ESTIMATING VALUE AT RISK FOR SUKUK MARKET USING GENERALIZED AUTOREGRESSIVE CONDITIONAL HETEROSKEDASTICITY MODELS

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SELF- ESTIMATING VALUE AT RISK FOR SUKUK MARKET USING GENERALIZED AUTOREGRESSIVE CONDITIONAL HETEROSKEDASTICITY MODELS

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A thesis submitted in fulfilment of the
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Specially dedicated to

My beloved mother and father who have always encouraged me throughout my journey of education

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ABSTRACT

Islamic Finance has experienced unsurpassed growth over the past ten years. A major reason for this accelerated growth is the wide issuance of Sukuk. The structure of Sukuk are akin to conventional bonds and allow sovereign and corporate entities raising funds in capital markets in compliance with the Sharia philosophy of Islam. This study offers an overview of the Sukuk data time series, and a description of the statistical and distributional features related to its operation as a liquidity instrument in the secondary market. Subsequently a wide-ranging list comprising both symmetric and asymmetric GARCH models such as GARCH, EGARCH, GJR-GARCH, IGARCH and asymmetric power GARCH were considered for modelling the volatility of the Sukuk market. Concisely, through this investigation, the researcher determined if Sukuk are financial tools with the exact characteristics of conventional bonds, or a separate financial instrument with features of their own. The significant of this matter is linked to the fact that in several developing countries with pronounced Muslim populations, thus the study maintained that traditional debt markets cannot thrive if the availability of Sukuk is beyond reach. Ultimately, this study discovered that while an obvious theoretical disparity exists between Sukuk and conventional bonds, there are similarities in their performances where the secondary market is concerned. This study also determined that for predicting capability in the Sukuk market, the performance of asymmetric GARCH models is superior to that of symmetric models. Finally, this study demonstrated that the student-t distribution is more favorable than normal or generalized error distribution.

ABSTRAK

Kewangan Islam telah mengalami pertumbuhan yang tiada tandingannya dalam tempoh sepuluh tahun yang lalu. Sebab utama berlakunya pertumbuhan ekonomi yang pesat ialah terbitan pelbagai jenis Sukuk. Struktur Sukuk adalah serupa dengan ikatan konvensional dan merupakan entiti korporat yang diiktiraf untuk mengumpul dana dalam pasaran modal selaras dengan falsafah Syariah Islam. Kajian ini menjelaskan gambaran keseluruhan siri masa data Sukuk dan huraian ciri-ciri statistik dan pengagihan yang berkaitan dengan operasi sebagai instrumen tunai dalam pasaran sekunder. Senarai menyeluruh yang terdiri daripada kedua-dua model GARCH simetri dan tidak simetri seperti GARCH, EGARCH, GJR-GARCH, IGARCH, dan GARCH kuasa simetri digunakan untuk pemodelan turun naik pasaran Sukuk. Ringkasnya, melalui kajian ini, penyelidik menentukan adakah Sukuk merupakan instrumen kewangan dengan ciri-ciri sebenar bon konvensional, atau instrumen kewangan berasingan yang mempunyai ciri-cirinya sendiri. Kepentingan perkara ini dikaitkan dengan keadaan di beberapa negara membangun dengan populasi penduduk Islam yang tinggi, justeru, kajian ini menetapkan bahawa pasaran hutang tradisional tidak mampu berkembang maju jika kewujudan Sukuk sukar untuk dimanfaatkan. Secara muktamadnya, kajian mendapati walaupun perbezaan teori jelas wujud antara Sukuk dan ikatan konvensional, namun terdapat persamaan sumbangan antara kedua-duanya di pasaran sekunder. Pengkaji juga mendapati bahawa dari segi keupayaan meramal dalam pasaran Sukuk, prestasi model GARCH tidak simetri adalah lebih unggul daripada model simetri. Akhirnya, pengkaji telah membuktikan bahawa pengagihan pelajar-t adalah lebih baik daripada pengagihan biasa atau pengagihan ralat umum.

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LIST OF ABBREVIATIONS

AAOIFI	-	Accounting and Auditing Organization for Islamic Financial Institutions
AIC	-	Akaike Information Criterion
AP	-	Asymmetric Power
BIC	-	Bayesian Information Criterion
EGARCH	-	Exponential Generalized Autoregressive Conditional Heteroskedastic
GARCH	-	Generalized Autoregressive Conditional Heteroskedasticity
GCC	-	Gulf Cooperation Council
GJR	-	Glosten-Jagannathan-Runkle
HQC	-	Hannan-Quinn Information Criteria
IGARCH	-	Integrated Generalized Autoregressive Conditional Heteroskedastic
UAE	-	United Arab Emirate
VaR	-	Value at Risk

CHAPTER 1

INTRODUCTION

1.1 Introdguction

In order to endure in the competitive global market, financial managers and policy makers need to improve the forecasting and estimating abilities of methods to evaluate the financial risk. Over the last ten years, the unpredictability of financial markets worldwide has elevated the significance of financial risk management (Yamai & Yoshiba, 2005).

The occurrence of several financial crises during the last fifteen years has exposed some weaknesses in current risk management methods. This situation has driven risk managers and policy makers to seek improved approaches to estimate market risk in the financial industry as well as to formulate and redefine risk management schemes (Yamai & Yoshiba, 2005).

While much emphasis has been placed on the prediction and estimation of risk for conventional finance, Islamic markets have been somewhat neglected in this area. The development of Islamic finance is particularly vital for markets in countries with elevated Muslim populations as their progress is hindered by their sole reliance on a conventional scheme (Tariq, 2004).

Among all the areas of Islamic finance development, the growth pace of S*ukuk* or Islamic bonds stands head and shoulders above the rest (Hesse, Jobst, & Solé, 2008). Sukuk are long term financial tools that come with the features of conventional bonds while retaining the rules of Shariah (Islamic principles).

Although the Sukuk markets are in their infancy and tracing its origins to Bahrain in 2001, but the market of Sukuk has grown significantly in recent years. However, of late, these markets have undergone rapid development in all aspects, including those of magnitude, quantity and refinement (Ab Majid, Shahimi, & Bangaan, 2010).

The brisk development of the Sukuk market on an international level has culminated in its yearly issuances virtually tripling from USD 45 bln in 2011 to USD 118.8 bln in 2014. Notably, this speedy growth was stimulated by the key fundamental markets such as Malaysia, Saudi Arabia and the United Arab Emirates (UAE), as well as up-and-coming players such as Turkey and Indonesia. Ground-breaking issuances were documented in 2014 from the UK, Hong Kong, Senegal, South Africa and Luxembourg. This served to fortify the standing of *Sukuk* markets as practical and assertive providers of financial support (Zawya, 2013).

As illustrated in Figure1.1 and Table1.1, the worldwide issuance of Sukuk experienced a steep climb over recent years (Figure 1.1 and Table 1.1 are derived from IIFM[1] data and all amounts are based on million USD). The international issuance of *Sukuk*, amounting to USD 100 million, was initiated by Bahrain in 2001. And by the close of 2007, it had risen to USD 49 billion. *Sukuk* issuance was expected to swell in 2008, but the global crises of 2007 applied the brakes to this development (Cakir & Raei, 2007).

After an initial shortfall, issuances began to gain momentum from 2009 to record USD140 billion at the close of 2012 (POOR'S, 2012) and USD120, 854 billion at the close of 2014. As revealed by Standard and Poor's rating service, despite the issuance of S*ukuk* is presently minor in comparison to global conventional bonds, it has the potential to develop and rub shoulders with the big players in this domain and join to the mainstream.

[1] International Islamic Financial Market

Table 1.1: Global Sukuk Issuances From 2001-2014

Year	Issue	Year	Issue
2001	1,172	2008	18,752
2002	1,372	2009	25,571
2003	6,410	2010	47,081
2004	8,140	2011	92,403
2005	12,180	2012	137,310
2006	29,992	2013	138,170
2007	48,929	2014	120,854

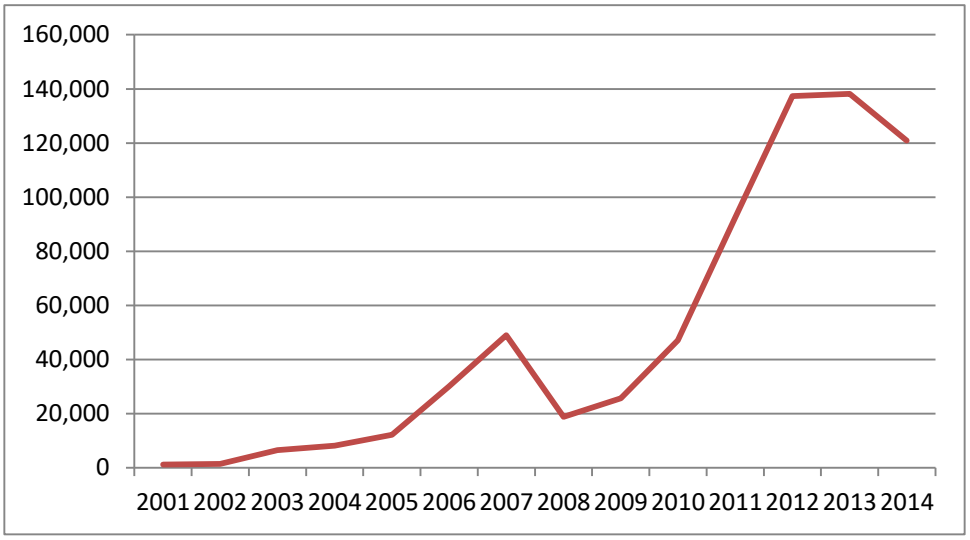

Figure 1.1 Trend of Global Sukuk Issuances (From 2001-2014)

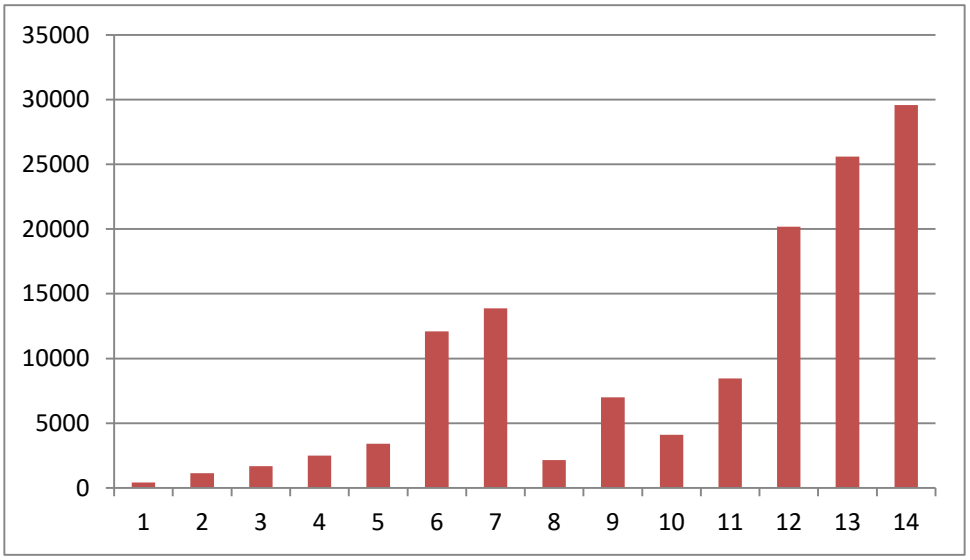

Figure 1.2 International Sukuk Issuance (Jan 2001- March 2015, USD Millions)

Over the past year, encouraging developments in the Sukuk market have led to an elevated level of cross-border activities in this market. The market saw a rise of Sukuk issuances in foreign currency, especially in USD; while Malaysia drew issuances from other regions including Singapore and Turkey.

Other than issuances, Sukuk listings also experienced increased cross-border activities as issuers raised listings especially on major European stock exchanges, specifically, the London, Irish and Luxembourg Stock Exchanges. Another significant development between 2013 and 2014 was the conformity of Islamic financial institutions to Basel III liquidity and capital requirements (Global Sukuk Report, Q1 2015).

As portrayed in Figure 1.3, sovereign issuers generally preside over the market. This is evident as they are credited with more than 50% of the overall issuances. Meanwhile, supra-national organizations that include the Islamic Development Bank (IDB) also have a share in the market with several hefty issuances that amounted to 15.2% (Report, Q1 2015)

Based on (Report, Q1 2015) the main part of Sukuk corporate issuers are from the financial sectors of Turkey and Malaysia. It is important to mention that two financial institutions from Turkey issued MYR-denominated Sukuk in Malaysia, and announced plans for more similar cross-border issuances in the future.

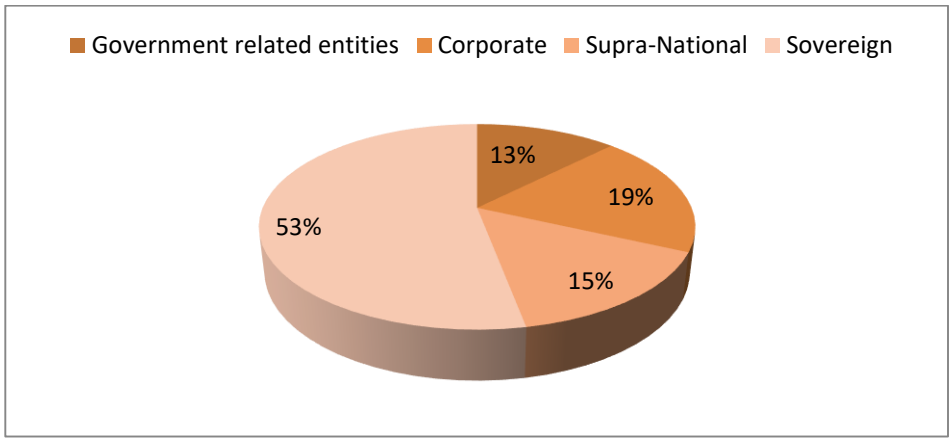

Figure 1.3 Sukuk Issuance in 2014 by issuer type

1.2 Background of Study

The many investigations conducted on Sukuk are mostly concept-based and very few were focused on the evaluation of the Sukuk market as a financial tool. In other words, in spite of several studies that took place about Sukuk recently, most of them are conceptual and theoretical and not attention has been paid to the evaluation of the Sukuk market as a financial instrument. With this in mind, this study sets out to determine if there are any disparities between Sukuk and conventional bonds in the secondary market. During this endeavour, all conceptual as well as constructional differences and similarities are set aside. We also explored the most favourable procedure for approximating downside market risk in the Sukuk market.

Forecasting and estimating financial loss is the main task of financial managers and policy makers to survive in the competitive global market. The importance of financial risk management has increased in the last decade mainly due to increased volatility in financial market all over the world. Considering the importance of this risk, its evaluation is necessary for all banks and financial markets. In this context, we will present the measurement methods VaR in order to evaluate risk of Sukuk (Alexander, 2009).

The chosen VaR methodology for evaluating risk is widely applied in the area of finance. The VaR approach measures the downside risk of a portfolio position as the maximum loss that can be materialize at a future prescribed date with a given probability due to adverse changes in relevant asset and liability prices (Cakir & Raei, 2007).

Value at risk (VaR) is deemed the most effective and prominent instrument for gauging downside market risk. VaR became the basic market management tool for all financial institutions when the Basel Committee on banking supervision ruled that these institutions are obliged to satisfy capital requirements based on the VaR estimate (Alexander, 2009).

VaR is a mathematical approach that portrays the highest degree of expected loss for a portfolio over a given holding period at a specific confidence level (Jorion, 2007). VaR can be regarded as an envelope for all volatility and correlations among separate risk variables over time (Cakir & Raei, 2007).

Although the general usage of VaR is deemed easy, significant and extensive, its utilization as a procedure for estimation and prediction financial risk remains demanding. The main challenge to VaR application is the lack of unique accepted method for its computation so that considerably distinct results can be realized through the implementation of different approaches. The disparities in results can be put down to the varying assumptions taken into consideration by each process (Kuester, Mittnik, & Paolella, 2006; D. G. McMillan & Kambouroudis, 2009).

It is on record that several common traits exist in the stock return time series. These traits, which include asymmetry, fat-tail and volatility clustering, are known as stylized facts. As such, an appropriate approach would be one that considers these stylized facts with regard to financial returns (Mills and Markellos, 2008).

Previously-developed VaR estimation procedures including Variance-Covariance and Historical Simulation have been mostly discarded. This is attributable to their unacceptable assumptions regarding normal distribution for asset return in parametric approaches, and constant variance in cases of non-parametric approaches (Abad, Benito, & del Rey, 2009).

Bollerslev (1986) came up with Generalized Autoregressive Conditional Heteroscedasticity (GARCH) for the modelling of time-varying volatility data in financial markets. This procedure is held in high esteem as it considers significant features of the financial time series. During this thesis, a wide range of both symmetric and asymmetric GARCH methods (including GARCH, EGARCH, GJR-GARCH, IGARCH and Asymmetric power GARCH) were considered for modelling volatility in the Sukuk market.

Bearing in mind the significance of Sukuk, this study focused on providing a synopsis on Sukuk data time series as well as a description on the features of its statistical distribution function. To the best of our knowledge, studies on the behaviour of Sukuk as a liquidity instrument in the secondary market are few and far between. This investigation also applied a variety of GARCH techniques to approximate the VaR of Sukuk for both in-sample and out-sample performances. This was to determine the most suitable model for the Sukuk market.

1.3 Problem Statement

As already mentioned Sukuk refers to bonds issued in accordance with Islamic law. The rapid spread of Sukuk, primarily in the Middle East and Islamic countries in Asia, has made it an important tool for raising funds and asset management. Sukuk provide government and corporations with access to the huge and growing Islamic Liquidity pool, in addition to the conventional investor base (El Qorchi 2005).

The most outstanding feature of Sukuk to assess is that it can be considered as an alternative to conventional bonds to have more diversification in portfolio. At the other side, it is important to examine if the secondary market behaviour of Sukuk and conventional bonds are so distinguished that there is significant value in issuing Sukuk instead of bonds.

Obtaining positive answer to these questions raises Sukuk capacity to decrease risk to the portfolio and promote Sukuk as a long term alternative to conventional bonds. Thus, for Muslims and non-Muslims alike who are concerned about reducing risks to their investment, Sukuk would appear to be a wise investment (Cakir & Raei, 2007).

At the other side, Sukuk provide sovereign governments and corporations with access to the huge and growing Islamic liquidity pool, in addition to the conventional investor base. Particularly, the initial step for evaluating Sukuk as an

alternative to conventional bonds is the assessment of its performance in secondary markets. Subsequently, an improved procedure for modelling volatility as well as for approximating and predicting VaR in the Sukuk market needs to be realized.

It is our opinion that no attention has been paid to approximation and prediction of VaR in the Sukuk market.

The theme of my thesis covers an area which is relatively new and under-developed. The many studies took place on Sukuk are mostly concept- based and very few were focused on the evaluation of the Sukuk market as a financial tool.

The main contribution of this research is that in some respects this study will set a precedent for a financial market, which is still evolving in terms of regulatory and legal framework relating to the Islamic finance industry. In other words, this research aims to contribute to the debate on the issuance of Sukuk as an alternative investment/financial instruments.

1.4 Objectives of the Study

1. Describe the performance of Sukuk returns in the secondary market and provide an overview about modelling of Sukuk returns.
2. Apply a variety of GARCH procedures to Sukuk return series and uncover more appropriate procedures for the modelling of Sukuk returns based on in-sample criterion.
3. Compare the forecasting capability of various GARCH procedures to estimate the VaR of Sukuk based on out-of-sample evaluation.

1.5 Research Questions

i. How is the performance of Sukuk returns in the secondary market?

ii. Which GARCH procedure is most appropriate for the modelling of Sukuk returns?

iii. Which GARCH model is superior for forecasting and estimating the VaR of Sukuk?

1.6 Scope of the Study

To analyse the risk of Sukuk we consider six Sukuk issued by Malaysia, UAE (Dubai) and Saudi Arabia (IDB), Bahrain, Indonesia and Turkey. These countries are ideal for this research since they are the most active countries in terms of Sukuk issuance. Figure 1.4 shows the global Sukuk issuances by each country for the time period of 2001 till July of 2014.

As it can be seen the major part of Sukuk issuance was from Malaysia (42%) and in to lesser extend the Sukuk issuance was from Gulf Cooperation Council (GCC) countries. In GCC countries the most active countries in Sukuk market are UAE and Saudi Arabia which have 18% and 7% of the market respectively. Since the dominant part of Sukuk market in the world is in these three countries and generally they are considered as leader of global Sukuk market, we choose them for this research.

However we didn’t restrict out research only to these three countries. In order to avoid dependent on a specific financial market and obtain more robustness results we also consider three more countries including Bahrain, Indonesia and Turkey.

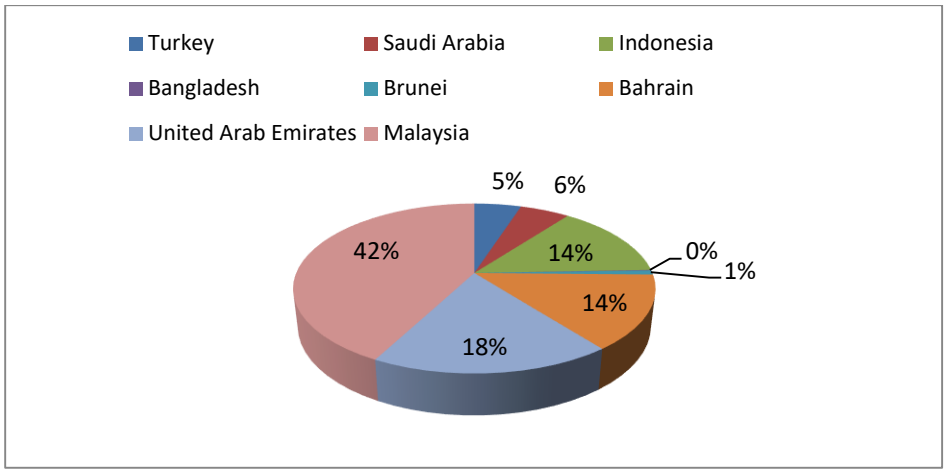

Figure 1.4 International Sukuk issuances country wise break- up (2001-July 2014)

Table 1.2 represent the international Sukuk issuances country wise break- up from 2001 till July 2014. As can be seen from this table, in terms of number of issues the first place is related to Bahrain and United Arab Emirate, respectively. However, in terms of USD million, the first place is related to Saudi Arabia with USD 21,542 million which consist 18.43 percent of total value and the second step is related to Malaysia with USD 16,339 million and 13.98 percent of total value.

Table 1.2: International Sukuk issuances country wise break-up (2001-July 2014)

ASIA & FAR EAST	NUMBER OF ISSUES	AMOUNT USD MILLIONS	% OF TOTAL VALUE
Malaysia	32	16,339	13.98%
Indonesia	7	5,782	4.95%
Singapore	4	711	0.61%
China	1	97	0.08%
Hong Kong	2	196	0.17%
Japan	3	190	0.16%
Pakistan	1	600	0.51%
Total	50	23,917	20.47%
GCC & MIDDLE EAST	**NUMBER OF ISSUES**	**AMOUNT USD MILLIONS**	**% OF TOTAL VALUE**
Bahrain	94	6,830	5.84%
Kuwait	13	2,127	1.82%
Qatar	10	8,935	7.65%

Saudi Arabia	30	21,542	18.43%
United Arab Emirates	68	45,986	39.35%
Total	215	85,420	73.09%
ARFICA	**NUMBER OF ISSUES**	**AMOUNT USD MILLIONS**	**% OF TOTAL VALUE**
Sudan	1	130	0.11%
Total	1	130	0.11%
EUROPE & OTHERS	**NUMBER OF ISSUES**	**AMOUNT USD MILLIONS**	**% OF TOTAL VALUE**
Kazakhstan	1	77	0.07%
France	1	0.65	0.001%
Germany	1	55	0.05%
Luxembourg	2	60	0.05%
Turkey	12	5753	4.92%
United Kingdom	8	687	0.59%
USA	3	767	0.66%
Total	28	7,400	6.33%
Grand Total	294	116,867	100.00%

It should be noted that in this study, the application is restricted to international issuances of Sukuk by the government of Malaysia, Saudi Arabia, United Arab Emirates, Turkey, Bahrain and Indonesia. The lack of accessible data, especially data on secondary market trading, hindered the selection of issuers as well as the investigation in general.

As stated previously, Sukuk markets are in their formative years and for the most part trading is currently confined to primary markets. Although secondary market data are accessible in some areas, the time series is inadequate for the realization of an acceptable outcome. These limitations have forced us to confine our investigation to the sovereign issuance of *susuk* in the global markets, an area where secondary market data are at hand. Local Sukuk are left out as the lack of secondary market price data renders the assessment of volatility and risk unreliable.

1.7 Structure of Thesis

The remainder of this thesis is arranged in the following order: The opening section of chapter two provides the theoretical concepts and features related to Islamic finance and Sukuk. This is followed by a description of VaR, its concept, as well as various statistical and econometrical procedures for its approximation. This chapter also includes a re-evaluation of previous studies. These studies are separated into two categories. The first category focuses on previous studies related to Sukuk risk assessment, while the second category concentrates on previous studies linked to VaR estimation.

Chapter three provides a description on the methodology, data and scope of this study. Chapter four involves the application of various GARCH procedures to Sukuk returns, as well as examinations on the in-sample and out-sample performances of GARCH models. Chapter five opens with an in-depth discussion on the outcomes, followed by the revelation of findings and an account on the limitations of this investigation as well suggestions on ways to overcome them.

1.8 Definition of Terminologies

Islamic Banking and Finance: Islamic banking and finance is based on the principles of Islamic law. This mode of banking is ruled by two main decrees; the sharing of profit and loss, and more importantly, the ruling out of collection and payment of interest.

Sukuk: Similar to a bond in western finance, Sukuk is an Islamic financial certificate which meets the terms of Islamic religious laws. As the conventional interest paying bond arrangement is not permitted in Islam, the Sukuk issuer sells the certificate to an investor, who then rents it back to the issuer for a predetermined rental fee. Through a contractual agreement, the investor is assured that at a future date, the bonds will be bought back by the issuer at par value.

Risk: This refers to the possibility of the actual return to an investment varying from the anticipated return. Risk involves the chance of suffering partial or total loss of the primary investment. For the most part, the various forms of risk are gauged through a calculation of the standard deviation of the historical returns, or average returns of a particular investment. An elevated standard deviation points to a raised risk level.

Value at risk: This is a mathematical procedure utilized for measuring and quantifying the degree of financial risk for a given duration. This procedure is employed by risk administrators and policy makers to gauge and manage the risks taken on by organizations. The computation of value at risk involves three variables; the likely amount of use, the probability of loss related to that amount, and the time frame. The main task of risk managers is to make certain that the risk taken on by an organization does not exceed its risk tolerance capacity.

Riba: Riba, or interest in conventional economic vocabulary, denotes "an excess" and is described as "any unjustifiable increase of capital whether through loans or sales." Riba also refers to any positive, fixed and predetermined rate.

1.9 Summary

Forecasting and estimating financial loss is the main task of financial managers and policy makers to survive in the competitive global market. The importance of financial risk management has increased in the last decade mainly due to increased volatility in financial market all over the world. In spite of extensive research on forecasting and estimating value at risk in the conventional financial markets, less attention has been paid to the Sukuk markets.

Sukuk has established itself as the fastest developing aspect of Islamic banking. The market of these long-term Islamic compliant financial tools has grown from $1,172 billion in 2001, to USD 118.8bln in 2014. Currently, Sukuk are also issued in other regions by sovereign, corporate and international and global

organizations including the Saxony-Anhalt German State, GE Capital, and the International Finance Corporation (IFC).

While the significance of forecasting and estimating risk in the financial market is clear, we are of the opinion that the *Sukuk* market has been overlooked in these areas. The focus of this study is on identifying, if any, the technical disparities between Sukuk and conventional bonds. For this analysis, we deliberated on six Sukuk issued by Malaysia, UAE, Saudi Arabia, Bahrain, Indonesia and Turkey.

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