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Sukuk and Bond Puzzle: An Analysis with Characteristics Matched Portfolios

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Sukuk and Bond Puzzle: An Analysis with Characteristics Matched Portfolios

Abstract

Sukuk is an Islamic financial asset structured to offer a bond equivalent cash flow to its holders. The difference between them lies with their contractual mechanism: bond constitutes a lender-borrower relationship between the holders and issuer while sukuk constitutes either- a lessor-lessee, buyer-seller or a partnership relationship. Therefore, we examine if they are different assets concerning their return and risk profile. Given the difference between them, it is also important to know what drives sukuk returns. The study finds that sukuk return is insignificantly different from that of the bond, but risk is significantly higher. However, we find that sukuk investors are not sufficiently compensated for the higher level of risks. Overall, our study finds that sukuk market performance has no relationship with the bond market performance, but the market performance of the industry in which the sukuk-financed project belongs has a significant effect on the performance of sukuk.

Key Words: Sukuk, Conventional Bond, Sukuk Performance, Industry Performance.

1. Introduction

Sukuk as an Islamic alternative to conventional bond is engineered to replicate cash flows of similar bonds while complying the Islamic tenets that prohibit an interest-based transaction, forbid investment in illicit sectors, and require sukuk cash flows to generate from the earnings of sukuk-financed asset known as the underlying asset. The earlier researchers compare the performance of sukuk with that of the bonds assuming that the sukuk is an alternative borrowing instrument to conventional bond, but the findings are generally inconsistent. Therefore, existing studies cannot help us to know if sukuk perform indeed differently from (or similarly to) the conventional bonds. The reason because none of the prior studies focuses on heterogeneous characters of the different bonds and sukuk. Instead, researchers assume sukuk and bonds are substitute assets and compare them based on composite indices. A comparison between sukuk and bonds without matching underlying characteristics is less meaningful and cannot help us to identify if sukuk and bonds are functionally similar or different. We need to know this because it is difficult to understand the risk of a sukuk without adequate knowledge of its underlying contractual features in comparison to that of a matching bond. It is important because we do not know yet what are the common risk factors of a sukuk and how to estimate an expected return for this Islamic financing instrument.

A sukuk differentiates from a bond because it does not constitute a lender-borrower relationship between the holders and issuer of a sukuk. The issuer finances an asset with sukuk proceeds, but asset ownership belongs to the sukuk holders for a fixed tenure. According to contract, the issuer shares earnings from the asset with sukuk holders based on a mutually determined ratio. This means a sukuk holder's cash flow would depend on the earnings of underlying assets invested in a business project. Therefore, sukuk market performance could also be inherently linked to the profitability of the underlying assets (Meager, 2017; Önder, 2016; Ahmed *et al.* 2015; Safari *et al.* 2013; Afshar,

2013; Alqahtani, 2012; Zin *et al.* 2011). Hence, *ceteris paribus*, we conjecture that the overall growth and productivity of the industry in which the sukuk financed-project belongs might commonly influence the profitability of the sukuk underlying asset, which means the market performance of sukuk could have a relationship with that of the respective industrial sector. However, the earlier sukuk studies did not focus on this matter.

In this study, we address two research questions. First, does a sukuk behave like a conventional bond in the financial market? Second, is the market performance of sukuk associated with that of the corresponding industrial sector? An investigation addressing these questions is important to enhance the body of corporate finance literature. For instance, sukuk might have a better prospect as a debt financing instrument primarily in Muslim majority countries if both sukuk and bond are perfect substitutes. Otherwise, there might have reasons to use (or not to use) sukuk for raising debt capital from the wider financial markets globally when sukuk and bond are functionally different. Moreover, the use of sukuk in the capital structure could alter the agency relationship between the equity and debt holders. An assessment of sukuk performance based on the interest-based benchmark may not be appropriate practice if sukuk is not a bond substitute, then it is valuable to reveal whether the performance of sukuk is concomitant with the performance of the industry.

In relation to this study, researchers examined sukuk and bond across different dimensions such as risk and return performance (Arif and Safari, 2012; Fathurahman & Fitriati, 2013; Afshar, 2013; Zakaria *et al.* 2013; Mosaid and Boutti, 2014; Afshar and Muhtaseb, 2014; Patrick & Kpodar, 2015; Bacha *et al.* 2015), sukuk announcement effect on firm valuation (Godlewski *et al.* 2016; Godlewski *et al.* 2013; Elian & Taft, 2014), valuation of sukuk (Ahmed *et al.* 2014; Safairi *et al.* 2013; Sukor *et al.* 2008; Ramasamy, 2011.b), agency costs and information asymmetry in sukuk investment (Halim *et al.* 2017; Nagano, 2017; Ebrahim *et al.* 2016; Klein & Weill, 2016; Klein *et al.* 2015), sukuk capital structure effect (Hossain *et al.* 2018; Mohamed *et al.* 2015), and challenges and limitations in sukuk market (Alam, 2009; Hanefah *et al.* 2013; Chazi *et al.* 2014; Rusgianto & Ahmad, 2013; Zakaria *et al.* 2013; Jobst *et al.* 2008). However, these studies do not provide a clear idea about the risk and return behavior of sukuk since the results are inconsistent across the studies. This could be because earlier researchers did not align the heterogeneous features of different sukuk contracts with those of the similar bonds. Hence, the findings of these studies are less useful for the academics and practitioners. In this background, we undertake a new research on sukuk and bond behavior by matching their cash flow characteristics across different types of underlying contracts. We also examine if the sukuk performance is subject to the performance of the industry in which the sukuk underlying asset is invested. To the best of our knowledge, no prior study has looked into this matter.

We implement this study based on the performance of 627 Malaysian sukuk over a period of 7 years of daily data from 2010 to 2016, comprising of a total of 1724 observations for each sukuk. An examination of Malaysian sukuk is important because sukuk was first listed in this market and currently accounts for more than 57 percent of the global sukuk market as on 2015 (IIFM, 2016; pp.43). We examine the first research question by creating the sukuk portfolios based on the homogeneous characteristics and matching them with the relevant bond portfolios. Accordingly, we construct a fixed cash flow (FCF) sukuk portfolio and a non-fixed cash flow (NFCF) sukuk portfolio. For example, Ijarah and Murabaha sukuk are grouped under FCF sukuk portfolio, because they generally offer a fixed cash flow to sukuk holders which is much similar to a fixed coupon payment as in the bond, but Mudarabah and Musharakah sukuk are clustered under NFCF sukuk portfolios, as they normally distribute a part of the profit generated by sukuk underlying assets to the sukuk holders. In the next stage, we estimate a set of financial parameters to compare the sukuk portfolios with those of the bonds that include return, yield-to-maturity (henceforth, yield or YTM), duration, and convexity. To examine the second research question, we arrange and create sukuk portfolios across nine industrial sectors of Malaysian exchange in which the respective underlying sukuk assets belong.

The results overall show that a sukuk generally yields a bond-equivalent return for the investors but the yield to maturity, duration, and convexity are higher than those of the bonds. The statistical tests such as correlation, causality, and cointegration cannot identify a significant association or interdependency between the performances of sukuk and bond. We do not find a variation in these results for the characteristic matched (FCF and NFCF) sukuk and bond portfolios. Hence, the study provides a clear evidence showing that the sukuk is indeed a different financial asset than the conventional bond in spite of that both assets can have similar cash flows. This accentuates the fact that the sukuk contract yields a bond-equivalent cash flow stream in a different method to comply with Shari'ah guidelines. A key marker of the sukuk to be a Shari'ah compliant asset is whether its cash flows are originating from the earnings of the sukuk financed asset so that investors also bear the risk of the underlying business project. On this matter, the study finds the market performance of sukuk irrespective of the structure of cash flows significantly depending on that of the industrial sector in which the business project belongs. As expected, the bond market performance does not influence the performance of sukuk. Hence, the study confirms that a sukuk despite its debt-like features is functionally different from a bond and its performance is associated with the industry performance.

This study contributes to the body of literature focusing on the role of Islamic financial securities in corporate finance. First, with cash flow characteristics matching between the sukuk and bond, we document the first credible evidence to show that the sukuk is different from a bond as there is no

significant relationship between their performances. This evidence sheds a different light on the common perception that the sukuk is a substitute of conventional bond for debt financing. Second, we document the first evidence showing that the performance of the industrial sector in which the sukuk financed project belongs significantly influences the performance of sukuk. This evidence also sheds a new light on the current practice of assessing sukuk performance based on an interest-based benchmark such as LIBOR and KLIBOR. If the performance of sukuk can be estimated from the industry performance instead of bond performance then the underlying common risk factors determining sukuk performance might be different than bond risk factors. Thus, the present study lays the foundation for finding a sukuk pricing model in the future. This may also fulfill the desire of Shari'ah scholars to assess the performance of sukuk based on the benchmark that is not related to an interest rate.

The rest of the paper is organized as follows. We provide an analyze of sukuk contractual mechanism that is available online Appendix S1. In section 2, we review literatures to construct our hypotheses. In the subsequent sections, the research methodology, sample characteristics, empirical results, and findings are described. Finally, the study is wrapped up with conclusion in the last section.

2. Literature and hypothesis

The review of literature focuses on the return and risk performance of the sukuk in comparison with the conventional bonds. First, we review the studies that find the sukuk and bonds are similar in terms of their market performance. Second, we present the evidence showing that the performance of sukuk and bond are different. Finally, we construct the test hypotheses based on the literature review and our earlier analyses on the contractual mechanisms of sukuk.

The literatures suggesting sukuk and bond are similar financial instruments were based on the analyses that a sukuk has many features that resemble those of a bond (Ariff and Safari, 2013; Alam *et al.* 2013; Ahmed *et al.* 2014; Zakaria *et al.* 2013; Trad and Bhuyan, 2015). These studies argued that, like a conventional bond, a sukuk also has a fixed term maturity and a contractual profit rate. They also contend that a sukuk trades in the financial market maintaining a yield-price relationship like a bond. Therefore, several empirical studies find no significant difference in the return and yield between the bonds and sukuk (Fathurahman and Fitriati, 2013; Arif and Safari, 2013; Krasicka and Nowak, 2012; Abdullah *et al.* 2007; Ahmad and Radzi, 2011). Researches also find that sukuk and bond are significantly correlated based on their yields (Mosaid and Bouti, 2014; Naifar, 2016; Maurer, 2010; Alam, 2009; Miller *et al.* 2007), and they have a significant causal relationship (Naifar, 2016; Safari *et al.* 2013). Hence, sukuk and bonds are closely pegged in terms of their expected returns suggesting that an investor cannot benefit from diversifying a portfolio

(Bashir, 1983; Faccio, et al. 2011; Hamzah, 2016) combining both the securities as they are alternative to each other.

In contrast, a few other studies claim that sukuk are different from bonds on account of their underlying contracts such as a sukuk provides an ownership stake in the assets purchased with investors' funds while a bond is a documentation of a pure debt. Thus, a sukuk is not an exchange of money with a certificate alone, but it is a trustee certificate (henceforth, an investment certificate) identifying the exchange of assets that enables investors receiving profits from the transaction (Zin *et al.* 2011; Mohammed *et al.* 2015). In this regard, some empirical studies find that sukuk return performance is significantly better than that of the bond (Afshar, 2013; Kamso, 2013; Ahmed *et al.* 2014; Bacha *et al.* 2015; Ramasamy *et al.* 2011.a), while others find an opposite result (Mansur & Bhatti, 2011; Ariff *et al.* 2013; Azmat *et al.* 2014a). Apart from these studies, a number of other researchers find that both the return and risk of sukuk are greater than those of the bonds, but they did not identify the underlying reasons why a sukuk is riskier and thereby offer a higher return in comparison with the bond (Fathurahman and Fitriati, 2013; Abedifar *et al.* 2013; Krasicka and Nowak, 2012; Abdullah *et al.*, 2007; and Ahmad and Radzi, 2011).

Given these conflicting and inconclusive evidences, the suggestion that a sukuk could be an alternative to bond demands a further analysis. As the cash flow of sukuk is expected to be derived from the earnings of the underlying assets, investors may benefit from its value appreciation (Alam *et al.* 2013; Afshar, 2013; Trad and Bhuyan, 2015). Therefore, all else equal, a sukuk could have a higher demand than a conventional bond – as sukuk could offer a better return when the underlying asset earns a high profit (Meager, 2017; Hamzah, 2016; Patrick & Kpodar, 2015; Mansor and Bhatti, 2011; Zulkhibri, 2015; Hanefah, 2013; Safari *et al.* 2013). Nevertheless, it is likely that the sukuk return could be more volatile due to the possible uncertainty in the underlying asset earnings. As a whole, an empirical difference between the sukuk and bond has been documented by a group of prior researchers. Hence, some studies find no correlation and causality (Ariff *et al.* 2013; Mohamed *et al.* 2015; Zakaria *et al.* 2012; Harun & Ibrahim, 2012; Ramasamy, 2011.a) between the market performance of both securities. In summary, the prior empirical studies provide mixed evidence about the comparative behavior of sukuk and bond performance. Hence, we construct following hypothesis about the sukuk and bond:

Hypothesis 1:

H₀: Sukuk and bond are not different in terms of their return and risk behavior.

H_A: Sukuk and bond are different in terms of their return and risk behavior.

If empirical tests reject the null hypothesis-1, the basic reason indicating a sukuk performance to be different from bond needs to be examined. As we discussed earlier that the sukuk contract

provides an asset ownership to the sukuk holders, the periodic cash distribution by the issuer ideally comes from the earnings of the sukuk underlying asset (Afshar and Muhtaseb, 2014; Alam *et al.* 2013; Trad and Bhuyan, 2015; Ahmed *et al.* 2014; Rauf and Ibrahim, 2014; Muhamed & Radzi, 2011). This is also because a sukuk cannot be issued for funding the general financial needs of the issuer; instead the raised fund is invested in a specific business project (Zin *et al.* 2011; Mosaid & Boutti, 2014; Ahmed *et al.* 2015). Therefore, subject to the operational and managerial efficiency of the sukuk issuer being the user of asset, the earnings of the sukuk underlying asset could be influenced by the overall profitability of the industry in which the underlying asset belongs. Hence, we expect a significant relationship between the market performances of sukuk and respective industry; thereby, we construct following hypothesis:

Hypothesis 2:

H₀: The sukuk market performance is not correlated with respective industry performance.

H_A: The sukuk market performance is correlated with respective industry performance.

Finally, following the analysis of sukuk contractual mechanism (available online), and literature review, we present a conceptual framework in Figure S1.

[Insert Figure S1 Here]

4. Methodology

4.1 Sukuk and bond portfolios

We examine the first research question by using characteristics-matched sukuk portfolios. We construct sukuk portfolios based on similar characteristics and matching them with relevant bond portfolios. For example, Ijarah and Murabaha sukus are assigned to FCF sukuk portfolio as they provide fixed cash flow to sukuk holders, which is similar to a fixed coupon bond. Mudarabah and Musharakah sukus are placed under the NCF sukuk portfolio because the cashflows are unknown. We provide more details in Table S1, available online.

[Insert Table S1 Here]

4.1.1 Comparison parameters

Following literature, we compare the market performance of sukuk and bond portfolios based on a set of parameters such as return, yield-to-maturity, duration, and convexity (Mansor & Bhatti, 2011; Jobst, 2009; Ghysels *et al.* 2005; Campbell & Viceira, 2005; Christensen & Sorensen, 1994; Imanen *et al.* 1994; Kahn & Lochoff, 1990; Dunetz, 1988). We construct an equally weighted composite index for Ijarah and Murabaha sukus to estimate the daily returns for the FCF sukuk portfolio. Similarly, we build another equally weighted composite index for Mudarabah and Musharakah sukus to calculate

returns for NFCF sukuk portfolio. The corresponding FCF bond portfolio returns are estimated based on the fixed coupon bond index while the NFCF bond portfolio return is calculated by subtracting the FCF bond portfolio return from that of the all-bond index. Following the similar approach of return estimation, we calculate the daily average of YTM, duration, and convexity for both FCF and NFCF sukuk portfolios. The corresponding YTM, duration, and convexity of FCF bond portfolio are tracked based on those of the fixed coupon bonds, but we could not follow them for NFCF bond portfolio because of non-availability of required data.

4.1.2 Tests Measures

We compare the return, YTM, duration, and convexity of characteristics matched sukuk and bond portfolios based on their (i) mean difference, (ii) correlation, (iii) causality and (iv) cointegration tests. Following literature, we apply the paired sample *t-test* to estimate the mean difference between sukuk and bond across four parameters return: YTM, duration, and convexity (Afshar, 2013; Fathurahman and Fitriati, 2013; Abedifar *et al.* 2013; Kamso, 2013; Ariff *et al.* 2013; Azmat *et al.* 2014b; Ahmed *et al.* 2014; Ramasamy *et al.* 2011a; Mansur & Bhatti, 2011). We estimate Pearson correlation matrix in order to determine the degree to which sukuk and bond are associated with each other across different parameters mentioned above (Naifar, 2016; Mosaid and Bouti, 2014; Mosaid and Boutti, 2014; Ariff and Safari, 2013; Maurer, 2010; Alam, 2009; Miller *et al.* 2007 Levin & Rubin, 2007). Next, we test granger causality for all comparison parameters to investigate if there is a causal relationship between sukuk and bond. The causality test also identifies the direction of the causal relationship: whether bond affects sukuk, or vice versa (Nazlioglu *et al.* 2015; Safari *et al.* 2013; Harun & Ibrahim, 2012). Finally, we determine if there is any long-term association between sukuk and bond across their comparison parameters. Therefore, we apply Johansen cointegration test through the cointegrating rank of Vector Error Correction Model (VECM) by including the report of maximum eigenvalue statistics.

4.2 Sukuk returns and industry performance

To investigate the second research question whether sukuk performance is correlated with industry performance, we arrange and create sukuk portfolios by classifying a total of 627 FCF and NFCF sukuk according to the corresponding industry areas of bursa Malaysia in which the sukuk underlying assets fit in. For this purpose, we first examine the indenture of each sukuk to determine the nature of business activity or project in which sukuk funded asset is employed. After determining the business activity or project, we identify the industry affiliation of a sukuk. Finally, we have nine different sukuk portfolios across the bursa Malaysia industry categories. Then we compute the daily returns of these nine sukuk portfolios that are compared with the corresponding industry's average return. As we want to examine whether sukuk market performance is correlated with corresponding industry performance, we execute correlation test to address the second research issue.

4.2.1 Regression analysis

Finally, we undertake regression analysis to further confirm whether the market performance of a sukuk, which is not a pure debt asset like the bond, is influenced by the performance of the industry in which the sukuk underlying asset or business project belongs. We estimate two regression models. The first model is a time series autoregressive distributed lag (ADRL) model that regresses the average return of all sukuk for the period t against the lagged return of sukuk, level and lagged returns of the respective industrial sector, bond market, and equity market. The second model is also a time series regression that determines the effect of market momentum prevails in the respective industrial sector subject to that both in the overall bond and equity markets.

$$R_t^{Sukuk} = \alpha_0 + \alpha_1 t + \sum_{i=1}^p \phi_i R_{t-i}^{Sukuk} + \sum_{i=0}^q B_1 R_{t-i}^{Ind} + \sum_{i=0}^s B_3 R_{t-i}^{Bond} + \sum_{i=0}^r B_2 R_{t-i}^{Equity} + e_t \quad (1)$$

$$R_t^{Sukuk} = \alpha_0 + \alpha_1 t + B_1 M^{Ind} + B_3 M^{Bond} + B_2 M^{Equity} + e_t \quad (2)$$

To estimate these models, we compute the daily returns of industry-sorted sukuk portfolio (R_t^{Sukuk}), industrial sectors (R_t^{Ind}), overall bond market (R_t^{Bond}), and overall equity market (R_t^{Equity}) based respectively on Bursa Malaysia sukuk index, industrial indices, all bond index, and Kuala Lumpur composite equity index. In the second model, M^{Ind} , M^{Equity} , and M^{Bond} are the prevailing momentums respectively in the industrial sectors as well as that in the bond and equity markets. These momentum variables are respectively the geometric returns of the respective industrial sector, bond market, and equity market over the period of 30 days prior to the current date. In these two regressions, we would mainly check if the industry performance (R_t^{Ind} and M^{Ind}) significantly influences the performance of corresponding sukuk whose underlying assets or business projects are linked to the same industry. We include the bond market variable as a control factor because the sukuk and bond are often considered as substitutes. Whereas, we add the equity market variable as another control factor because the equity market performance could also influence the performance of sukuk even though sukuk and stock are not substituting assets - yet the cash flows of sukuk underlying assets might be susceptible to the operational efficiency of the sukuk issuing company as the ultimate manager of the sukuk underlying assets or business projects.

5. Sample and data description:

The sample of the study includes a total of 627 Malaysian sukuk which are available at Thomson Reuters Eikon data base over a period of 7 years' daily data from January 2010 to December 2016, comprising of total of 1724 observations for each sukuk. This sample size covers about 81% of the whole bursa Malaysia sukuk market. We also use all bond index of Bursa Pricing Agency Malaysia (BPAM) for the same 7-year period as sukuk counterpart. We provide the details of sample and data in Table S2, available online.

[Insert Table S2 Here]

The distribution of sukuk samples, presented in Panel A of Table S2, shows that a total of 97 sukuks (15.47%) are ijarah, followed by 283 sukuks (45.13%) are murabaha. In addition, 50 sukuks (7.98%) are mudarabah and the remaining 197 sukuks (31.42%) are musharakah. Considering the prior discussion on sukuk contractual mechanism, we find that the samples are compiled from both fixed rate sukuk and profit-loss sharing sukuk. As presented in the Panel B of Table S2, FCF sukuk portfolio has a total of 380 sukuks (60.61%) whereas NFCF sukuk portfolio has the remaining 247 sukuks (39.39%). Hence, this shows that the study sample of 627 sukuks is classified into two portfolios based on their cash flow characteristics (FCF and NFCF). In order to compare the return of characteristics matched sukuk portfolio with that of the corresponding bond portfolio, we require FCF and NFCF bond indices. However, BPAM has only two bond indices: (i) all bond index and (ii) FCF bond index. Since BPAM does not compute a separate NFCF bond index, we track the performance of NFCF bonds by subtracting the return of FCF bond index from all bond index over the 7-year period from January 2010 to December 2016. We report the types of FCF and NFCF bonds in Panels C and D of Table S2. According to BPAM, the fixed coupon treasury, municipal, and corporate bonds pay a fixed percent of a periodic coupon to bondholder and thus are classified as FCF bond. All other bonds such as convertible and different types of floating rate bonds are categorized as NFCF bond.

Finally, Panel E of Table S2 shows that a total of 627 sukuks are distributed across different industry areas in which sukuk underlying asset belongs to. It shows that a total of 71 sukuk (11.32%) are from property sector, followed by only three sukuk (0.48%) from the consumer product sector, 39 sukuk (6.22%) are from industrial product sector, 32 sukuk (5.1%) are from technology sector and 185 sukuk (29.51%) are from trade and service sector. In addition, 14 sukuk (2.23%) are from plantation sector, 55 sukuk (8.77%) are from mining sector and 109 sukuk (17.38%) are from finance sector respectively. The remaining 119 sukuk (18.98%) are from construction sector. Overall, this shows that samples are drawn from all sectors, although majority of the samples are from finance, construction and trade & service sectors.

After removing the outliers, we examine data normality and stationarity before presenting descriptive statistics for the parameters of our tests. We report data normality and stationarity results in Appendix S2 and test results in Table S3, both are available online. We find that the (i) average return, (ii) yield to maturity, (iii) duration, and (iv) convexity of different sukuk portfolios are generally higher than those of the bond portfolios, yet they vary across the different characteristics matched sukuk and bond portfolios. The standard deviations of these four

parameters are also found to be higher for all types of sukuk portfolios (comparing with those of the bonds across classifications), except that for the return of all-sukuk portfolio. These findings are generally consistent with the earlier studies (Ahmed *et al.* 2014; Safari *et al.* 2013; Ariff *et al.* 2013; Kamsu, 2013; Miller *et al.* 2007; Jokipii and Milne, 2011; Trad *et al.* 2017) that compare the sukus with bonds using their composite portfolios only and examined the differences in their returns and YTM. However, none of these studies tested if the duration and convexity of sukus are different from those of bonds. Hence, our study is more comprehensive than all the prior studies comparing sukus with conventional bonds.

[Insert Table S3 Here]

6. Results and discussions

In this section, we first report the statistical results on the comparative performances of sukuk and bond followed by a presentation of the results on the relationship between the performances of sukus and corresponding industrial sectors. Finally, we report the regression results to confirm if the performance of industrial sectors has a significant effect on the performance of sukuk.

6.1 Performances of sukuk and bond

Mean difference

We conduct paired sample t-test to examine the mean difference between the performance of sukuk and bond across the selected parameters of returns, YTM, duration, and convexity; and the summary of the mean difference test is presented in the following panel A of Table 4. We find that on the basis of returns performance, there is no significant difference between all bond portfolio and all sukuk portfolio, which is consistent with earlier findings conducted on composite sukuk and bond portfolios such as Mansor and Bhatti, 2011; Safari *et al.*, 2013. In this context, our paper with empirical evidences confirms that the return difference between all categories of bond and sukuk portfolios according to their characteristics matching is not significant. On the basis of YTM, duration and convexity, there is significant difference between all categories of bond and sukuk portfolios. Therefore, we find that though sukuk is innovated to replicate the bond equivalent returns, however, these two financial instruments are not functionally the same; eventually indicating that they behave in a different way in the financial market, which has been recognized by prior studies without adequate empirical evidences such as Mohamed *et al.*, 2015; Ariff *et al.*, 2013; Zakaria *et al.*, 2012. As a whole, the evidence does not suggest that bond and sukuk are similar assets as their risk parameters such as YTM, duration, and convexity are different.

[Insert Table 4 Here]

Correlation

We conduct the Pearson correlation matrix across the selected parameters mentioned earlier and then sequentially presented in the above panel B of Table 4. Based on the correlation matrix, we summarize that though there is significant positive correlation between all bond portfolio and all sukuk portfolio on the basis of return performance, which has been documented by preceding researches without acceptable empirical justification such as Mosaid and Boutti, 2014; Naifar, 2016; Ariff and Safari, 2013; Afshar and Muhtaseb, 2014. Nevertheless, the correlations between sukuk portfolios and bond portfolios created based on their matching characteristics are not significant. It implies that there is the possibility of diversification benefit from diverse types of bond portfolios and sukuk portfolios. On the basis of YTM, we find that there is significant positive correlation across the parameter of YTM of all bond portfolio and all sukuk portfolio. This finding is also applicable for different bond portfolios and sukuk portfolios according to characteristics matching portfolios. This finding is consistent with several of the prior findings of Muhamed & Radzi (2011) and Ariff & Rosly (2011). Consequently, on the basis of duration and convexity, the empirical evidences are same as those of YTM of different types of sukuk portfolios and bond portfolios. Hence, we conclude that on the basis of price sensitivity to interest rate changes (Abedifar, 2013; Faccio, et al. 2011; Flannery, *et al.* 1984), there is a significant positive correlation between sukuk and bond, indicating that the market performance of both financial instruments tends to move in the same direction due to price volatility in the financial market.

Causality

We find that now-a-days causality tests are widely used for testing the resemblance between two respective securities (Arif *et al.* 2013; Mosaid and Boutti, 2014). Hence, we compare sukuk with bond across the selected parameters through granger causality test in either or both directions, and the summary is presented in the above panel C of Table-4. On the basis of returns, we detect that there is no significant causal relationship between FCF sukuk portfolio and fixed coupon bond portfolio. Hence granger causality tests substantiate that these securities are not same. As our empirical findings is consistent with those of prior studies conducted on composite bond and sukuk portfolios such as Naifar, 2016; Haron & Ibrahim, 2012; Zakaria *et al.* 2012; Ariff and Safari, 2013; thereby these two securities have functional differences in financial market trading.

Nevertheless, on the basis of YTM, we observe that there is significant causal relationship between FCF sukuk portfolio and fixed coupon bond portfolio. From the scholarly review, we state that the potential risk exposure of sukuk may be similar to the conventional financial instruments of the capital market; however, sukuk risks may vary depending on the contract types, which is acknowledged by prior studies without satisfactory empirical evidence such as Muhamed & Radzi,

(2011), Ariff & Rosly (2011), Onal (2013) and Abdullah, et al. (2014). In this context, our paper with empirical evidences detects that there is significant causal relationship between YTM of sukuk and that of bond, hence sukuk risk is the same as that of bond in financial market trading. Eventually, it is, *prima facie*, evident that the performance of different sukuk portfolios is influenced by that of different bond portfolios and vice versa.

Cointegration

After checking data stationarity in online Apendix-S2, we examine the long-term relationship between the sukuk and bond based on Johansen cointegration test to detect whether they are moving together in the long run over the lag period of two, and findings are reported in panel D of Table 4. It shows that the performance of sukukuks and bonds are cointegrated with respect to their returns, but not to their YTM, durations, and convexities. The findings are consistent across the three pairs of portfolios. Therefore, results do not show any definite pattern in the long-term relationship between the sukuk and bond, which further confirms that sukuk and bond behave differently in the financial market. Hence, we can assume that investors can benefit by diversifying portfolios across bonds and sukukuks.

As a whole, Table 4 shows that sukuk return is closer to bond return but their risks are different. In addition, we find anomalies in the returns and risks of these two financial instruments based on the correlation, causality, and cointegration tests. Therefore, the study provides empirical proofs showing that sukuk and bond are different financial instruments. In this context, an investor may enquire which financial instrument is preferred given the behavior of return and risk – irrespective of his/her religious affiliation. To test this issue, we examine variations in the risk relative to return for both the instruments by estimating their risk-to-return ratios, which is particularly important to select portfolio assets. In these tests, we use YTM, duration, and convexity as the measures of risk for both bond and sukuk¹ (Hossain and Aktar, 2018; Campbell & Viceira, 2005; Christensen & Sgrensen, 1994; IImanen *et al.* 1994; Kahn & Lochoff, 1990; Dunetz, 1988).

[Insert Table 5 Here]

The findings reported in Panel A of Table 5, show that without characteristics matching the risk-to-return ratios of the bond portfolios are insignificantly lower than that of the sukuk portfolios based on three measures of risks, such as YTM, duration and convexity. In Panel B, the risk-to-return results remain the same when we match the characteristics of bonds and sukukuks and only compare FCF sukuk portfolios with the corresponding FCF bond portfolios. The study finds that

¹ Although sukuk is different from bond, the yield to maturity, duration, and convexity are used as the parameters of sukuk risks in order to compare these selected parameters with those of bonds from the investment perspective.

sukuks are riskier than bonds, yet market seems to inadequately compensate the sukuk investors. Therefore, our study seems to be contradicting with earlier researchers who find that, without considering risk, sukuk return is significantly different from the bond return (Azmat *et al.* 2017; Afshar, 2013; Kamso, 2013; Alam *et al.* 2013; Ahmed *et al.* 2014; Bacha *et al.* 2015; Mansur & Bhatti, 2011; Ramasamy *et al.* 2011.a).

6.2 Performances of sukuk and industry

As we hypothesize that sukuk performance could be related to the performance of industry, we estimate the correlation coefficient between the industry-wise sukuk portfolio and the corresponding market industry portfolio. The results presented in Table 5 shows that the correlation coefficients for all nine pairs of sukuk and industry portfolios are significantly correlated at a minimum five percent level (see the shaded diagonal cells in Table 5). However, the coefficient of correlations between the other pairs of sukuk and bond portfolios in the non-shaded cells are generally much lower than those in the shaded diagonal cells: the pairs of industry-wise sukuk and market industry portfolios. Therefore, we provide the first empirical proof that sukuk return is linked to the performance of the industry in which the sukuk asset belongs.

[Insert Table 6 Here]

Next, we extend the study to examine the causal relationship between the performances of industry-wise sukuk and market industry portfolios. The causality test results reported in Table 7 show that market industry performance influences the sukuk performance in all the nine causality tests involving the nine market industries of bursa Malaysia. However, a closer look at the results reveal that the causal relationship between the sukuk and industry market portfolio is found to be bi-directional in the three tests involving the construction, mining product, and property industries. As a whole, based on causality results, the study findings suggest that all other things being equal the sukuk expected return could be subject to the corresponding market performance of the industry.

[Insert Table 7 Here]

We recheck the above findings with respect to FCF and NCF portfolios of the sukuks and bonds, and results are reported in Table 8. The results in panel A show that both FCF and NCF sukuk portfolios are significantly correlated with corresponding industry portfolios at a minimum five percent level. However, the coefficient of correlations between NCF sukuk portfolios and industry portfolios are higher than those of FCF sukuk portfolios and industry portfolios, indicating that the performance of profit-loss sharing sukuk is more closely linked with industry performance than that of fixed coupon sukuk. Then again, the causality tests result in panel B show that respective industry performance affects the returns of both FCF and NCF sukuk portfolios. The causality results are consistent for all industrial

sectors except mining and property. A deeper look at results detects that the causal relationship between NFCF sukuk portfolios and respective industry portfolios is more significant than those between FCF sukuk portfolios and industry portfolio. Hence based on the causality results, the findings suggest that all else same the expected returns of both FCF and NFCF sukuk portfolios are subject to the corresponding industry performance. Overall, Table 8 confirms that market performance of sukuku irrespective of their cash flow pattern (fixed or non-fixed) is influenced by the performance of industry in which the sukuk underlying assets belong.

[Insert Table 8 Here]

Following the correlation and causality tests between the sukuk returns and industry performance, we estimate two regressions to confirm if the performance of industry indeed the key driver determining the return of sukuku – setting aside the bond and equity market effects (if any). The first regression is an ARDL time-series model that regress the average industry-sorted sukuk portfolio's daily return on the average market return of the corresponding industry after checking the required data stationarity for all variables². We estimate ARDL regression separately for nine industry-sorted sukuk portfolios, and bound tests find F values of the models are higher than the upper bound I(1) critical value, suggesting the existence of cointegration in the model. The second regression regresses the average 30-day market momentum return of the industry-sorted sukuk portfolio on the same-period average market momentum return of the corresponding industry. The findings are summarized in Table 9. Panel A shows that the market performance of industry overall significantly determines the return of industry-sorted sukuk portfolio. This finding is consistent across industries and test models applied. The separate results for FCF and NFCF sukuk portfolios reported in Panels B and C further confirm that the effect of industry performance on the sukuk return is not restricted by the cashflow patterns of different types of sukuku as the coefficients of average industry market return and momentum variables (R^{IND} and M^{IND}) are significant across all industries and test models. However, it is important to note that the performance of overall bond and equity markets has generally an insignificant effect on the returns of sukuku, as we find it from the coefficients of R^{Equity} , R^{Bond} , M^{Equity} and M^{Bond} for all test models and across industries. Overall, the time-series regressions results in Table 9 are supportive of the earlier findings of correlation and causality between the market performance of a sukuk and that of the industry in which the sukuk belongs.

[Insert Table 9]

² ADRL estimation method is appropriate because the time-series variables are integrated at different levels, i.e., the performances of sukuk, industry, and bond are integrated at I(0) and I(1) levels, but the equity performance is integrated at I(0) only. We also confirm that none of these time-series are integrated at I(2) level.

6.3 Discussion

Sukuk has been in the global financial market for nearly two decades now, but we do not know much about its market behavior in contrast to that of the conventional bond. There are some studies on this issue, but the evidence was inconclusive. So, we cannot determine if the sukuk behaves similarly to or differently from a conventional bond in financial market trading. Therefore, researchers are not yet able to determine how a sukuk could be valued in the financial market, mainly because the underlying reasons affecting sukuk return in the financial market is not known. The key limitation of the previous studies is that they did not consider the heterogeneous underlying characteristics of the sukuk and bonds while comparing their market performances. Therefore, we undertake a new study comparing the performances of sukuk and bonds by matching their characteristics across different types of contracts (IIFM, 2016; ISRA, 2011, pp. 415; AAOIFI, 2008); and then identify the underlying reasons that influence the sukuk market performance.

We find that sukuk is not different from the bond in terms of their returns, but they are different based on YTMs, durations, and convexities. The findings are consistent across the characteristics matched portfolios of the sukuk and bonds: FCF and NCF sukuk and bonds. Hence, the findings of the study imply that sukuk irrespective of their cash flow nature are relatively riskier security than bonds although their returns are similar, which is an empirical anomaly in the financial market because sukuk investors seemed not to be adequately compensated for the level of risk in the sukuk investment. This anomaly perhaps indicates Muslim investors' religious inclination towards sukuk than bond despite the higher risk of sukuk investment. It suggests that sukuk investors might earn a less than required return, which is a very interesting phenomenon because the sukuk market has been thriving in Muslim majority countries particularly in Malaysia despite that sukuk holders bear more risk than bondholders do for similar investments. The anomaly between the risk and return for sukuk and bonds suggests that religiosity sentiment is an important matter for deciding whether to invest in sukuk despite there is a probability of earning a less than required return. On the account of why a bond is less risky than a corresponding sukuk, we explain that bond is a debt contract in which bondholders' cash flow normally does not vary when coupon rate is pre-determined, and it becomes obligatory on the issuers. Whereas, a sukuk is an ownership contract where the sukuk holders' cash flow is supposed to depend on the earnings of the underlying asset, and the issuer has no legal obligation to pay a regular periodic payment – except in a non-partnership sukuk.

Since bond and sukuk are based on two different financing contracts (debt vs. ownership), we find that their performances are not correlated. The causality and cointegration tests further confirm that both securities perhaps do not affect each other and maintain no significant longer-term relationship. As a whole, sukuk is successfully engineered to replicate a bond equivalent return by replacing a fixed interest (coupon) with a cashflow distribution seemingly deriving from sukuk underlying asset (Hamzah, 2016; Zakaria et al. 2012; Kabir et al. 2015; Jokipii and Milne, 2011; Lewis, 2008). Hence, it is evident that a bond is legally and functionally different, but almost same for return earning. However, findings imply that there is a diversification benefit if a portfolio is created combining both bond and sukuk as they are not significantly correlated, provided that investor has no religious motivation to invest in sukuk only.

We find that sukuk is generally a riskier asset than a conventional bond, the future study could examine whether the anomaly is due to additional risk-shifting (Jensen and Mackling, 1976) in disguise of risk-sharing between the equity holders and sukuk holders. There is a possibility of additional risk-shifting in case of sukuk finance because undertaking risky projects is easier because of the risk-sharing principle. If risk-shifting indeed occurs in Islamic financing and sukuk holders' wealth redistributes to equity holders in disguise of risk-sharing contracts then it is to be a violation of Shari'ah principle. Although sukuk is an asset-backed debt security, the evidence of higher risk in sukuk indicates that the asset-backing system under Islamic finance contracts might not be effective like that of bonds. Thereby, this study corroborates Zakaria *et al.* (2012) who find that sukuk contracts promote default risk despite asset security. Overall, we confirm that sukuk and bonds are functionally different from each other due to the differences in their operational characteristics (Kabir *et al.* 2015; Lewis, 2008). Therefore, the statistical tests such as correlation, causality, and cointegration do not identify a significant relationship between sukuk and bond. This implies an interest-based benchmark such as LIBOR or KLIBOR may not be the best standard to assess sukuk performance as sukuk is found inherently different from the conventional bond.

In this study, we document sukuk performance has an association with the performance of the industrial sector in which the sukuk underlying asset belongs. The causality test shows the performance of industry to influence the performance of sukuk but not the opposite way, which indicates the common underlying driver of sukuk performance could be inherently linked to the corresponding industry. We confirm this conjecture based on several regression tests that find the performance of the industry significantly determine the market performance of sukuk. As expected, the average performance of the bond market has no significant effect on the market performance of sukuk even though sukuk is widely known bond substitute. This finding further underscores the fact that bond and sukuk are two different classes of financial assets because the underlying

contracting mechanisms are different. However, we discover that the average performance of equity market generally has a weak effect on the performance of sukuk market – suggesting that factors affecting the equity market might have limited influence on the sukuk market performance.

7. Conclusion

The difference between the Islamic bond (sukuk) and conventional bond is linked to their contractual arrangement. For example, the conventional bond constitutes a lender-borrower relationship between the investors and bond issuer, while sukuk constitutes a partnership, lessor-lessee, or buyer-seller relationship between the investors and sukuk issuer. Therefore, if sukuk is a different class of asset than a bond, the current practice of benchmarking sukuk returns to LIBOR or KLIBOR might not be appropriate as underlying risk drivers of sukuk and bond could be different. The empirical tests show that sukuk return is not different from bond return irrespective of their cash flow patterns (fixed or non-fixed), but their risk parameters are significantly different. We find three parameters, such as YTM, duration, and convexity of all types of sukuk are significantly higher than those of the characteristics matching corporate bonds. Hence, we suggest that a sukuk can replicate a bond return but cannot match the risk of a similar bond as underlying contractual features of sukuk are different from those of conventional bonds. The difference mainly occurs because the risk-sharing principle of Islamic finance requires the cashflows to originate from the earnings of sukuk financed project and distribute it based on a partnership, lessor-lessee, or buyer-seller contracts subject to a type of sukuk contract.

Therefore, *ceteris paribus*, we argue the sukuk performance is inherently related to the industrial sector in which the sukuk-financed project belongs. We confirm it based on regression analysis. The results also show that bond performance has no significant effect on sukuk performance, further confirming that a sukuk is fundamentally different from the conventional bond. However, the average performance of the overall equity market has a weak effect on sukuk performance. As a whole, we draw three conclusions. First, a sukuk investor generally bears more risk than a similar bond investor because of the variations in financing contracts. Second, the sukuk is unlikely to be a bond substitute asset because there is no association between the performances of these two assets. Third, the performance of a sukuk is determined by that of the industrial sector in which a sukuk financed project belongs. These conclusions suggest further study to identify the reason why the firms use Islamic debts instead of conventional ones and the risk factors determining sukuk returns for the investors.

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Table 4: A comparison between the performance of bonds and sukuk in Malaysian market over the period 2010-2016 (N=1724 for each sukuk).

Panel A: Mean difference										Panel B: Correlation									
Pair	Portfolio	Return		YTM		Duration		Convexity		Pair	Portfolio	Return		YTM		Duration		Convexity	
		Diff.	<i>P</i> value			Corr.	<i>P</i> value.	Corr.	<i>P</i> value	Corr.	<i>P</i> value	Corr.	<i>P</i> value						
1	All bonds All sukuk	-0.001	0.624	-0.249	0.000	-0.487	0.000	-7.48	0.000	1	All bonds All sukuk	0.504	0.000	0.929	0.000	0.946	0.000	0.934	0.000
2	Fixed coupon bond FCF sukuk	-0.001	0.821	-0.827	0.000	-1.35	0.000	-15.5	0.000	2	Fixed coupon bond FCF sukuk	0.045	0.260	0.595	0.000	0.006	0.804	-0.035	0.092
3	Non-fixed bond Non-debt sukuk	-0.011	0.645	NA	-	NA	-	NA	-	3	Non-fixed bond Non-debt sukuk	0.027	0.263	NA	-	NA	-	NA	-
Panel C: Causality										Panel D: Co-integration									
Pair	Portfolio	Return		YTM		Duration		Convexity		Pair	Portfolio	Return		YTM		Duration		Convexity	
		<i>P</i> value	Sig.			Trace value	Crit. value	Trace value	Crit. value	Trace value	Crit. value	Trace value	Crit. value						
1	All bonds All sukuk	0.015	YES	0.000	YES	0.096	NO	0.077	NO	1	All bonds All sukuk	524.9	3.76	2.02	3.76	0.462	3.76	0.69	3.76
2	Fixed coupon bond FCF sukuk	0.681	NO	0.000	YES	0.079	NO	0.756	NO	2	Fixed coupon bond FCF sukuk	558.6	15.4	8.02	15.4	9.88	15.4	9.29	15.4
3	Non-fixed bond Non-debt sukuk	0.044	YES	NA	-	NA	-	NA	-	3	Non-fixed bond Non-debt sukuk	1154	15.4	NA	-	NA	-	NA	-

This table reports the summary of empirical results of different test measures to address the first research issue. Panel A shows the findings of mean differences across selected parameters of return, YTM, duration, and convexity considering different sukuk and bond portfolios. Panel B indicates the findings of underlying correlation across the selected parameters considering different portfolios mentioned earlier. Panel C summarizes the empirical results of causality across the same parameters. Finally, Panel D identifies the underlying co-integration across different portfolios considering the selected parameters as stated before. The causality and co-integration tests are conducted considering lag 2. All of the test measures do not have any missing observation.

Table-5: Risk to return ratio (RRR) of sukuk and bonds (N = 1724 for each sukuk)

Risk-Return Ratio	Panel A: Sukuk and bond portfolios without characteristics matching.			Panel B: Sukuk and bond portfolios with characteristics matching.		
	Bond portfolios	Sukuk portfolios	<i>P value</i> (Mean Difference)	FCF Bond portfolio	FCF Sukuk portfolio	<i>P value</i> (Mean Difference)
RRR-1.	212.11	216.19	0.15	217.23	250.85	0.13
RRR-2.	278.60	292.45	0.11	274.36	331.45	0.33
RRR-3.	2556.03	2843.88	0.14	2331.94	3031.99	0.08

This table reports the summary of risk to return ratio (RRR) across selected parameters of returns, YTM, duration, and convexity considering different types of sukuk portfolios and bond portfolios. The empirical test measures include three different sets of risk to return ratio across the selected parameters of YTM, duration, and convexity, such as RRR-1 = (Average YTM / Average return), RRR-2 = (Average duration / Average return) and finally RRR-3 = (Average convexity / Average return). The column for *p value* refers the significance level across daily difference of risk to return ratio between the corresponding bond and sukuk portfolios; nevertheless, the table detects that none of the daily differences of risk to return ratio is statistically significant at 5% level. The results do not consider risk to return ratio for non-fixed bond and sukuk portfolio; because the process of subtracting the daily YTM, duration, and convexity of fixed coupon bond portfolio from those of all bond portfolio does not become meaningful.

Table 6: Relationship between performances of sukuk & industries of bursa Malaysia (N= 1724)

		Sukuk portfolios based on the underlying asset classification across the industries									
		Industries	1	2	3	4	5	6	7	8	9
Bursa Malaysia industry portfolios	1		0.23**	0.20**	0.07*	0.11**	0.02	0.05	0.11**	0.03	0.05**
	2		0.05*	0.26**	0.07*	0.16**	0.03	0.08**	0.09**	0.03	0.07*
	3		0.01	0.09	0.18**	0.11**	0.05*	0.10**	0.09**	0.018	0.06**
	4		0.05*	0.16**	0.02	0.33**	0.00	0.07**	0.14**	0.07**	0.08**
	5		-0.01	0.04	0.09**	0.04	0.21**	0.06**	0.02	0.01	0.01
	6		0.03	0.08**	0.06**	0.08**	0.02	0.20**	0.06**	0.06*	0.04
	7		0.03	0.12**	0.08**	0.19**	0.04	0.06**	0.24**	0.06**	0.08**
	8		0.08**	0.07**	0.03	0.13**	0.09**	0.01	0.11**	0.19**	0.04
	9		0.08**	0.14**	0.09**	0.13**	0.02	0.08**	0.17**	0.08**	0.16**

In this table, industries are classified as Construction = 1, Consumer Product = 2, Finance = 3, Industrial Product = 4, Mining = 5, Plantation = 6, Property = 7, Technology = 8, and Trade & Service = 9. Number in the cell shows the coefficient of correlation between the performances of industry-wise sukuk portfolio and the corresponding bursa Malaysia industry. Asterisks ***, **, * denote the level of significance at respectively one, five and ten percent levels. The test measure does not have any missing observation.

Table 7: Testing if the industry performance leads sukuk performance, (N=1724)

Pair	Portfolios	<i>P-Value</i>	Significance.	
1	A. Bursa Malaysia construction B. Sukuk construction	0.002 0.035	yes	yes
2	A. Bursa Malaysia consumer product B. Sukuk consumer product	0.004 0.348	yes	no
3	A. Bursa Malaysia finance product B. Sukuk finance product	0.028 0.354	yes	no
4	A. Bursa Malaysia industrial product B. Sukuk industrial product	0.026 0.656	yes	no
5	A. Bursa Malaysia mining product B. Sukuk mining product	0.010 0.003	yes	yes
6	A. Bursa Malaysia plantation B. Sukuk plantation	0.050 0.451	yes	no
7	A. Bursa Malaysia property B. Sukuk property	0.045 0.002	yes	yes
8	A. Bursa Malaysia technology B. Sukuk technology	0.016 0.209	yes	no
9	A. Bursa Malaysia trade/service B. Sukuk trade/service	0.012 0.205	yes	no

This table reports summary of the granger causality results for nine pairs of portfolios of the equities and sukuk across different industrial sectors. In each pair, A is the bursa Malaysia industry portfolio and B is the industry based sukuk portfolio. The causality test is based on lag 2.

Table 8: Sukuk & industry performance across fixed cash flow (FCF) & non-fixed cash flow (NFCF) sukuk portfolios (N=1724).

Panel A: Relationship Between Industry & Sukuk			Panel B: Causality Between Industry & Sukuk		
Industry	Sukuk portfolios		Portfolio Pairs	Sukuk portfolios (<i>P value</i>)	
	FCF	NFCF		FCF	NFCF
Construction	0.20**	0.37**	A. Bursa construction	0.015	0.004
			B. Sukuk construction	0.068	0.008
Consumer Product	0.18**	0.32**	A. Bursa consumer	0.024	0.026
			B. Sukuk consumer	0.494	0.711
Finance	0.16**	0.22**	A. Bursa finance	0.025	0.041
			B. Sukuk finance	0.316	0.493
Industrial Product	0.26**	0.28**	A. Bursa Industrial Pro.	0.027	0.014
			B. Sukuk Industrial Pro.	0.689	0.590
Mining	0.21**	0.32**	A. Bursa Mining	0.011	0.031
			B. Sukuk Mining	0.004	0.003
Plantation	0.19**	0.29**	A. Bursa plantation	0.064	0.034
			B. Sukuk plantation	0.486	0.357
Property	0.09**	0.27**	A. Bursa property	0.042	0.043
			B. Sukuk property	0.003	0.001
Technology	0.19**	0.21**	A. Bursa Technology	0.049	0.019
			B. Sukuk Technology	0.321	0.144
Trade & Services	0.14**	0.25**	A. Bursa trade/services	0.018	0.030
			B. Sukuk trade/services	0.214	0.409

In this Table, Panel A shows the relationship between sukuk & industry performance across FCF and NFCF sukuk portfolios. Panel B shows the causality if the industry performance leads sukuk performance across FCF and NFCF sukuk portfolios. Number in the cell shows the coefficient of correlation and *p values* of granger causality between the performances of industry-wise sukuk portfolios (FCF & NFCF) and the corresponding bursa Malaysia industry. Asterisks ***, **, * denote the level of significance at respectively one, five and ten percent levels. The causality test is based on lag 2.

Table 9: Regression results

We run Auto Regressive Distributed Lag (ARDL) Model-1: $R_t^{Sukuk} = \alpha_0 + \alpha_1 t + \sum_{i=1}^p \phi_i R_{it-1}^{Sukuk} + \sum_{i=0}^q B_1 R_{t-i}^{Ind} + \sum_{i=0}^r B_2 R_{t-i}^{Equity} + \sum_{i=0}^s B_3 R_{t-i}^{Bond} + e_t$, in which R_t^{Sukuk} is the return of sukuk portfolio based on the underlying asset's industry classification, R_{t-1}^{Sukuk} is the lagged return of sukuk portfolio as defined, R_{t-i}^{Ind} is the market return of the corresponding industry, R_{t-i}^{Equity} is the equity market return based Kuala Lumpur Composite Index, and R_{t-i}^{Bond} is the bond market return. ARDL Model-1 examines the contemporary and lagged effects of the industry, equity, and bond market performances on the sukuk returns. In running ARDL model, we use Akaike information criterion method to select optimal lags of the variables. We further examine the market sentiment effects on the sukuk returns by running Model-2: $R_t^{Sukuk} = \alpha_0 + \alpha_1 t + B_1 M^{Ind} + B_2 M^{Equity} + B_3 M^{Bond} + e_t$ in which R^{Sukuk} is the return of sukuk portfolio, M^{Ind} , M^{Equity} , M^{Bond} are respectively the momentum return (geometric mean return) of the industry, equity and bond markets over the past 30 days from the current date. In both models, we include a time variable 't' that controls the trends of the time-series data. In the panels below, we report the coefficients of relevant variables only. To save space here, we could not report the coefficients of trend and lagged variables.

Industry-sorted Sukuk Portfolio	Panel A: All sukuk						Panel B: Fixed cash flow sukuk						Panel C: Non-fixed cashflow sukuk					
	Model 1			Model 2			Model 1			Model 2			Model 1			Model 2		
	R ^{IND}	R ^{Bond}	R ^{Equity}	M ^{IND}	M ^{Bond}	M ^{Equity}	R ^{IND}	R ^{Bond}	R ^{Equity}	M ^{IND}	M ^{Bond}	M ^{Equity}	R ^{IND}	R ^{Bond}	R ^{Equity}	M ^{IND}	M ^{Bond}	M ^{Equity}
1	.09** (0.00)	-.07* (0.10)	.07 (0.32)	.05** (0.00)	-.06 (0.21)	-.25 (0.35)	.06** (0.00)	-.01 (0.6)	.042 (0.4)	.06** (0.00)	-.10** (0.04)	-.23 (0.38)	.09** (0.00)	-.073* (0.10)	.010 (0.69)	.054** (0.00)	-.059 (0.22)	-.25 (0.35)
2	.16* (0.1)	.05 (0.28)	-.09* (0.1)	.09** (0.04)	.06 (0.18)	.03* (0.08)	.13** (0.00)	.07 (0.15)	-.02* (0.06)	.079** (0.03)	.03 (0.9)	.23* (0.05)	.15** (0.00)	.05 (0.25)	.011 (0.58)	.09** (0.00)	.07 (0.19)	.05* (0.09)
3	.043** (0.00)	.019 (0.37)	-.06 (.81)	.02* (0.10)	.007 (0.7)	-.07 (.52)	.04** (0.00)	.033* (0.1)	-.02 (.49)	.025* (0.06)	.005 (0.7)	-.08 (0.5)	.046** (0.00)	.027** (0.001)	-.005 (.85)	.033** (0.00)	.08 (0.73)	-.001 (.92)
4	.092** (0.00)	.019 (0.42)	.009* (0.09)	.05* (0.08)	.07** (0.00)	-.02* (0.08)	.08** (0.00)	.02 (0.3)	.007 (0.8)	.048** (0.00)	.08** (0.00)	.017 (0.9)	.09** (0.00)	.02 (0.39)	.10* (0.07)	.04** (0.00)	.09** (0.02)	-.01 (0.23)
5	.005* (0.06)	.03 (0.30)	.016 (0.33)	.012** (0.00)	.046 (0.20)	-.15 (0.46)	.027* (0.05)	.02 (0.4)	.017 (0.72)	.02** (0.00)	.059* (0.1)	-.05 (0.7)	.028* (0.06)	.003 (0.87)	.017 (0.72)	.016* (0.08)	.035 (0.33)	-.16 (0.43)
6	.079** (0.00)	-.041 (0.24)	-.014 (0.77)	.03** (0.00)	.07** (0.04)	-.10 (0.61)	.072** (0.00)	-.04 (0.23)	-.01 (0.9)	.04** (0.00)	.07* (0.06)	-.09 (0.64)	.070* (0.05)	-.02 (0.4)	-.011 (0.81)	.044** (0.00)	.072* (0.05)	-.09 (0.65)
7	.07** (0.00)	-.03* (-.07)	-.03 (0.44)	.02** (0.00)	.07** (0.03)	.39** (0.05)	.053** (0.00)	-.01 (-.63)	-.03 (0.49)	.03** (0.00)	.08** (0.02)	.36* (0.07)	.08* (0.05)	.001 (.96)	-.035 (0.45)	.03** (0.00)	.06* (0.07)	.38** (0.05)
8	.03** (0.01)	.20** (0.02)	.017 (0.86)	.01 (0.17)	.07 (0.3)	.25 (0.55)	.02* (0.06)	.17** (0.03)	.014 (0.85)	.023** (0.03)	.036 (0.4)	.15 (0.49)	.035** (0.00)	.21** (0.02)	.017* (0.06)	.008 (0.20)	.038 (0.4)	.01 (0.52)
9	.07** (0.00)	.051 (0.25)	.22** (0.00)	.04** (0.00)	.07* (0.1)	.12* (0.06)	.08** (0.00)	-.05 (0.26)	-.2** (0.03)	.05* (0.06)	.05 (0.28)	.24 (0.33)	.08* (0.05)	-.05 (0.26)	.30** (0.00)	.044** (0.00)	.08* (0.1)	.001 (0.88)

The industry-sorted sukuk portfolio 1 through 9 are classified as Construction = 1, Consumer Product = 2, Finance = 3, Industrial Product = 4, Mining = 5, Plantation = 6, Property = 7, Technology = 8, and Trade & Service = 9. Values in the parenthesis show the p values of the coefficients. Asterisks ** and * denote the level of significance at respectively five and ten percent levels.

Sukuk and Bond Puzzle: An Analysis with Characteristics Matched Portfolios

APPENDIX S1: Sukuk contractual mechanisms

As the study aims to determine if the sukuk resembles a conventional bond based on the market performance and risk parameters across their characteristics-matched portfolios, we provide an analysis on the contractual mechanism of the different types of sukuk to identify the basis of their similarity and dissimilarity. The analysis focuses on the difference of investors' cash flows from both securities across their types, which is important for the valuation of these securities. The Accounting and Auditing Organization for Islamic Financial Institutions (AAOIFI) and Securities Commission Malaysia (SCM), the regulatory bodies that govern sukuk and bond listing in Malaysia, approve several types of sukuk such as *ijarah sukuk*, *murabaha sukuk*, *mudarabah sukuk*, *musharakah sukuk*, *wakalah sukuk*, *istisna sukuk*, *salam sukuk*, and *embedded sukuk* are among others. However, we find that five types of sukuk such as *ijarah*, *murabaha*, *mudarabah*, *musharakah*, and *wakalah* are generally available in the financial market (IIFM, 2016). Of these five sukuk, a *wakalah* is different from the other categories of sukuk as the investors do not directly provide funds to the firm who originates sukuk issuance (*henceforth* 'sukuk issuer' or 'issuer')¹; instead, an investment bank operates as a middleman (*wakil*) between the sukuk investors and fund users. Whereas, in other categories, a sukuk holder directly provides funds to the sukuk issuer while a separate entity Special Purpose Vehicle (SPV) is created by the issuer to secure the sukuk holders' investment and manage sukuk related transactions between the investors and firm.

However, in this study, we relate the *ijarah*, *murabaha*, *mudarabah*, and *musharakah* sukuk with the different types of conventional bonds because an investor by contract directly provides fund to the issuer without an agent - unlike *wakalah* sukuk. Let us now analyze the *ijarah*, *murabaha*, *mudarabah*, and *musharakah* sukuk to understand the patterns of their cash flows to the investors.

Ijarah Sukuk:

¹ The originator of a sukuk is the firm that raises funds from the investors (sukuk holders) through a Special Purpose Vehicle (SPV). This is a legal entity created by the sukuk originator (firms) that (i) issues sukuk certificates, (ii) operates as a trustee of the funds raised and asset purchased (underlying asset belonging to the sukuk holders' ownership), (iii) leases or sells back the underlying asset to the sukuk originator on behalf of the sukuk holders (for partnership contracts), (iv) gets into a partnership contract on behalf of the sukuk holders (for partnership contracts) with the sukuk originator, (v) collects periodic payments (rentals, instalments, and/or share of the profits generated by the sukuk underlying asset) from the sukuk originator, and (vi) distributes to the sukuk holders according to the agreements in the contract. Although SPV issues sukuk certificate to the investors on behalf of the originator firm, in this paper, we identify the sukuk originator (the firm) as the 'sukuk issuer', 'issuer' 'originating sukuk issuer' or 'firm'. This is because the firm being the originator of sukuk creates the SPV in order to issue sukuk and raise funds for its business.

An ijarah sukuk is structured based on a financing lease contract in which the sukuk holders transfer usufruct of the asset purchased by their funds to the sukuk issuer for a series of periodic payments. This usufruct is transferred for a period, and the issuer has a right to buy the asset at a predetermined value upon the expiry of the lease period. Therefore, an ijarah sukuk provides a fixed cash flow to the investors which is much similar to a cash flow from a fixed coupon conventional bond that may include a treasury bond, a corporate bond, or a municipal bond. In brief, like a fixed coupon bond, an ijarah sukuk provides a series of cash flows to the investors but unlike a bond the sukuk contract constitutes a lessor-lessee relationship between the sukuk holders and issuer instead of a lender-borrower relationship. The holders of an ijarah sukuk (lessor) retain the ownership of underlying sukuk asset leased to the issuer (lessee). This is an important element in the context of Islamic laws (*shari'ah*), as the cash flows to the sukuk holders being the asset owner need to be originated from the profits of the underlying asset (DIFCSG, 2017; Meager, 2017; 2008; ISRA 2011, pp.423; Hasan *et al.* 2013, pp.272; Ahmad *et al.* 2015; Safari *et al.* 2013; Ahmad and Hassan, 2007). Therefore, the predetermined fixed rental proceeds that sukuk issuer periodically pays to the sukuk holders is expected to depend on the cash flows from the underlying asset. Hence, similar to an asset-backed bond, the creditworthiness of an ijarah sukuk does not directly rely on the paying ability of the issuer. Hence, *ceteris paribus*, an ijarah sukuk is structured to provide a fixed cash flow to investors like a fixed coupon bond, yet their risk may not be the same unless a fixed coupon bond is also an asset backed security².

Murabaha Sukuk

The design of a murabaha sukuk is based on the sales contract in which the SPV on behalf of sukuk holders buys an asset from the third party in the spot market and then sell it on deferred payments with an agreed mark-up to the sukuk issuer, the firm that originates the issuance of sukuk for funding the purchase of the same asset. In this contract, the period of deferred payments reflects the maturity of the sukuk, and the periodic payments of installments over the maturity period constitutes the series of a fixed cash flow to the sukuk holders. Therefore, based on the structure of cash flows to the sukuk holders, a murabaha sukuk is also similar to a fixed coupon bond, but as discussed above the investors' cash flow in murabaha sukuk is also expected to rely on the profits

² A sukuk could be an asset-backed or asset-based financial security depending on the nature of sukuk holders' asset ownership and their benefit claims (Halim *et al.* 2018; Zolfaghari, 2017; Arundina *et al.*, 2015). Hence, the inherent risk profile of asset-backed and asset-based sukuk could vary. As the purpose of this paper is to compare if the return and risk of sukuk differ from those of the cash flow matched corresponding bonds, we align the cash flow pattern of different types of sukuk with that of the corresponding bond types. We do it because the market valuation of a financial asset depends on its cash flow stream. In this context, we assume that the market will understand the uncertainty associated with the cash flow stream of an asset-backed or asset-based sukuk and price will reflect the risk level of sukuk.

of underlying asset. A point to note that the ownership of the asset sold on deferred payments remains with the sukuk holders until the installments are fully paid by the sukuk issuer. The retention of asset ownership by the sukuk holders during the maturity of sukuk serves as collateral against the risk of payment defaults. Therefore, a murabaha sukuk has a similarity with the features of a mortgage bond. In summary, all the terms of the murabaha contract are determined ahead of time (Saad, et al., 2016; Al-sayyed, 2010; Lackmann, 2015; Jobst, 2009), and it provides a fixed cash flow to the investors similar to a fixed coupon bond although the risks of investment might vary because of the collateral features.

Mudarabah Sukuk

In a mudarabah sukuk, SPV being the trustee of investors' funds enters into a partnership contract with the sukuk issuer, the firm originating sukuk issuance through same SPV. Set aside the mediating role of SVP in the process, the mudarabah partnership contract is basically between the sukuk holders and issuers in which the sukuk holders as investors place their funds with the sukuk issuer who acts as an entrepreneur and manager of the business venture. Therefore, the relationship between the investors and sukuk issuers emerges as sleeping-executive partnership: the investors are sleeping partners while the sukuk issuer is the executive partner. According to the mudarabah partnership contract, the sukuk holders retain the ownership of invested funds and business venture. The issuer and sukuk holders share the profit of business venture on a pre-agreed ratio, but the sukuk holders bear the full amount of loss (Yunita, 2015; 2008; Krichene, 2012, pp. 634; Zin *et al.* 2011; Archer & Karim, 2009). However, because of the sleeping-executive partnership structure of mudarabah contact, a fiduciary relationship emerges between the sukuk holders and issuer (Securities Commission Malaysia, 2009, pp.226; Mirakhor, & Zaidi, 2007; Rahman *et al.* 2014) that may lead to moral hazard problem (Zhang *et al.* 2016; Kolsi *et al.* 2014; Diamond, 1984), since the earnings of a sukuk holder (principal) under a mudarabah sukuk partnership is subject to the best efforts and management ability of the issuer (agent). As the sukuk holders agreed to bear the business losses and share the profits, they cannot effectively penalize the sukuk issuer for a bad investment. Hence, the cash flows to the sukuk investors under a mudarabah contract is less certain as compared to that in ijarah and murabaha sukuk as discussed above, because a mudarabah sukuk does not provide a guarantee on the profit payments and capital return (Zakaria *et al.* 2012; Hamzah, 2016; Alshamrani, 2014).

Therefore, in this paper, we identify a mudarabah sukuk is similar to a conventional bond where the amount of periodic coupon payments is not known ahead of time, such as a floating rate bond and inflation adjusted bond. We analyze that, in terms of cash flow uncertainty, a mudarabah sukuk is likely to be riskier than the floating rate bonds because a floating coupon rate is usually linked

to a reference rate such as LIBOR, KLIBOR or IIBR that can be tracked from market; so, investors can at least estimate the amount of coupon to be paid more easily. However, in case of *mudarabah sukuk*, an investor cannot easily *ex-ante* predict how much profits the *sukuk* underlying asset can generate, as it is subject to the moral hazard problem in addition to other reasons that may affect the market performance of the underlying asset. Hence, while a *mudarabah sukuk* has similarity to a non-fixed coupon bond yet the level of its investment risk is higher than that of the bond.

Musharakah Sukuk

In a *musharakah sukuk*, investors participate (through SPV) in a joint venture business with the *sukuk* issuer (the originator firm) by providing a capital contribution and enters into a partnership contract to share profits and losses according to their capital contributions in the project or at pre-agreed rate (Trad and Bhuyan, 2015; Saripudin *et al.* 2012.b). This *sukuk* contract ideally allows the investors (through SPV) to participate in the management of the *sukuk*-financed project for a period until the *sukuk* holders' investment is recovered (Hamzah, 2016; Zakaria *et al.* 2012; Saripudin *et al.* 2012.a; Zin *et al.* 2011; Jobst, 2009), but SPV in practice appoints the originator (*sukuk* issuer) as the managing agent. Hence, there is a chance of moral hazard as discussed above, because investor/SPV does not participate in the management of business which is selected solely by the originator/*sukuk* issuer, and in the event of losses, the investor/SPV has no strong recourse, as they are contracted to share both the profits and losses from the joint-venture project. Therefore, like *mudarabah sukuk*s, a *musharakah sukuk* also has a similarity with the non-fixed coupon or floating rate bonds based on the investors' cash flow pattern; yet the risk of investment in this *sukuk* is higher than a similar bond due to the moral hazard and other reasons affecting the profitability of business project funded by the *musharakah sukuk*.

Given the above analysis on the contractual mechanisms of different *sukuk*s, we identify that both the *ijarah* and *murabaha sukuk*s provide a series of fixed cash flows to the *sukuk* investors while both *mudarabah* and *musharakah sukuk*s do not offer a fixed cash flows to the investors. Hence, based on the investors' cash flow pattern the *ijarah* and *murabaha sukuk*s are similar to the fixed coupon bonds but the *mudarabah* and *musharakah sukuk*s resemble the floating or non-fixed coupon bonds. Based on the analysis of our prior theoretical discussion, we estimate that *sukuk* might possibly be riskier than the corresponding conventional bond; the reason for our general assumption is that a conventional bond creates a lending-borrowing relationship whilst a *sukuk* does not. Nonetheless, the empirical findings could vary based on the different contractual mechanism and characteristics matched portfolios. In case of *sukuk*, the investors' cash flows are directly generated from the profits of the underlying asset or business project, but not from the performance of the firm as a whole. Hence *sukuk* investment could be subject to higher risk in case

of poor performance of the suggested business project. So, the cash flow generated from sukuk investment could be more uncertain in comparison to that of a conventional bond.

Finally, we look into a basic matter if a sukuk has a debt characteristic like a bond, and analysis shows that the investors' cash flow from the ijarah and murabaha sukuk are like receivable payments by the originating sukuk issuer to the sukuk holders, but those from mudarabah and musharakah sukuk are the payments of profits generated by the project financed by the sukuk funding. This means the ijarah and murabaha sukuk have debt characteristics although their contractual mechanisms are shari'ah permissible as they are based on either lease or sale contracts. However, the mudarabah and musharakah sukuk have equity characteristics as the investors' cash flow are directly generated from the business profits. Therefore, the sukuk are structured securities that give a bond equivalent cash flow to the investors, but the risks of investment are different from the characteristics-matched bonds. Next, we review the literature to know about the results of prior studies comparing the sukuk with bonds.

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APPENDIX S2: Data stationarity tests

Panel A: Data stationarity at level I(0)

Name	Variable	Significance level = 1%				Significance level = 5%				Significance level = 10%			
		Constant but no trend	DF critical value	Constant and trend	DF critical value	Constant but no trend	DF critical value	Constant and trend	DF critical value	Constant but no trend	DF critical value	Constant and trend	DF critical value
Sukuk	Return	-4.49	-3.43	-5.91	-3.96	-4.81	-2.86	-4.40	-3.41	-2.80	-2.57	-4.19	-3.12
	YTM	-5.41	-3.43	-6.12	-3.96	-3.54	-2.86	-3.95	-3.41	-3.57	-2.57	-5.10	-3.12
	Duration	-5.73	-3.43	-8.19	-3.96	-3.87	-2.86	-5.48	-3.41	-3.21	-2.57	-3.92	-3.12
	Convexity	-7.13	-3.43	-5.61	-3.96	-5.19	-2.86	-7.46	-3.41	-4.03	-2.57	-5.90	-3.12
Bond	Return	-5.24	-3.43	-4.81	-3.96	-2.96	-2.86	-5.91	-3.41	-2.71	-2.57	-6.02	-3.12
	YTM	-5.40	-3.43	-5.16	-3.96	-4.99	-2.86	-4.31	-3.41	-3.58	-2.57	-4.20	-3.12
	Duration	-6.42	-3.43	-6.19	-3.96	-2.89	-2.86	-8.11	-3.41	-5.59	-2.57	-3.99	-3.12
	Convexity	-8.49	-3.43	-7.23	-3.96	-5.16	-2.86	-4.61	-3.41	-3.91	-2.57	-5.11	-3.12

Panel A: Data stationarity at the first difference I(1)

Name	Variable	Significance level = 1%				Significance level = 5%				Significance level = 10%			
		Constant but no trend	DF critical value	Constant and trend	DF critical value	Constant but no trend	DF critical value	Constant and trend	DF critical value	Constant but no trend	DF critical value	Constant and trend	DF critical value
Sukuk	Return	-33.0	-3.43	-33.0	-3.96	-32.8	-2.86	-34.3	-3.41	-35.4	-2.57	-31.6	-3.12
	YTM	-25.1	-3.43	-16.2	-3.96	-22.1	-2.86	-27.4	-3.41	-24.2	-2.57	-26.2	-3.12
	Duration	-15.3	-3.43	-18.1	-3.96	-17.4	-2.86	-14.8	-3.41	-18.1	-2.57	-15.1	-3.12
	Convexity	-66.9	-3.43	-66.2	-3.96	-66.9	-2.86	-66.9	-3.41	-66.2	-2.57	-65.4	-3.12
Bond	Return	-32.3	-3.43	-32.8	-3.96	-37.1	-2.86	-35.3	-3.41	-35.1	-2.57	-32.8	-3.12
	YTM	-15.0	-3.43	-15.6	-3.96	-16.4	-2.86	-14.7	-3.41	-15.8	-2.57	-14.5	-3.12
	Duration	-16.2	-3.43	-16.1	-3.96	-18.1	-2.86	-15.7	-3.41	-18.8	-2.57	-17.7	-3.12
	Convexity	-67.0	-3.43	-77.2	-3.96	-66.7	-2.86	-68.9	-3.41	-69.2	-2.57	-68.9	-3.12

We run the Dickey-Fuller (DF) unit root test across different test parameters, such as returns, YTM, duration, and convexity. The test statistic values are less than the corresponding critical values, indicating that all the selected test parameters of Sukuk and bond are stationary and do not contain any unit root

Figure S1: A framework on sukuk and bond characteristics matching portfolios

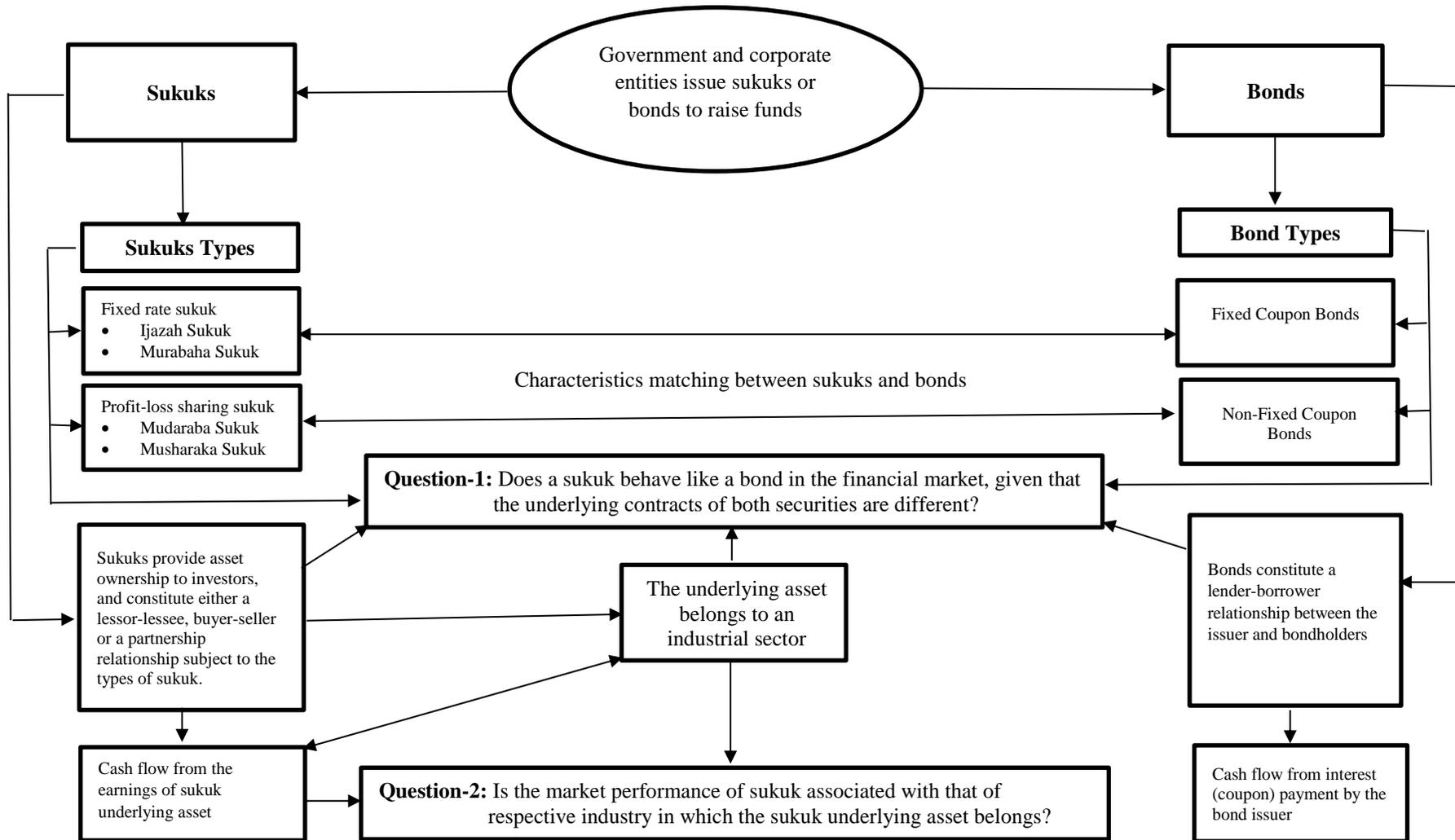


Table S1: Sukuk and bond according to characteristics matching

Pair	Sukuk	Characteristics	Bond	Characteristics
Pair 1 (FCF)	Fixed Rate Sukuk Examples: • Ijara sukuk • Murabaha sukuk	<ul style="list-style-type: none"> • Generates fixed data to sukuk holders, • Thereby, cash flow is known. 	Fixed Coupon Bond Examples: • Treasury bond • Corporate bond • Municipal bond	<ul style="list-style-type: none"> • Generates fixed cash flow to bond holders, • Thereby, cash flow is known.
Pair 2 (NFCF)	Profit-loss sharing Sukuk Examples: • Mudarabah • Musharakah	<ul style="list-style-type: none"> • Distributes a part of profit generated by underlying assets, • Thereby, cash flow is unknown. 	Non-fixed Coupon Examples: • Convertible bond • Inflation adjusted bond	<ul style="list-style-type: none"> • Offers floating cash flow to bond holders, • Thereby, cash flow is unknown.

This table outlines the functional difference between sukuk and bond considering the heterogeneity of contract types and their characteristics matching. It shows that fixed cash flow (FCF) sukuk portfolio is closely matched with FCF bond portfolio whereas NFCF sukuk portfolio is matched with NFCF bond portfolio.

Table S2: Sample Description

Panel A: Distribution of sukuk			Panel E: Sukuk industry areas		
Sukuk Type	No	%	Sukuk industry	No	%
Fixed Rate Ijara	97	15.47%	Construction	119	18.98%
Fixed Rate Murabaha	283	45.13%	Trade/Services	185	29.51%
PLS Mudarabah	50	7.98%	Technology	32	5.10%
PLS Musharaka	197	31.42%	Plantation	14	2.23%
Total	627	100%	Mining	55	8.77%
Panel B: Sukuk portfolio classifications			Industrial Product	39	6.22%
Sukuk portfolio pair	No	%	Consumer Product	3	0.48%
Pair-1 (FCF)	380	60.61%	Finance	109	17.38%
Pair-2 (NFCF)	247	39.39%	Property		
Total	627	100%	Total	627	100%
Panel C: FCF bond portfolio			Panel D: NFCF bond portfolio		
FCF bond portfolio includes all bonds that provide a periodic fixed coupon to the holders. For example, fixed coupon treasury, municipal and corporate bonds. The cash flow to bond holders is certain and guaranteed.			NFCF bond portfolio includes all bonds that do not provide a fixed periodic coupon to the holders. For examples, convertible bonds and different floating rate bonds. The cash flow to bond holders is variable.		

This table outlines the sample description based on the data set of the study (7 years daily data for 627 sukuk). Panel A shows the distribution of sukuk across different contract types. Panel B shows the distribution of sukuk across the FCF and NFCF portfolio classifications. In addition, Panels C and D respectively describes the FCF and NFCF bond portfolio. Finally, Panel E shows the list and percentage of nine sukuk industry areas in which sukuk underlying asset belongs to.

Table S3: Descriptive statistics (N=1724 for each sukuk).

Parameters & Test		All bond portfolio	All sukuk portfolio	Fixed coupon bond	Fixed coupon sukuk	Non-fixed-coupon bond	Non-fixed-coupon sukuk
Return	Mean	0.0179	0.018	0.0164	0.017	0.0015	0.0127
	SD	0.075	0.067	0.095	0.181	0.08	0.23
	Median	0.020	0.020	0.020	0.005	0.00	0.003
	Minimum	-0.57	-0.73	-0.57	-0.82	-0.68	-1.34
	Maximum	0.53	0.41	0.70	0.70	0.42	8.05
YTM	Mean	3.815	4.064	3.580	4.408	NA	4.97
	SD	0.19	0.19	0.18	0.36	NA	0.44
	Median	3.80	4.07	3.56	4.44	NA	4.83
	Minimum	3.42	3.65	3.16	3.82	NA	4.36
	Maximum	4.28	4.43	4.09	11.88	NA	6.53
Duration	Mean	5.011	5.498	4.521	5.825	NA	7.076
	SD	0.38	0.40	0.29	0.63	NA	0.82
	Median	5.23	5.67	4.66	5.74	NA	7.18
	Minimum	4.21	4.76	3.79	4.67	NA	5.48
	Maximum	5.46	5.97	4.96	7.01	NA	8.59
Convexity	Mean	45.978	53.465	38.433	53.287	NA	71.10
	SD	6.49	7.58	4.56	14.76	NA	19.25
	Median	49.50	56.07	38.43	56.43	NA	75.72
	Minimum	33.97	40.93	28.41	13.65	NA	26.37
	Maximum	53.40	63.90	45.69	76.19	NA	96.67

This table reports the summary of descriptive statistics for the selected parameters (i) returns, (ii) YTM, (iii) duration, and (iv) convexity for different types of sukuk and bond portfolios. The database provides the records of (i) fixed coupon bonds and (ii) the composite bond index only, therefore, we estimate the return of non-fixed coupon bond portfolio by subtracting the return of fixed coupon bond portfolio from the return of composite bond index. However, as estimation of YTM, duration, and convexity for the non-fixed coupon bond portfolio is not appropriate.