Monte Carlo simulation with the VaR of 99% confidence level. Hong Kong *Sukuk* Ltd and Dar Al Arkam *Sukuk* provide the highest VaR risk levels of (-0.165% and -0.162) in 10 days holding period and the highest VaR values of (-2.13%) for Dar Al Arkam and (-1.99%) for Hong Kong *Sukuk* Ltd. Whereas, the lowest VaR values are provided by Indonesia III-144A in both the 10 days and 5000 runs of VaR estimates.

Table 5: Monte Carlo Simulation for Sukuk and Bonds in 99% of VaR Confidence

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **List of Sukuk** | **VaR\*** | **VaR\*\*** | **List of Bonds** | **VaR\*** | **VaR\*\*** |
| Dar Al Arkam Sukuk Co | **-1.52%** | **-2.13%** | Agri Bank of China | -0.22% | -0.24% |
| DIB Sukuk Limited | -0.29% | -0.54% | Bank of China Ltd AD | -0.20% | -0.20% |
| DIB Tier 1 Sukuk Ltd | -0.83% | **-1.47%** | DP World Ltd GMTN- RegS | -0.32% | -0.45% |
| DIB Tier 1 Sukuk 2 Ltd | -1.05% | -1.44% | DP World Ltd- 144A | -0.21% | -0.57% |
| DIP Sukuk Ltd | -0.33% | -0.28% | Dubai Holding C.O. Ltd | -0.47% | -0.67% |
| DP World Sukuk Ltd | -0.22% | -0.55% | Emirates NBD PJSC2015 | -0.30% | -0.34% |
| EMG Sukuk Limited | **-1.34%** | -1.37% | Emirates NBD PJSC 2015 | -0.18% | -0.31% |
| ICD Sukuk Co. Ltd | -0.81% | -1.18% | Emirates NBD PJSC 2014 | -0.38% | -0.43% |
| IDB Trust Services Ltd | -0.32% | -0.39% | Emirates NBD PJSC 2013 | -0.14% | -0.19% |
| INDONESIA III -144A | **-0.16%** | **-0.20%** | Emirates NBD PJSC 2014 | -0.11% | -0.22% |
| INDONESIA III | -0.06% | -1.38% | Emirates NBD Tier 1 Ltd- PRP | -0.07% | -0.39% |
| JAFZ Sukuk Ltd | -0.95% | -1.30% | ICD Funding Ltd | **-0.86%** | **-1.73%** |
| Hong Kong Sukuk Ltd | -0.40% | -0.39% | Ind. & Com. Bank of China | -0.15% | **-0.66%** |
| Hong Kong Sukuk Ltd -Reg S | **-1.65%** | **-1.99%** | MAF Global Securities-14 | **-1.18%** | **-1.42%** |
| RAK Capital | -0.24% | -0.71% | MAF Global Securities-13 | -0.29% | -0.22% |
| **Average** | **-0.68%** | **-1.02%** | **Average** | **-0.34%** | **-0.54%** |
| \*VaR of 10 days holding period simulations.  \*\*VaR of 5000 randomly iterations. | | | | | |

In the case of bonds, MAF Global Securities-14 and ICD Funding Ltd have the highest VaR Values of (-1.18% and -0.86%) in 10 days, as well as, the highest VaR estimates of (-1.73% and -1.42%) in the VaR estimates of 5000 repetitions. While the lowest VaR on bonds is Emirates NBD PJSC 2014 for (-0.11%). In summarising, the VaR values of *Sukuk* are higher than conventional bonds VaR values in both the day VaR and 5000-iterations as shown the above Table 5. Therefore, the model shows that the expected average for the daily returns loss of value cannot exceed (-0.68%) for Sukuk and (-0.34%) for bonds with 99% confidence level in 10 days VaR estimates. Whereas, the expected average of daily returns loss of value cannot exceed more than (-1.02%) for *Sukuk* and (-0.54%) with 99% confidence level in the second VaR estimates of 5000 iterations.

Figure 5: VaR of Sukuk and Bonds in 10 Days Holding Period and VaR Estimates of (5000 Repetitions) with 99% Confidence Level

Figure 5 reveals clearly that VaR risk level of *Sukuk* are greater than conventional bonds in both the 10-day holding period and the VaR estimates of (5000 iterations) as shown in the above figure. This illustrates that expected daily returns of *Sukuk* are almost double those of conventional bonds in both the Historical and Monte Carlo simulation models. Therefore, Monte Carlo simulation strongly supports the results of Historical simulation, which means that *Sukuk* has more risk than conventional bonds and we can conclude that *Sukuk* risk levels are strongly higher than conventional bonds which indicates that *Sukuk* instruments are different and riskier than conventional bonds.

In addition, a line chart and frequency histogram are used to simulate the expected daily returns of *Sukuk* and conventional bonds as shown in Figure 6, by selecting the highest and the lowest VaR values of *Sukuk* and conventional bonds. In the case of Dar Al Arkam *Sukuk*, the line chart in 10 days VaR estimates shows that the expected daily returns of the Dar Arkam are volatile in the 10 days’ period, indicating more risk. Whereas, expected returns are more stable and normally distributed after performing 5000 simulations as shown in Figure 7. For the lowest *Sukuk* VaR values, the expected daily returns of Indonesian III *Sukuk* are less volatile and normally distributed, illustrated in Figure 6 (see Appendix B).

Figure 6: Sukuk Distribution in Line Chart and Histogram

With conventional bonds, the expected daily returns of ICD Funding provides a changing trend in the10 days’ holding period applying the Monte Carlo simulation, which means that its daily returns are not stable compared to others. On the other hand, its expected returns appear stable and normally distributed in 5000 runs’ VaR estimates as presented in Figure 7, while Emirates NBD BJSC-14 are more stable and normally distributed after performing 5000 simulations (see Appendix C).

Figure 7: Conventional Bonds Distribution in Line Chart and Histogram

## 

## Comparing VaR Results of Historical and Monte Carlo Simulation

Comparison is, now, offered of both methods’ results of VaR calculations in Historical and Monte Carlo simulations (MCS) as reported in Figures 6 and 7. The worst expected loss of values in a day for *Sukuk* and bonds’ portfolios are calculated by multiplying the worst daily returns of VaR estimates with a hypothetical portfolio value of $100,000. For example, historical simulation method shows a VaR of $900 for a portfolio of *Sukuk* issuance and a VaR of $480 for bonds’ portfolio. This implies that one can expect the maximum daily loss on the market value of the *Sukuk* portfolio will not be larger than $900 and for bonds’ portfolios will not be greater than $480 of its value at 99% of the time. It also means that there is a 1% chance the loss could be larger than those values.

Table 6: Maximum Loss of Sukuk and Conventional Bonds’ Portfolios

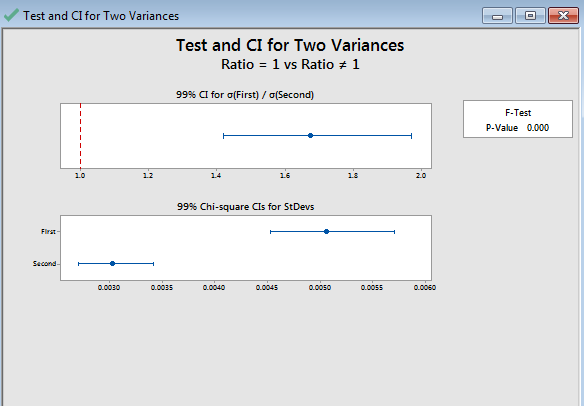
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Method** | **VaR of Sukuk** | **Loss of Sukuk portfolios** | **VaR of Bonds** | **Loss of Bonds portfolios** | **Change** |
| Historical simulations | | -0.90% | -$900 | -0.48 | -$480 | 47% |
| Monte Carlo simulation: | |  |  |  |  |  |
|  | VaR of 10 days | -0.68% | -$680 | -0.34 | -$340 | 50% |
|  | VaR of (5000 replications) | -1.02% | -$1,020 | -0.54 | -$540 | 47% |
|  | \*VaR confidence level of 99%.  \*\*VaR Values are percentages of expected returns loss in holding period. | | | | |  |

In the case of the MCS method, results show a VaR of $680 for a portfolio of *Sukuk* and a VaR of $340 for bonds’ portfolios in VaR estimates of 10 days. Whereas, a VaR of $1,020 for a portfolio of *Sukuk* and a VaR of $540 for a portfolio of bonds in VaR estimates of (5000 iterations). Therefore, this suggests that the worst daily loss of *Sukuk* portfolio will not exceed $680 and $340 for bonds with the 99% confidence level in 10 days VaR estimates. In the second model of (5000 iteration) MCS, the maximum loss in a day will not exceed $1,020 for a *Sukuk* portfolio and $540 for bonds, which means that there is a 1% chance the loss could be larger than these VaR estimates.

On the other hand, the historical simulation shows that the expected daily loss of *Sukuk* portfolios are greater than a portfolio of bonds with a value of 47%. Similarly, the results of Monte Carlo simulation show that the percentage change of both methods are close to the historical simulation method which highlights that the findings are robust when compared to each other. For example, the expected daily losses of *Sukuk* portfolios are higher than those of conventional bonds,’ illustrating 50% in a 10-day holding period. Whereas, the second method shows that *Sukuk* have higher losses of 47% compared to conventional bonds. However, the slight differences apparent to both methods can be attributed to the extent to which returns on *Sukuk* and bonds diverge from normal presumptions, whereby, deviation from normality can lead to a different estimate of VaR when a normality assumption is dropped both in Historical simulation and the MCS methods. As illustrated in the above Table 6, *Sukuk* portfolios have a higher VaR risk level of expected daily losses than the conventional bonds. This highlight *Sukuk* as riskier than conventional bonds.

However, differences between *Sukuk* and conventional bonds risk level were tested using the F-test model by employing Minitab software. The results show that p-value is less than 0.01 with a 99% confidence level as presented in Figure 8, which confirms that there are significance differences between the risk level of *Sukuk* and conventional bonds (see Appendix D). Therefore, this results in a null hypothesis to be rejected, and, hence, accept the opposite. Therefore, the statement that *Sukuk* and bonds should have similar levels of risk were incorrect as revealed through the above figures, hence, a rejection of the null hypothesis, which illustrates no difference between *Sukuk* and conventional bonds, and the results support the alternative hypothesis that stated *Sukuk* are riskier than conventional bonds.

Figure 8: F-Test Results for Sukuk and Conventional Bonds



Furthermore, the study shows that *Sukuk* inherits higher market and credit risks than conventional bonds due to some restrictions that Shar’iah principles impose on *Sukuk* risk management. Also, other risks related to *Sukuk* are legal and regulatory risks specific to *Sukuk* may effect the *Sukuk* returns, and operational risks, which donot effect conventional bonds. Therefore, these risk factors place a major disadvantage on *Sukuk* competiveness in the global market as an alternative investment product.

# CONCLUSION

*Sukuk* is an important instruments of an Islamic financial system, and normally, allow mobilisation of resources. This helps Islamic financial institutions to match their assets and liabilities. Whereas, the *Sukuk* market has diverged from initial *Sukuk* issuances by financial institutions to issuers ranging from infrastructure development, aircraft financing, socially responsible investing, *Takaful* sector, capital enhancement purposes, and so forth. Also, *Sukuk* encourages small investors to participate in Islamic financing and earn profits at the same time.

The uniqueness of *Sukuk* from its conventional counterparts has been a debatable issue among scholars and within relevant literature as an alternative to investment products. This study introduced a portfolio of *Sukuk* and conventional bonds to evaluate the risk level of Sukuk and conventional bonds. The results show that *Sukuk* portfolios have a higher VaR risk level of the expected daily losses than the traditional bonds in both Historical simulation and Monte Carlo simulation. Therefore, the empirical evidence reveals that *Sukuk* instruments are different to, and riskier than, conventional bonds. However, the study shows that *Sukuk* inherits higher market and credit risk than traditional bonds due to some restrictions that Shari’ah principles impose on *Sukuk* risk management. Also, the results confirm that these risks may be associated with other risk factors of *Sukuk*, such as, legal, regulatory, and operational risks, not affecting conventional bonds. Therefore, these specific risks may place significant disadvantage on the competitiveness of *Sukuk* in global markets as an alternative investment product.

There is little research regarding *Sukuk* compared to conventional products in literature. Therefore, this study fills the gap by examining risk levels of Sukuk instruments, when compared to conventional bonds. The findings reflect those of Cakir and Raei (2007) and Hassan (2012).

Finally, this study evaluates risks of *Sukuk* when compared to conventional bonds by investigating it as an alternative investment instrument. Although, the findings of this study are based on a reasonable sample of *Sukuk* and conventional bonds' portfolios, further studies including corporate and sovereign *Sukuk* and conventional bonds issuers, such as Qatar, Bahrain, Kuwait, and Saudi Arabia will produce better evaluations of *Sukuk* effects on investment portfolios.

Interesting aspects for future research include an examination and comparison of different industry sectors of *Sukuk* and conventional bonds in the Gulf states. Here, other methods of *Sukuk* risk evaluation may be applied using suitable software, since recent risk evaluation studies on *Sukuk* and bonds rely mainly on VaR Method analysis.

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APPENDICES

APPENDIX - A  
Table 1: Main types of sukuk structures.

|  |  |
| --- | --- |
| **Sukuk type** | Characteristics |
| **Murabaha**  (mark-up sale) | Usually used for purchasing products under an instalment sales contract. In this type of transaction, an asset is acquired by the purchaser (usually a bank); from a third party, at the demand of the originator. The product is then resold to the originator at an agreed mark-up for immediate or deferred payment in instalments. |
| **Istisna**  (Supply agreement) | Generally used in infrastructure and large developmental projects. In this type, the Islamic financial institution funds the project during its construction phase, whilst acquiring the title to that asset. Ownership is then passed on to the developer upon competition of the project. |
| **Salam** (futures contract) | The buyer pays the seller the full price of a product, with the promise to be delivered at a future date. |
| **Ijarah**  (rental and lease agreements) | Based on a leasing scheme, the financing party purchases property, equipment or other asset desired by the originator and then leases it to the client for a rental fee. At maturity, the originator repurchases the underlying asset. |
| **Wakala**  (agency agreement) | One party (either the bank or client) serves as an agent to the originator undertaking transactions on his behalf. |
| **Mudaraba** (partnership agreement) | A partnership agreement where the funds to finance a project are supplied by the provider of capital; while the entrepreneur offers labour and expertise. Profits ratios are agreed upon and are shared accordingly. However, in the case of loss, all losses are borne by the owner of capital; as the liability of the entrepreneur is restricted only to his time and effort. |
| **Musharakah** (Equity partnership agreement) | Represents ownership of partnership equity. The financing party and originator contribute assets (cash or property) to a joint venture and share the generated profits according to predetermined ratios, whereas losses are split according to the respective capital  contributions. |

Source: Lackman (2015); Kammer et al. (2015, pp.33-34)

APPENDIX - BSukuk for 10 Day Monte Carlo simulation and (5000 iterations) tabulated in ahistogram**.**

APPENDIX - C  
Conventional bonds for 10 Day Monte Carlo simulation and (5000 iterations) tabulated in a histogram.

APPENDIX - DF-Test Analysis for sukuk and conventional bonds

**Test and CI for Two Variances**

Method

Null hypothesis σ(First) / σ(Second) = 1

Alternative hypothesis σ(First) / σ(Second) ≠ 1

Significance level α = 0.01

Statistics

99% CI for

Sample N StDev Variance StDevs

First 250 0.005 0.000 (0.005, 0.006)

Second 250 0.003 0.000 (0.003, 0.003)

Ratio of standard deviations = 1.673;

Ratio of variances = 2.799

99% Confidence Intervals

CI for

CI for StDev Variance

Method Ratio Ratio

F (1.420, 1.971) (2.017, 3.883)

**Test and CI for Two Variances**

Tests:

Test

Method DF1 DF2 Statistic P-Value

F 249 249 2.80 0.000

