Religious effects on Malaysian capital markets

- A value at risk approach on Islamic and conventional bonds

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Abstract

The capital market in Malaysia is emerging through its establishment of Islamic bonds being issued parallel to its conventional counterpart. Traded on the same platform and denominated in the same currency, previous research has shown evidence that sukuk (Islamic bonds) are more risky than conventional bonds. We conduct a nonparametric bootstrap where we compute a value at risk (VaR) analysis of Islamic and conventional treasury bills and coupon bonds that are issued by the same entity (the Malaysian Government). Our results show that Islamic treasury bills are exposed to less market risk than its conventional counterpart. However, the case is contrary among coupon bearing bonds when controlling for different maturities.

Key words: Islamic finance, Malaysian capital market, sukuk, value at risk, market risk

Tutor: Roine Vestman

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1 Introduction

According to the principles of Shariah (Islamic law), interest rates are prohibited which has led to numerous financial innovations. In recent years, the Islamic finance market has expanded rapidly on the global capital market – particularly in Southeast Asia and the Middle East. Malaysia has been among those countries behind this tremendous growth and is to this point the world leader in the Islamic bond (sukuk) market (World Islamic Banking Competitiveness Report, 2013). The Islamic and conventional financial sectors operate in parallel with each other on the Malaysian capital markets – a unique financial market structure. As outlined in the Financial Sector Blueprint (2011), the sukuk market accounts for a majority of the debt security market and the government aims to establish two markets in synchrony.

The central bank of Malaysia, Bank Negara Malaysia, explicates that the structure of issuance is different for a sukuk compared to a conventional bond. However, sukuk structures that are issued by the government have a fixed maturity and can bear coupons similar to government issued conventional bonds – the traditional yield-price relationship prevails. However, once the sukuk has reached the secondary market in the Malaysian bond market, issuance structures become irrelevant (BNM, 2014). We therefore find it interesting to measure the market risk using a value at risk (VaR) method. Our method is to estimate the market risk, using a historical bootstrap method, using market data collected from Malaysian conventional bonds and sukuk, respectively. We generate hypothetical future prices, conducting 10,000 iterations, using historical data.

To our knowledge, estimating the market risk using a bootstrap method has never been conducted in the case of the Malaysian capital market. On the other hand, studies applying VaR measures in the financial sector outside Malaysia are numerous (see among others, Cakir & Rabei (2007) and Chen et al. (2014)). Due to limitations on availability of price observations on the secondary market, they used bonds and sukuk from different countries and corporates. A belief of better data availability today motivated us to investigate this subject further, where Malaysia was found to be superior in this aspect.

We are investigating the differences in market risk between sukuk and conventional bonds based on two hypotheses. In our first hypothesis we argue that the VaR estimates of a sukuk should be equal or higher than the VaR of a comparable conventional bond. In the second hypothesis we claim that the VaR estimates of a sukuk should increase, relative to a comparable conventional bond, when controlling for different maturities.
In contradiction to our first hypothesis, our study shows that VaR estimates for a sukuk are generally lower than their conventional counterpart when using all maturities aggregated together. The results show that both Islamic coupon-bearing bonds (GII) and treasury bills (MITB) are exposed to less market risk than the conventional coupon-bearing bonds (MGS) and bills (MITB). Furthermore, when controlling for different maturities given the same length of holding periods used in the first method, we find different outcomes. In contradiction to previous results, the Islamic bonds shows substantially higher VaR estimates than the conventional bonds in each buy and hold-strategy. We find this result more relevant due to the isolation of maturities conducted by the iteration process. In contrast, the Islamic treasury bills constantly show lower VaR compared to the conventional treasury bills through all holding periods.

The Malaysian bonds and sukuk used in this paper are ranked pari passu, in either A3 (Moody’s) or A (Fitch). However, in this study we find that there is a significant difference in market risk exposure between Islamic and conventional bonds. Therefore, there are arguments against the homogenous ranking. Another issue we consider is the differences in liquidity between the Islamic and conventional bond markets. A sukuk is considered to be a more illiquid instrument compared to the conventional bonds which clearly can be observed by looking at secondary market activity (Jobst, 2007). The market data collected in this paper evince less trading activity for Islamic bonds compared to it conventional counterpart. This is something we have observed when comparing our historical data from 2014 against earlier dates. The illiquidity problem imposes additional risk to investors, especially at times of volatility. However, El Qorchi (2005) argues that it is believed that the risk will decrease with the increase of knowledge and numbers of sukuk issues.

The rest of this paper is organized as follows. Section 2 covers some necessary background regarding Islamic finance and capital markets, particularly in the case of Malaysia. Section 3 contains a review of previous literature on Islamic finance and VaR measures applied in sukuk markets. A description of our data and utilized market quotes are presented in Section 4. The methodology and theory constituting the basis of this paper are presented in Section 5. Further, we describe how we estimated the market risk with a non-parametric bootstrap method. Section 6 covers our results and interpretations while Section 7 includes our most important conclusions, limitations and suggestions for future research.
2 Background

This section provides an overview of the Malaysian bond market and Islamic capital markets in general, as the field of Islamic finance is unfamiliar to many readers. The knowledge provided is mainly based on information from the central bank of Malaysia, Bank Negara Malaysia (BNM). For a deeper review of this subject we refer to various IMF-papers, for example, Jobst (2007); Cakir & Raei (2008) and Jobst et al. (2008). Also, Krichene (2013) and Omar et al. (2008) further describe the fundamentals of Islamic capital markets.

2.1 Fundamentals of Islamic finance

Islamic finance is driven by the demand of extending the tenets of religious beliefs of Islam to financial aspects and operates in the capital markets with a limitation to certain ethical principles based on Shariah law. Islamic and conventional finance is differentiated in the market by three main prohibitions. Firstly, riba (usury) is strongly prohibited, which forbids the charging of interest according to the main interpretation of the Quran. Secondly, the prohibition of gharar (uncertainty) eliminates the hazardous sales from the Islamic capital markets. Lastly, maisir (gambling) is prohibited, observed as a scenario in bond/stock-trades. Additionally, this implements an ethical screening in the Islamic financial market in which companies that promote haram (sinful) activities are excluded from the market. For example, according to Islamic economic jurisprudence, industries engaging in tobacco, alcohol and gambling are prohibited (Omar et al., 2008).

2.1.1 Islamic bonds

Islamic bonds are called sukuk. A sukuk is a document representing the value of an asset. Sukuk can be based on several different principles that are Shariah obedient. However, the criteria for what is compliant with Shariah can vary across countries and are determined by a “Shariah board”. In Appendix A, we describe principles that are relevant for the Malaysian capital market and that are used in our paper. Due to similarities between sukuk and conventional bonds, conventional bond valuation models are frequently used to value sukuk.

The structure of issuance differs between a sukuk and a conventional bond, mainly in regard to cash flow. A sukuk, the certificate of indebtedness, must be based on the transfer of an asset. This is one of the fundamental differences between the Islamic and conventional principles, since charging interest is considered haram (prohibited). Moreover, the ownership of an asset is transferred between an issuer
and a lender so that the lender makes a pre-specified profit on the transaction. The coupons and principal is constituted from the profit that is paid out on a pre-agreed deferred payment basis. The conventional issue structure of bonds entails an exchange of money against a certificate of indebtedness in which the issuer then pays coupons (interest) over the bonds “lifetime”. Once matured, the principal amount and the final coupon payment is received. On the secondary market, the issuance structure of a sukuk or conventional bond is irrelevant since it only affects the issuance price and not the secondary market prices (Bank Negara Malaysia, 2014).

Islamic finance is based on the laws of Shariah – an environment where frictions arise due to different interpretation of the Quran and Hadiths\(^1\). Regarding the interest, many scholars refers to a chapter in the Quran (Surat Al-Baqarah, aya 275), where the following is stated:” *They say: ’buying and selling is but a kind of usury’ - while God has made buying and selling lawful and usury unlawful*”. In 1997, BNM decided to establish The Shariah Advisory Council, to manage frictions created by different interpretations on the capital markets. As the highest Shariah authority of Islamic finance in Malaysia, SAC has been given authority for the ascertainment of Islamic law for the purposes of Islamic finance (Bank Negara Malaysia, 2014).

The Shariah compliance of several sukuk structures is questioned by many scholars. The Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) in 2008 stated that 85 percent of all sukuk were not Shariah compliant (Naim et al., 2013). As a result, it caused a significant decrease in the number of new issued sukuk. Shariah advisors were forced to improve their Shariah compliance. Furthermore, the demand for sukuk could be affected negatively if investors refrain from investing in sukuk by the reason of questionable Shariah compliance in the features of Islamic bonds (Azmat et al., 2013).

### 2.2 The Malaysian bond market

Since the enactment of the Islamic Banking Act 1983, the Islamic financial sector has grown steadily and continuously. The Malaysian government, in compliance with Bank Negara Malaysia as a policy maker, is committed to establishing a well-developed and effective Islamic financial system. As stated in the Financial Sector Masterplan (2001), the government of Malaysia is aiming to enhance the effectiveness of the Islamic sector in the financial sector of Malaysia.

As the frontrunner for Islamic capital markets, Malaysia has the largest sukuk

\(^1\) *Hadiths* is prophetic ‘traditions’, meaning the corpus of the reports of the teachings, deeds and sayings of the Islamic prophet Muhammad.
market in the world, in terms of number of issues and outstanding size. Due to this, the Malaysian financial sector attracts various investors as well as leading the innovational product development forward (Jobst et al., 2008). However, the conventional sector still represents a majority of the Malaysian bond market (Bank Negara Malaysia, 2012).

As outlined in BNM’s report “Shariah resolutions in Islamic finance (2010)” , conventional bonds and sukuk are issued by the same entity, a Special Purpose Vehicle (SPV), which issues the government bonds on behalf of the Malaysian government. Bonds are also traded on the same platform and denominated in the same currency. Jobst (2007) argues that disincentives prevail in the issuance of sukuk since the Islamic finance transactions due to their asset backed structure, often incur double taxation. However, in the case of Malaysia, no preferential tax treatment is currently applied in either market.

2.2.1 Bonds traded on the Malaysian Sovereign Debt Market

In this study, two types of Islamic securities are considered; Government Investment Issues (GII) and Malaysian Islamic Treasury Bills (MITB). On the conventional bond market, we study Malaysian Government Securities (MGS) and Malaysian Treasury Bills (MTB). Information on specific issues is publicly available on BNM Bond Info Hub website.

- Malaysian Government Securities (MGS). MGSs are long-term conventional interest-bearing bonds issued with various maturities, ranging from 3-30 years. According to BNM, MGSs and GIIs are issued to raise funds from the domestic capital market for development expenditure. Furthermore, MGS is the only bond issued by the Malaysian government eligible for short selling.

- Government Investment Issues. GIIs are long term (3-20 years) Islamic bonds issued under the Government Funding Act 1983 to enable the government of Malaysia to raise funding in accordance with Shariah principles. GII based on Murabaha principle is essentially a certificate of indebtedness arising from a deferred mark-up sale transaction of an asset, such as commodity (typically crude palm oil). Due to the commodity-linked bond structure which includes more parties (a SPV and a commodity market), the transaction structure is more complex than the profit-based structure. Furthermore, the bond is coupon bearing with some zero coupon issues. Cash flow and transaction process are illustrated in Figure 2.1. Prior to 22 July 2013 GII was issued based on a different structure, known as Bai
Bithaman-Ajil. This structure has fewer steps, where an investor buys an asset from the government, and practically instantaneously gives it back to the government. In return, the investor receives a profit rate (coupon) and the principal amount at maturity. This process is illustrated and described in Figure 2.2. In this study we bundle these together into one since the number of Murabaha contracts issued are considerably lower.

- *Malaysian Treasury Bills (MTB)*. MTBs are securities traded on the conventional debt market. These treasury bills are issued with a variety of short maturities, not exceeding one year. MTBs are always issued as zero coupon bonds, traded on a discount basis. The secondary market trading of MTBs is quoted in terms of discount rate.

- *Malaysian Islamic Treasury Bills (MITB)*. MITBs are the Islamic counterpart of MTBs. Similar to MTB, MITB are always issued as zero coupon bonds with short maturities never exceeding one year. The bills are either issued with a maturity of 1 year or 9 months. MTBs are based on the Bai-al Inah principle and are traded on a discount basis on the Islamic capital market.

### 2.3 General risk factors

Different types of market risk are predominant factors that affect the return and therefore the risk on securities in the Malaysian capital market. As conventional bonds face the possibility of interest rate risk, sukuk based on fixed rates are also exposed to this risk. This implies that a rise in market interest rate, leads to a fall in the value of sukuk. Some sukuk securities are indirectly exposed to interest rate fluctuations due to the widespread benchmarking by London Interbank Offered Rate (LIBOR). For example, the issuer of a Murabaha sukuk will have to respond to fluctuations in LIBOR, since any increased earnings have to be shared with investors. However, this repricing of a Murabaha contract is not possible on the asset side, since debts are non-tradable according to Shariah law. Hence, the interest rate risk is very obvious in some sukuk cases. Nevertheless, if a sukuk is designed as a Shariah-compliant instrument, where returns are based on profits from the underlying asset, these risks can be significantly reduced or possibly avoided. (Krichene, 2013).

The fact that sukuk attracts investors that are Shariah conscious as well as Shariah unconscious has its effects. One can believe that the inclusion of an additional type of investor would lead to increased liquidity. However, a sukuk is considered to be a
more illiquid instrument compared to conventional bonds, which can be observed when looking at secondary market activity. This illiquidity imposes additional risk to the investor, especially at times of volatility. Additional implications of illiquidity on the sukuk market finds evidence of investors having longer holding periods with low secondary market trading as a consequence. However, it is believed that this risk will decrease with the increase of knowledge and numbers of issues (El Qorchi, 2005).
Figure 2.1: Issuance structure of sukuk based on Murabaha principle. Initially, the potential investor appoints BNM to purchase a commodity (mainly crude palm oil) using provided funds. BNM then sells the commodity to the government on a predetermined cost plus sale basis paid out in profit rates (coupons) on a pre-deferred basis to the holder of the certificate. The government appoints BNM to sell the commodity on the market in order to raise funds from the transaction. Profit rates (“coupons”) are noted as PR. The figure is constructed based on information from Bank Negara Malaysia (2013).

Figure 2.2: Issuance structure of sukuk based on the Bai Bithaman-Ajil principle. Initially, the eventual investor purchases an asset from the government for a settlement price. In the second transaction, the pre-determined profit is received when the investor sells the asset back to the government. The profit is then paid out in installments (coupons) on a deferred basis to the certificate holder. The figure is constructed based on information from Bank Negara Malaysia (2013).
3 Literature review

Our review of previous published research is divided into two sections. Section 3.1 covers a brief description of previous research on Islamic finance and bond markets. Since this paper has a value at risk (VaR) approach, Section 3.2 includes an introduction and overview of relevant research on VaR.

3.1 Previous literature on Islamic finance

Previous literature on Islamic finance and bond markets are relatively limited and the associated research has mainly been published in recent years. In general, subjects within the field of Islamic finance emanates from two different points of views; research conducting a comparative perspective between sukuk and conventional bonds and research analyzing the Shariah compliance of Islamic securities. Publications evaluating the differences between Islamic and conventional securities often conduct performance reports and examine relevant bond valuation models for sukuk type securities.

Ariff et al. (2013) conducted an empirical study, investigating differences between sukuk and conventional bonds of various issuers. The study applies Granger causality tests as well as a comparison in performance and to substantiate evidence in differences between bond and sukuk yields. The authors argue that if investors in the two types of bonds are treated equally for the same risk, term and issuer – sukuk and conventional bonds can be asserted to be the same. Moreover, Ariff et al. (2013) concludes that the capital market associates significantly higher risks to sukuk than to conventional bonds, hence the observed higher returns.

A paper written by Alam et al. (2013) found absence of significant stock market reaction to sukuk and conventional bond announcements over a large time horizon. The adverse-selection mechanism is discussed where the authors argue that companies that are not strong enough prefer to issue sukuk as they will be able to share loss in the worst case scenario. Godlewski et al. (2013) conducted a similar event study on the Malaysian market to compare the stock market’s reaction on sukuk and conventional bond announcements. Their research only involved the corporate bond market. Wilson (2008) enhances that sukuk serves as an essential tool for resource mobilization and is a key instrument for the future development of the financial industry.

Several papers published by the International Monetary Fund (IMF) studies Islamic capital markets and sukuk. Jobst et al. (2008) analyze some of the issues encompassing the sukuk market. The authors advocate that, despite the global
financial crisis, there is a strong and increasing demand for Shariah compliant securities from both Islamic countries and conventional financial institutions. Moreover, Jobst (2007) investigates the asset-backed structure in Shariah compliant securities in another study. The author examines the fundamental legal principles of Islamic finance. He presents a valuation model that helps distil the essential economic characteristics of Shariah compliant synthetization of conventional finance.

Ahmad & Radzi (2011) conduct an event study investigating the role of prevailing economic conditions in Malaysia, regarding issuance of sukuk and conventional bonds. The authors conclude that significant effects of GDP, market liquidity and Malaysian Ringgit exchange rate with USD exists on the issuance of sukuk in Malaysian capital markets. However, issuance of conventional bonds only affected the exchange rate.

3.2 Previous research on value at risk

Previous studies on sukuk with a VaR approach are rare. Diverging from the other studies, Cakir & Raei (2007) use a different approach analyzing different countries sovereign corporate sukuk and Eurobonds by the same issuer. Proposing that sukuk are different from conventional bonds concerning risk reduction benefits, Cakir & Raei compare the VaR of two portfolios – one including both instruments and another containing Eurobonds only. Their results show that VaR is reduced for the portfolio containing both sukuk and conventional bonds, inferring diversification advantages for the investors combining sukuk and Eurobonds.

Our thesis is inspired by Cakir & Raei study, though enhanced with several modifications. They use both a delta-normal and Monte Carlo simulation method; however, we wanted to use another method and came across bootstrapping. Instead of looking at portfolios, we wanted to look at the different types of bonds issued by the Malaysian government and compare them in order to retrieve a more accurate result in performance of conventional and Islamic bonds.

Using a semiparametric VaR approach, Chen et al. (2014) investigate stock-bond portfolios among the countries included in the G7-group and Australia. The authors estimate market risks after the global financial crisis showing that these increase compared to the pre-crisis benchmark. According to their results, strong evidence of “flight to quality” and “safety first” behavior after the global crisis was found. The study claims that the tail risk forecasts provide adequate regulatory capitals after the financial crisis.
4 Data

The data used in this paper exclusively consists of Malaysian sukuk and bonds. The time period we chose to study was between the 2nd of October 2009 until the 26th of September 2014, looking at both not yet matured and matured bonds between these two dates. Bonds that had matured before the former date or been issued after the prior date were not included. Data availability imposes even further restrictions on the analysis. We did not include the period before 2009 by reason of the lack of data, due to the small numbers of sukuk issued, which had reduced the significance and real values of our results. Due to the fact that prices far from always are available on a given day, we therefore solely observe data on a weekly basis, with the use of end-of-week quotes. This allowed us to obtain information on 505 Malaysian government issues and approximately 13,300 price observations at weekly frequency across four categories; MGS, GII, MTB and MITB. The summary statistics of our data are illustrated in Table 4.1.

In order to obtain our data we primarily used Bloomberg, where we collected last prices, coupon rates, issue- and maturity dates. Unfortunately this database did have its limitations; it lacked information on securities that had matured. This was more prominent in the case of MITB and MTB since they have a maximum length of 1 year. In order to collect more data on these two types of bonds, we used Bond Pricing Agency Malaysia and BNM Bond Info Hub. GII- and MGS-securities with less than ten price observations were dropped, which left us with 51 securities for the prior and 54 for the latter. However, this was not applied in the case of MITB and MTB, since the historical price information on the two types was not as extensive. Following this approach it would have caused a relatively large loss in the amount of securities covered in our paper. In addition, we dropped bonds that did not have any historical price information, which lead to a drop of 28 securities for MITBs and 67 for MTBs. Finally, this resulted in a drop of observations from 505 to 398 issues with 13,246 historical price observations.

Since we are conducting a VaR analysis we are observing at weekly average return (equally-weighted) for the four securities. Due to the limitations of available price data with MTBs and MITBs, we were not able to get price information for all weeks in our time interval for these two. For the former we had information for 249 weeks, while only 235 for the latter. Due to this fact we dropped 14 observations from the MTBs, resulting in an equal amount of observations for weekly returns, which made them comparable. To provide further understanding of the Malaysian bond market and the data used in this paper, an illustration with average weekly
prices over time is provided - Figure 4.1 illustrates GII and MGS while Figure 4.2 illustrates MITB and MTB. Further, as illustrated in Table 4.2, we used a two sample mean comparison (Students T-test) and a two sample Wilcoxon rank-sum test- this to test for the null hypothesis. The latter is a nonparametric test that should be more significant and have greater efficiency to our results due to the nonparametric distribution that our data possesses (Wilcoxon, 1945). Time series correlation is reported in Table 4.3. Average weekly prices over time are illustrated in Figures 4.1 and 4.2.

**Table 4.1:** Illustrates our aggregated data, by bond type, between October 2009 and September 2014. The number of total weekly price observations, maturity and coupon (with minimum, maximum and mean) is also reported.

<table>
<thead>
<tr>
<th>Type</th>
<th>Issues</th>
<th>Price Observations</th>
<th>Maturity (Years)</th>
<th>Coupon (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>MGS</td>
<td>59</td>
<td>7108</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>GII</td>
<td>58</td>
<td>3801</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>MTB</td>
<td>271</td>
<td>1235</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MITB</td>
<td>117</td>
<td>1137</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>505</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Err.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>GII</td>
<td>261</td>
<td>100.988</td>
<td>0.986024</td>
<td>0.061033</td>
<td>98.53529</td>
<td>103.4002</td>
</tr>
<tr>
<td>MGS</td>
<td>261</td>
<td>102.4266</td>
<td>1.299696</td>
<td>0.080449</td>
<td>99.33508</td>
<td>105.0702</td>
</tr>
<tr>
<td>MITB</td>
<td>235</td>
<td>97.81621</td>
<td>0.506453</td>
<td>0.033037</td>
<td>96.91</td>
<td>99.495</td>
</tr>
<tr>
<td>MTB</td>
<td>235</td>
<td>98.18759</td>
<td>0.592326</td>
<td>0.038639</td>
<td>97.01846</td>
<td>99.89423</td>
</tr>
</tbody>
</table>

**Table 4.2:** Illustrates computed T-test and Wilcoxon rank-sum test conducted on the mean of sukuk and conventional bonds for each week, given end-of-week prices and our chosen time period. The descriptive statistics is also reported of these weekly prices.

<table>
<thead>
<tr>
<th>Type</th>
<th>Obs.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Std. Err.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
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<td>96.91</td>
<td>99.495</td>
</tr>
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<td>98.18759</td>
<td>0.592326</td>
<td>0.038639</td>
<td>97.01846</td>
<td>99.89423</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>T-statistic</th>
<th>p-value</th>
<th>Z-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>GII</td>
<td>-26.3937</td>
<td>0.000</td>
<td>11.737</td>
<td>0.000</td>
</tr>
<tr>
<td>MGS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MITB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MTB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.3:** Describes the time series correlation computed from the average weekly prices on our used bonds/sukuk. Graphical illustration can be seen in Figures 4.1 and 4.2.

<table>
<thead>
<tr>
<th>Type</th>
<th>GII</th>
<th>MGS</th>
<th>MITB</th>
<th>MTB</th>
</tr>
</thead>
<tbody>
<tr>
<td>GII</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGS</td>
<td>0.7375</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MITB</td>
<td>-0.4214</td>
<td>-0.405</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>MTB</td>
<td>-0.0342</td>
<td>-0.0117</td>
<td>0.0937</td>
<td>1</td>
</tr>
</tbody>
</table>
4.1 Market quotes

Given our dataset, we standardized all observed bonds to a par value of 100 Malaysian ringgit (MYR). MTB and MITB (discount bonds) were quoted by discount on actual/360 basis by Bloomberg. Par value is denoted by PV:

\[
\text{Discount Yield} = \left[ \frac{(PV - \text{purchase price})}{PV} \right] * \left[ \frac{360}{\text{days to maturity}} \right] \quad (4.1)
\]

The price observations collected through BNM Bond Info are calculated through the bond equivalent yield:

\[
\text{Bond equivalent yield} = \left[ \frac{(PV - \text{purchase price})}{PV} \right] * \left[ \frac{365}{\text{days to maturity}} \right] \quad (4.2)
\]

There is a slight difference between the two formulas, where the discount yield sometimes is considered to be a slightly inaccurate measure of an investor’s actual return on its investment. Nevertheless, it is still widely used as a measure mainly for treasury bills (Finnerty, 1972).

Our MGS (conventional) and GII (Islamic) bonds were quoted in clean prices, which are defined as trade price excluding any accrued interest in between coupon payments for each bond.
5 Methodology and theory

In our analysis we compare GII (Islamic) with MGS (conventional) and MITB (Islamic) with MTB (conventional), separately. We conduct this procedure due to the fact that they have different structures in issuance and returns. Therefore we do not consider the subgroups to be similar enough to compare. Unlike corporate bonds, the credit risk for government issued securities is practically non-existent. We therefore assume no default risk in our method and analysis. The presence of conventional investors in the Islamic capital market suggests that any cross-market arbitrage opportunities should be eliminated. Due to this, we conduct our analysis based on typical no-arbitrage arguments.

Our method is to estimate the market risk, using a historical bootstrap method, from market data collected on Malaysian conventional bonds and sukuk, respectively. We generate hypothetical future prices, conducting 10,000 iterations, using historical data. Thereafter the VaR estimates are calculated, given different holding periods and confidence intervals. We then compare the VaR metrics to determine if there are significant differences between issued sukuk and conventional bonds. The second part of our analysis is conducting an iteration (bootstrap) process, however, in this case controlling for maturities. We use identical holding periods as was used previously.

The outline of this section begins in Section 5.1, with generating the two hypotheses that are investigated in the paper. The focus of Section 5.2 is to increase the understanding of fundamental aspects of VaR, as well as presenting our chosen confidence levels and holding periods used in our paper. In addition, the section includes a brief evaluation of three main VaR approaches. Following this, Section 5.3 describes in detail how we constructed our bootstrap and gathered our VaR estimates. Finally, we describe the process of controlling for different maturities in Section 5.4.

5.1 Hypothesis generation

Given the dual capital market structure in Malaysia where the government has established two separate markets working in synchrony, is an interesting, and in various circumstances, novel subject. Investigating the differences in risk between sukuk and conventional bonds has led us to developing two hypotheses that will be investigated in this paper.
**Hypothesis 1:** The VaR estimates of a sukuk should be equal or higher than the VaR of a comparable conventional bond.

The sukuk instrument should be preferred by Shariah conscious investors rather than the conventional instrument. By reason of this, these investors might be willing to accept a higher risk for Shariah compliant instruments (sukuk). Nevertheless, unconstrained investors should not value Shariah compliance and therefore be indifferent concerning risk between conventional bonds and sukuk. The sukuk market is more exposed to illiquidity due to the relatively low secondary market trading (Krichene, 2013). Due to the asset-backed structure of a sukuk, the longer a sukuk is active on market the higher should the risk exposure be (e.g. if the price of an asset decreases). We therefore argue that the VaR estimates should be equal or higher than its conventional counterpart.

**Hypothesis 2:** The difference in VaR estimates between sukuk and conventional bonds should increase, when controlling for maturities.

Diverging from the first hypothesis, we argue that VaR should increase when generating hypothetical future values when controlling for maturities. Previous studies observe that sukuk is more exposed to numerous risks compared to conventional bonds. Jobst (2007) argue that risks such as liquidity risk, interest rate risk and/or regulatory risk is widely affecting the sukuk. In addition, Krichene (2013) suggests there is a “Shariah compliance risk” that exists and affects the sukuk market. Cakir & Raei (2007) consider that the illiquidity issues of the sukuk market are caused by the segmented market structure. We therefore argue that the differences in VaR between sukuk and conventional bonds should increase, when controlling for maturities.

**5.2 Estimating market risk with VaR measurements**

For a long time researchers in the field of financial economics have recognized the significance of measuring the risk of financial assets and securities. The first recognized work goes back to 1959 by Harry Markowitz, who explored the appropriate definition and measurement of risk (Markowitz, 1959). VaR measures the market risk of these assets or securities, which mean the risk of fluctuation in commodity prices, equity prices, interest rates etc. might result in a decline of assets or bonds (Hendricks, 1996). The recognition of different VaR models has been increasing since Markowitz paper, which was fortified by Basel Committee on Banking Supervisions (BIS). In their risk-based capital proposal they recognized the
use of such models, reliant on important quantitative and qualitative standards (BIS, 2005).

Today, different approaches are used by risk managers when calculating the risk of securities such as bonds. Most of these methods use historical data to generate hypothetical future values; however, they often define the past differently and are also built on different assumptions regarding both the past and future. These different methods are most commonly summarized by three main categories.

The Delta-normal method (covariance-variance) method is possibly the most commonly used method. This is due to its simplicity and fast computation where historical data is used to calculate different parameters such as mean, standard deviation and correlation. Typically when used, the method assumes normal distribution which allows volatility to be described in terms of standard deviation. However, the assumption of normal distribution is a major critique of this method since it ignores the possibility of fat tails and extreme outcomes that often can be observed in reality (Beder, 1995).

The second commonly used method is historical simulation. Given from its name, the most important concept is assuming that history repeats itself which means that no other values than the ones observed in history can be simulated in the future. In addition to this, the method makes no specific assumption about the distributions of returns. Through collecting a set of risk factors, for example changes in prices over a specified time period, one can predict future scenarios with statistical significance. Using this as foundation, the bootstrap method, also known as the nonparametric bootstrap method, has evolved including the concept of efficiently estimate future returns through a given number of iterations (Cheung, 2012). In this paper we selected the bootstrap method, and therefore give a more detailed description in Sections 5.3 and 5.4.

Finally, the third method is known as the Monte Carlo simulation method. This process assumes that returns on assets are driven by a known stochastic process rather than through historical returns. This means that, unlike the bootstrap method, values that never have been observed in history can occur. The methodology involves calibration of a model for the return process, followed by the possibility of generating several thousands of scenarios. The main drawback is the possibility of misspecifying the model, which might lead to the retrieval of incorrect VaR-values (Stambaugh, 1996).

Through determining how much the value of a financial instrument could decline over a given time period, VaR measures the market risk with a given probability as a result of changes in market rates or prices. The VaR measurement as a financial
instrument measuring market risk is generally used in the same line of action. Through calculating the 5\textsuperscript{th} percentile, one will then find the 95\% confidence level (Efron and Tibshirani, 1986). For example, if estimating the risk at a 95\% confidence level, one can assume that the largest possible loss will only exceed the given value 5\% of the time (Hendricks, 1996). However, the notation differs among studies. We chose the percentile method since it is the most widely used measure. We therefore explain the notation used in this paper; for example, let \( \pi \) denote the price of a conventional bond/sukuk. In that case, the VaR\(_\pi\) of the yield \( \pi \), at confidence level \( \alpha \), is the \( \alpha \)-quantile of \( \pi \) defined by:

\[
\text{Probability}\{ \pi \leq \text{VaR} \} = \alpha
\]  

(5.1)

Although the VaR estimate depends on the level of confidence \( \alpha \), it is in general not shown explicitly for simplicity of notation. Hence, the probability that the value of an asset would fall below \( \pi \) is \( \alpha \) (as shown in equation 5.1). The values of \( \alpha \) frequently used are; 0.05, 0.01 and 0.001, which defines confidence intervals 95\%, 99\% and 99.9\% (Chen, 2014).

Multiple components might affect the outcomes of this measurement, the two most important once are which confidence level is chosen, as well as the holding period. The method assumes that the bond composition does not change over the holding period. Due to this fact, arguments of shorter holding periods are made since the compositions of active trading portfolios constantly adapt to change in the market. Thus, we have decided to study holding periods with 1, 4, 26 and 52 weeks.

5.3 The bootstrap method

The primary attraction of the nonparametric bootstrap approach is avoiding the possibility of misspecifying the distributions of average returns (Cheung, 2012). This is the one of the primary reasons to why we chose this method, since it reduces the risk of over- or under estimating VaR.

All price observations gathered for our MGS and GII bonds are quoted in clean prices. Since these are coupon bonds, that acquire interest semi-annually, we desired to convert the values to dirty prices. This was done since we wanted to retrieve more accurate pricing of our available bonds. The dirty price \( (dP_t) \), is equal to the clean price today \( (cP_t) \) plus the actual amount of coupon \( (C) \) that is acquired semi-annually:

\[
dP_t = cP_t + C
\]  

(5.2)
Since our MTBs and MITBs are quoted in discount- and bond equivalent yield, we converted these to their clean prices. Since these are treasury bills that do not obtain regular coupon payments, we were not able to calculate their dirty prices. A consequence of this is that we would retrieve slightly inaccurate prices of bonds, since the discount yield formula assumes months consisting of 30 days (360 days in a year). Our assumption that a year consists of 52 weeks leads to a difference between days. Since daily prices were lacking on the market, we observed prices on a weekly basis, which also meant eliminating the possibility of adjusting this. We calculated the clean price of a treasury bill by using the following equation:

\[ cP_t = \text{Par value} - \left( \frac{\text{Discount Rate} \times \text{Weeks left}}{52} \right) \]  

(5.3)

Having adjusted prices to their coupon we can calculate the average price for every week of our chosen bonds. Doing this we obtain 261 weekly average prices for our coupon bearing bonds (GII and MGS), 248 for conventional treasury bills (MTB) and 235 weekly average prices for Islamic treasury bills (MITB). As previously mentioned, the objective of this paper is to compare the two treasury bills with each other we had to remove the dates for MTBs that were not matching with their Islamic equivalent. We believed that an elimination of 13 weeks was necessary to have two comparable bonds. In doing so, the number of observed weekly average prices decreases which obviously might affect our estimated VaR in the future. To calculate the average of weekly prices \( P_t \), we used equation:

\[ P_t = \bar{X} = \frac{1}{n} \sum_{i=1}^{n} P_{t,i} \]  

(5.4)

Observing these different weekly prices, weekly returns could now be calculated. This was done in order to retrieve values that later was going to be resampled \( n \) times, which in our case was \( n=10,000 \). To do this we use equation 5.5, where \( wr \) is weekly return, \( P_t \) is the average weekly price observed today and \( P_{t-1} \) is the average weekly price from previous week:

\[ wr = \frac{P_t - P_{t-1}}{P_t} \]  

(5.5)

Since the first observed week in our sample does not have a previous week to calculate its return, we retrieved 260 and 234 observed weekly returns for our coupon bonds and treasury bills, respectively. This dataset of values then got resampled \( n \) times, with the possibility of replacement. Since we were interested in estimating possible future VaR from our historical data, we needed to calculate the
cumulative change. The calculation is as follows; tomorrow’s price \( P_{t+1} \), is equal to \( P_t \) multiplied by the observed weekly return:

\[
P_{t+1} = P_t \times w_{rt}
\]

(5.6)

With the knowledge of both weekly returns and the number of iterations, we can retrieve \( n \) values for different holding periods. Thereafter, we calculate the cumulative return, as described in equation 5.6, given the normalization and a par value of 100. As a result we can estimate our three chosen confidence levels given four selected holding periods.

5.4 Estimating VaR when controlling for maturities

In order to test our second hypothesis, we had to start by sorting all bonds with similar maturity to each other. The coupon bearing bonds, GII (Islamic) and MGS (conventional), had several different maturities. Therefore we bundled these in four groups where all 3 – 3.5, 5 – 5.5, 7 – 7.5 and 10 – 10.5 year bonds where sorted respectively. For simplicity we call these 3, 5, 7 and 10 year bonds.

We did not sort the bonds after the period that was left until maturity given a date we decided, due to two prominent factors. Firstly, as previously mentioned, the bootstrap method’s main assumption is predicting the future using historical values. Hence, predicting the future e.g. for a three year bond has to be conducted by solely looking at bonds with a maturity of that number. Furthermore, such a division would cause an exclusion of information on many bonds which would lead to a lower amount of observed prices, especially for sukuk with longer maturity.

After controlling for maturities, different quantities of weekly prices for MGS and GIIIs were observed. Generally, there was considerably more data available for conventional bonds, which also lead to a greater number of weekly prices (and therefore returns) to be observed. However, since we wanted to make these different bonds and maturities as comparable as possible, we once again had to reduce the number of observed weeks, so that weeks of observed prices would match. Arguments against this decision can be made, where one can claim that the exclusion of weekly observations might possibly lead to a slightly inaccurate estimated VaR. However, disregarding the differences in the number of observed weekly prices, observations would have worsen our comparison between our bonds and therefore considered as a necessity. We retrieved 204, 251, 156 and 261 comparable weekly prices for 3, 5, 7 and 10 year Islamic and coupon-bearing conventional bonds, respectively. Given these values, we were able to repeat the same bootstrap process as presented in Section 5.3.
The process of comparing different maturities was also applied on our Islamic and conventional treasury bills. The prior have two maturity lengths, 39 and 52 weeks, while the latter have maturities of 13, 26 and 52 weeks. This means that the only comparable length of treasury bills have a maturity of 52 weeks. The lack of data resulted in a retrieval of 149 weekly price observations.
6 Results

In this section, we will provide results for our bootstrap method where we have calculated the VaR estimates. We have organized our results in two subsections. The respective tables are shown at the end of each subsection.

In Section 6.1, we present the descriptive statistics and results we found when looking at all our Islamic and conventional bonds, given four different holding periods. We find significant evidence of lower VaR estimates for sukuk compared to conventional bonds, both in the case of treasury bills and coupon-bearing bonds.

In Section 6.2, we present the results when controlling for different maturities. We observe the VaR for coupon bearing bonds (GII and MGS) with a 3, 5, 7 and 10 year maturity – given the same holding periods used in the previous bootstrap. The treasury bills results will be presented with the maximum possible maturity which is one year. We find strong evidence that the VaR estimates of Islamic coupon bearing bonds (GII) are relatively higher than the conventional bonds (MGS) when controlling for different maturities. However, the results show significantly lower VaR estimates for Islamic treasury bills (MITB) compared to conventional treasury bills (MTB).

6.1 VaR estimates for all maturities aggregated together

The results of the nonparametric bootstrap with adjustment to the semi-annual coupon payments are presented in Tables 6.1 and 6.2, respectively. Our coupon bearing bonds (MGS and GII) have 260 weekly return observations, which is the maximum possible amount of weeks given our time interval. Our treasury bills, MTB and MITB, have 235 weekly returns observed.

Using 10,000 iterations the bootstrap produces some revealing outcomes, which can be best observed in the tables presented at the end of this section. Due to the amount of results, we have restricted the textual description, and instead focused on providing a readable table. Nevertheless, to gain an understanding on how one should interpret our results, we will provide a shorter description.

Looking at Table 6.1, one can understand that, for example, holding an Islamic bond (GII) for 4 weeks leads to a maximum potential loss (VaR) of 2.48% at a 99% confidence level. While the equivalent, non-Islamic, coupon bearing bond (MGS) will have a higher VaR of 3.41%.

A similar comparison can be done with our two treasury bills that consist of shorter maturities (maximum 1 year). Given a holding period of 4 weeks, the Islamic treasury bill (MITB) illustrates a maximum potential loss of 2.39% at a 99%
confidence level. An MTB using the same criteria as above has a VaR of 3.44 %, which is significantly higher than an Islamic bill. Further results can be obtained in Table 6.2.

Throughout our results we find a strong clear pattern - Islamic bonds have a lower VaR than conventional bonds. This can be observed in Tables 6.1 and 6.2. Further, our results observe a positive correlation between VaR and holding period in both Islamic and conventional securities. This is explained by several factors, but mainly the risks becomes higher the longer one holds the bond due to the differences in market risk, e.g. liquidity risk, interest rate change. Furthermore, we have added two additional confidence levels (95% and 99.9%) in our results to provide diversification. This decision does not change the general outcome of our analysis. However, depending on what certainty a bondholder is interested in, it will affect the maximum potential loss (VaR) observed.

In unreported results we find interesting kurtosis values when computing the VaR estimates. The kurtosis varies between Islamic and conventional securities – the kurtosis values are in majority below three, which indicates a platykurtic distribution. The platykurtic distribution obtained conducting the bootstrap points out that the density around the mean is high and the tails are thin (Joanes et al., 1998). Thus, we can observe that the kurtosis decreases the longer the maturities are.

The results show that there is a positive correlation between VaR estimates and standard deviation among both Islamic and conventional bonds. This implies that the Islamic bonds have a lower standard deviation and a lower VaR compared to conventional bonds. This can be fortified by observing the range (difference between max and min). The conventional bonds (MGS and MTB) have a wider range than the Islamic (GII and MITB). Furthermore, the variance is also higher among the Malaysian conventional bonds, which indicates more movement in prices compared to Islamic bonds. When conducting thousands of iterations, this can affect the tail risk (VaR) as we can see in the results presented in the tables.

---

2 Kurtosis, standard deviation and other descriptive statistics are available upon request.
Table 6.1: Illustrates the VaR for all Islamic (GII) and conventional (MGS) coupon bearing bonds, given different holding periods. Since we have normalized the par value to 100 MYR, we illustrate the lowest possible sales price at three different confidence levels, as well as the highest possible percentage loss in parenthesis.

<table>
<thead>
<tr>
<th>Holding Period</th>
<th>Type</th>
<th>95% VaR (loss in percent)</th>
<th>99% VaR (loss in percent)</th>
<th>99.9% VaR (loss in percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
<td>GII</td>
<td>99.18 (0.82%)</td>
<td>98.50 (1.50%)</td>
<td>98.15 (1.85%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>99.03 (0.97%)</td>
<td>98.19 (1.81%)</td>
<td>96.66 (3.34%)</td>
</tr>
<tr>
<td>4 weeks</td>
<td>GII</td>
<td>98.31 (1.69%)</td>
<td>97.52 (2.48%)</td>
<td>96.54 (3.46%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>97.83 (2.17%)</td>
<td>96.59 (3.41%)</td>
<td>95.15 (4.85%)</td>
</tr>
<tr>
<td>26 weeks</td>
<td>GII</td>
<td>95.75 (4.25%)</td>
<td>93.88 (6.12%)</td>
<td>92.22 (7.78%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>94.54 (5.46%)</td>
<td>92.23 (7.77%)</td>
<td>90.20 (9.80%)</td>
</tr>
<tr>
<td>52 weeks</td>
<td>GII</td>
<td>94.04 (5.96%)</td>
<td>91.55 (8.45%)</td>
<td>89.60 (10.40%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>92.33 (7.67%)</td>
<td>89.31 (10.69%)</td>
<td>86.13 (13.87%)</td>
</tr>
</tbody>
</table>

Table 6.2: Illustrates the VaR for two government treasury bills, MITB (Islamic) and MTB (Conventional). The same criteria’s as in the previous table are applied here.

<table>
<thead>
<tr>
<th>Holding Period</th>
<th>Type</th>
<th>95% VaR (loss in percent)</th>
<th>99% VaR (loss in percent)</th>
<th>99.9% VaR (loss in percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
<td>MITB</td>
<td>99.15 (0.85%)</td>
<td>98.82 (1.18%)</td>
<td>98.08 (1.92%)</td>
</tr>
<tr>
<td></td>
<td>MTB</td>
<td>98.70 (1.29%)</td>
<td>98.25 (1.75%)</td>
<td>97.47 (2.53%)</td>
</tr>
<tr>
<td>4 weeks</td>
<td>MITB</td>
<td>98.38 (1.62%)</td>
<td>97.61 (2.39%)</td>
<td>96.60 (3.40%)</td>
</tr>
<tr>
<td></td>
<td>MTB</td>
<td>97.72 (2.28%)</td>
<td>96.56 (3.44%)</td>
<td>95.36 (4.64%)</td>
</tr>
<tr>
<td>26 weeks</td>
<td>MITB</td>
<td>95.92 (4.08%)</td>
<td>94.30 (5.70%)</td>
<td>92.50 (7.45%)</td>
</tr>
<tr>
<td></td>
<td>MTB</td>
<td>94.39 (5.61%)</td>
<td>92.23 (7.77%)</td>
<td>90.02 (9.98%)</td>
</tr>
<tr>
<td>52 weeks</td>
<td>MITB</td>
<td>94.32 (5.68%)</td>
<td>92.01 (7.99%)</td>
<td>89.55 (10.45%)</td>
</tr>
<tr>
<td></td>
<td>MTB</td>
<td>92.05 (7.95%)</td>
<td>89.18 (10.82%)</td>
<td>85.35 (14.65%)</td>
</tr>
</tbody>
</table>

Figure 6.1 – 6.2: Distribution of sukuk and conventional bonds prices using the non-parametric bootstrapping method. Only showing the distribution of 10,000 iterations with a 4 week buy and hold-strategy. The VaR estimates given 95, 99 and 99.9% confidence level are linearly highlighted. All Islamic bonds have a (green) fill color, while conventional are (grey).

Figure 6.3 – 6.4: Distribution of Islamic and conventional treasury bill prices using the non-parametric bootstrap method. The same criteria as used in the previous table are applied here. All Islamic treasury bills have a (green) fill color, while conventional are (grey).
6.2 VaR estimates when controlling for maturities

In this section we present the results obtained when looking for the VaR estimates on GII and MGS bonds – when controlling for maturities. Next, we present the results when solely looking at Islamic and conventional treasury bills with a maturity of 52 weeks (1 year). Lastly, we will compare the results obtained when controlling for maturities with the previous results obtained using aggregated maturities. The results are presented in Tables 6.3 - 6.7.

Once again, we will restrict our description of our results through text. When looking at Tables 6.3 – 6.6, one can observe significant differences from previous results. Our Islamic coupon bearing bonds now have a higher VaR compared to its conventional counterpart. These results are observed through all different maturities and holding periods. This contradicts our previous result presented in Section 6.1, where we observed that Islamic bonds were to be considered less risky. There might be several reasons to why these results have appeared. First, as mentioned in our methodology Section 5.4, the exclusion of weekly returns due to lack of price observations, mainly with Islamic bonds, have affected the number weekly returns that later was simulated 10,000 times. Secondly, separating bonds with different maturities from each other lead to a more isolated iteration process, with fewer bonds affecting the average weekly price and return. Nevertheless, these average prices might be a better representation of the “actual” price on the market.

The results when looking at Islamic and conventional treasury bills with a maturity of 52 weeks are presented in Table 6.7. We find evidence that Islamic treasury bills are still considered less risky compared to its conventional equivalent, due to its lower VaR. Interesting is that the estimated VaR is relatively similar to the previous values obtained in Section 6.1 (compare Table 6.2. and 6.7). There are evidently differences to be observed, when comparing the different holding periods and confidence levels, though in some cases they may be considered small. Another significant result is that, in general, the estimated VaR-values are lower in these results, compared to the results obtained when looking for all Islamic and conventional treasury bills. This indicates that our VaR-values for treasury bills retrieved from Section 6.1 were overestimated. Therefore, an investor interested in Malaysian treasury bills with a maturity of 52-weeks, should observe the results presented in Table 6.7, since they are a better representation of the actual market.

When conducting an isolated iteration process controlling for maturities, we found clear results that the GII had higher market risk (VaR) than its conventional counterpart (MGS). This result can be observed throughout all maturities. The market risk varies for different maturities which the obtained results show. Further,
we can observe that the standard deviation is higher for the Islamic GII compared to conventional MGS. This result diverges from the previous result when not sorting bonds after different maturities. In addition, the kurtosis is higher for MGS compared to GII. Some of the MGS bonds (5- and 7 year) have leptokurtic distribution (kurtosis value over 3) which entails thicker tails compared to the GII sukuk.

During the course of our results, we find significant evidence comparing Islamic bills (MITB) with conventional (MTB). The VaR estimates for MITB are constantly lower than for the MTB in all controlled maturities and holding periods which implies that Islamic treasury bills are less risky.
**Tables 6.3 – 6.6:** Illustrates the descriptive statistics and results of a 3, 5, 7 and 10-year GII and MGS bond. Including different holding periods and selected confidence levels. As stated in the data section, all bonds have a normalized par value equal to 100 MYR.

<table>
<thead>
<tr>
<th>Holding Period</th>
<th>Type</th>
<th>95% VaR (loss in percent)</th>
<th>99% VaR (loss in percent)</th>
<th>99.9 % VaR (loss in percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
<td>GII</td>
<td>99.41 (0.59%)</td>
<td>98.24 (1.76%)</td>
<td>98.01 (1.99%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>99.55 (0.45%)</td>
<td>99.38 (0.62%)</td>
<td>99.14 (0.86%)</td>
</tr>
<tr>
<td>3 Y</td>
<td>GII</td>
<td>98.34 (1.66%)</td>
<td>97.55 (2.45%)</td>
<td>96.25 (3.75%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>99.17 (0.83%)</td>
<td>98.81 (1.19%)</td>
<td>98.28 (1.72%)</td>
</tr>
<tr>
<td>4 weeks</td>
<td>GII</td>
<td>98.07 (3.93%)</td>
<td>94.23 (5.77%)</td>
<td>92.47 (7.53%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>97.95 (2.05%)</td>
<td>97.13 (2.87%)</td>
<td>96.09 (3.91%)</td>
</tr>
<tr>
<td>26 weeks</td>
<td>GII</td>
<td>94.50 (5.50%)</td>
<td>92.19 (7.81%)</td>
<td>89.84 (10.16%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>97.16 (2.84%)</td>
<td>95.90 (4.10%)</td>
<td>94.59 (5.41%)</td>
</tr>
<tr>
<td>52 weeks</td>
<td>GII</td>
<td>94.15 (0.95%)</td>
<td>98.11 (1.89%)</td>
<td>96.11 (3.89%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>99.31 (0.39%)</td>
<td>98.96 (1.60%)</td>
<td>97.94 (2.51%)</td>
</tr>
<tr>
<td>1 week</td>
<td>GII</td>
<td>98.26 (1.74%)</td>
<td>97.14 (2.59%)</td>
<td>96.58 (3.86%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>98.45 (1.55%)</td>
<td>97.35 (2.65%)</td>
<td>96.16 (3.84%)</td>
</tr>
<tr>
<td>4 weeks</td>
<td>GII</td>
<td>96.03 (5.97%)</td>
<td>91.48 (8.52%)</td>
<td>88.76 (11.24%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>96.08 (3.92%)</td>
<td>94.48 (5.52%)</td>
<td>92.50 (7.50%)</td>
</tr>
<tr>
<td>26 weeks</td>
<td>GII</td>
<td>91.80 (8.20%)</td>
<td>88.42 (11.58%)</td>
<td>84.89 (15.11%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>94.29 (5.71%)</td>
<td>92.11 (7.89%)</td>
<td>89.47 (10.53%)</td>
</tr>
<tr>
<td>52 weeks</td>
<td>GII</td>
<td>91.80 (8.20%)</td>
<td>88.42 (11.58%)</td>
<td>84.89 (15.11%)</td>
</tr>
<tr>
<td></td>
<td>MGS</td>
<td>94.29 (5.71%)</td>
<td>92.11 (7.89%)</td>
<td>89.47 (10.53%)</td>
</tr>
</tbody>
</table>

**Table 6.7:** Illustrates the descriptive statistics and results of a 1-year treasury bill, with either a Islamic (MITB) or conventional (MTB) structure.

<table>
<thead>
<tr>
<th>Holding Period</th>
<th>Type</th>
<th>95% VaR (loss in percent)</th>
<th>99% VaR (loss in percent)</th>
<th>99.9 % VaR (loss in percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
<td>MITB</td>
<td>99.20 (0.80%)</td>
<td>98.82 (1.18%)</td>
<td>98.08 (1.92%)</td>
</tr>
<tr>
<td></td>
<td>MTB</td>
<td>98.64 (1.36%)</td>
<td>97.83 (1.27%)</td>
<td>97.65 (2.35%)</td>
</tr>
<tr>
<td>4 weeks</td>
<td>MITB</td>
<td>98.55 (1.45%)</td>
<td>97.77 (2.23%)</td>
<td>96.71 (3.29%)</td>
</tr>
<tr>
<td></td>
<td>MTB</td>
<td>97.63 (2.37%)</td>
<td>96.48 (3.52%)</td>
<td>94.85 (5.15%)</td>
</tr>
<tr>
<td>26 weeks</td>
<td>MITB</td>
<td>96.28 (3.72%)</td>
<td>94.81 (5.19%)</td>
<td>92.98 (7.02%)</td>
</tr>
<tr>
<td></td>
<td>MTB</td>
<td>94.02 (5.98%)</td>
<td>91.62 (8.38%)</td>
<td>89.16 (10.84%)</td>
</tr>
<tr>
<td>52 weeks</td>
<td>MITB</td>
<td>94.79 (5.21%)</td>
<td>92.45 (7.55%)</td>
<td>89.89 (10.11%)</td>
</tr>
<tr>
<td></td>
<td>MTB</td>
<td>91.71 (8.29%)</td>
<td>88.41 (11.59%)</td>
<td>84.95 (15.05%)</td>
</tr>
</tbody>
</table>
7 Limitations and conclusion

7.1 Limitations and suggestions for future research

Throughout the paper the limiting availability of data has been reoccurring multiple times. The bond market in Malaysia is no exception of this, especially the sukuk market has very limited amount of trading data. Due to our commitment of continuously having comparable bonds, we several times had to drop weekly to average price observations. Given the nature of the bootstrap method, the results might have led to an over- or underestimation of retrieved VaR estimates. In addition, another potential issue is the use of multiple sources led to the use of different end-of-week quotes, which might not reflect the “true” market.

Future researchers interested in calculating market risks with Malaysian government bonds, could continue to develop our analysis when this emerging market develops even further. The illiquidity aspect that has caused lack of both weekly and especially daily data might not be as prominent in the future, in which a similar study could be conducted using our or other available VaR methods to retain more significant estimates. Further, investigating the change in participation of Muslim investors might constitute interesting research. Finding evidence suggesting a low increase in participation might partially explain the issue of the existing higher liquidity risk on the Islamic bond market. In addition, it will aid future researchers explaining the differences in price, risk and therefore return.

7.2 Conclusion

The capital market system in Malaysia is unique in that it has both the conventional and Islamic interest-free mechanisms operating in synchrony. This structure and the extensive growth of investment in sukuk constitute an interesting study project.

We found that Islamic coupon bonds and treasury bills had a lower value at risk than its conventional equivalent, during all buy and hold-strategies. These results are in line with the previous study conducted by Cakir & Raei (2007). We can, given our results, reject our first hypothesis that states that the VaR estimates of a sukuk are not equal or higher compared to a conventional bond.

When controlling for maturities, we obtain different results than before. The results show that Islamic coupon bearing bonds obtain higher VaR estimates than its conventional counterpart. The Islamic treasury bills continue to be less risky than their conventional counterpart. However, we can observe an overestimation compared to the results obtained from the previous bootstrap when we looked at all treasury bills. Our second hypothesis can therefore be partially rejected.
Our results suggest that there are significant differences in risk between sukuk and conventional bonds as well as between Islamic and conventional treasury bills. The clear evidence of illiquidity on the sukuk market and the additional dimension of an underlying asset, suggest that this form of security is exposed to higher risk that increase with longer maturities since the price of the asset might, for example, fall. This advocates arguments against rating agencies rating Islamic and conventional bonds equally where one can argue that there is clear evidence that Islamic and conventional bonds need to be rated differently.

Another interesting aspect is the disadvantages of having two parallel market systems which might affect the exposure of illiquidity risk. There are several aspects to this. The spread of investors increase, compared to only having one market. This might lead to a lower liquidity over these two markets. On the other hand, one might argue that the increased participation of Muslim investors leads to an increase in activity on the market. However, the issue of the “true” Shariah compliance of sukuk leads to a possible limitation against increased participation of Muslim investors. In order to continue the growth of the Islamic capital market system, these risks and uncertainties needs to be solved.
References


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Appendices

Appendix A – Sukuk principles

Information of the below described principles are adapted from Bank Negara Malaysia and Securities Commission Malaysia (2009).

**Bai al-Inah principle.** Sukuk that are asset based and yield a profit. Observe that the sukuk is asset-based and not asset-backed, as the asset does not constitute collateral. The investor buys an asset from the issuer for a direct cash payment. Immediately after the transaction, the investor sells back the asset on a pre-agreed deferred payment basis (called “coupons”). The sukuk based on this principle does not generate any coupon payments.

**Bay al-Dayn.** The principle is purely the process of selling debt. Elements of the principle are always present if a transferrable sukuk certificate is issued. Furthermore, The Bay al-Dayn constitutes the foundation of the Islamic secondary market.

**Bai Bithaman Ajil.** This sukuk principle allows for purchases on an installment and deferred payment basis. As a Bai Bithaman Ajil sukuk allow for installments, it is coupon-bearing.

**Murabaha.** A principle applied on GII-issued sukuk. A sukuk based on the Murabaha principle are asset backed, but unlike Bai al-Inah, do not yield a profit. As Figure 2.1 illustrates, the transaction is based on a commodity (typically crude palm oil) and the fund flows are set on a cost plus sale basis instead of being profit-based. Compared to Bai al-Inah, the transaction structure is more complex when the Murabaha principle engages more parties; a Special Purpose Vehicle (SPV) and a commodity market, in addition to the already active issuer and investor.

The appointed agent, the SPV, purchases the asset on the investor’s behalf. The SPV then sells the purchased asset to the government at a (pre-determined) mark-up price – paid on a deferred payment basis. Lastly, the issuer sells the asset to raise funds.

**Quard al-Hasan.** This principle prohibits any official compensation for lending money. Sukuk based on Quard al-Hasan are issued and redeemed at par without any coupon payments. The first sukuk issued by the Malaysian government was based on this principle and the principle is based on the strictest interpretation of the law of Shariah. Sukuk based on this principle are not traded on the secondary market.
Appendix B – Complementing VaR histograms

Figure 6.5 – 6.11: Distribution of four selected maturities on sukuk and conventional coupon bond prices using the non-parametric bootstrap method. Illustrating the distribution of 10,000 bootstrap iterations with a 4 week buy and hold-strategy. The VaR given 95, 99 and 99.9% confidence level are linearly highlighted. All Islamic bonds have a (green) fill color, while conventional are (grey). Y equals years.

Figure 6.5 – 6.11: Distribution of possible prices on 1 year treasury bills, using the non-parametric bootstrap method. All Islamic bonds have a (green) fill color, while conventional are (grey). Y=Years