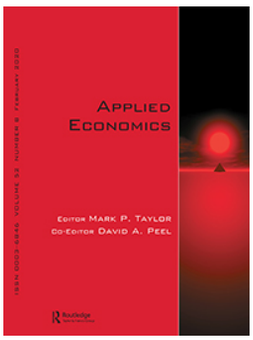

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The impact of Sukuk on the insolvency risk of conventional and Islamic banks

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ABSTRACT

This paper investigates the impact of Sukuk market development on bank insolvency risk using a sample comprising 72 Islamic banks (IBs) and 145 conventional banks (CBs) spanning 15 countries over the 2003–2014 period. We measure bank insolvency risk using the z-score. Using the system-GMM estimator, we find that Sukuk market development adversely affects the insolvency risk of IBs, while that of the CBs remains unchanged. Moreover, our results point to a negative and significant effect of the size on the insolvency risk of both CBs and IBs, thus confirming the well-documented Too-Big-To-Fail hypothesis. This effect is more pronounced for IBs indicating that large IBs exhibit higher insolvency risk than their conventional counterparts. Finally, we show that the 2008 global financial crisis has exacerbated the negative effect of Sukuk market development on bank insolvency risk, as expected.

KEYWORDS
Sukuk; Islamic banking; insolvency risk; panel model

JEL CLASSIFICATION
C33; G10; G21; G29

I. Introduction

In the last two decades, Sukuk markets have experienced extraordinary development reaching an outstanding global issuance hovering around $400 billion spanning the five continents. This rapid growth does not seem to be losing momentum; in 2017, global Sukuk issuance has grown by more than 22% reaching $91.9 billion[1]. In the same year, Saudi Arabia issued the largest sovereign international Sukuk thus far amounting to $9 billion. Crucially, this issuance qualifies as a high quality liquid asset under Basel III. In the largest corporate Sukuk market (Malaysia), corporate Sukuk denominated in local currency have increased by 50% in 2017, covering a variety of sectors. Increasingly, the maturity structure of Sukuk is shifting from short-term to medium and long-term (IFSI Stability Report, 2018).

Although the global Sukuk market has been growing rapidly, the literature on Sukuk has evolved at a slower pace. The existing studies cover several issues including firm-specific determinants of Sukuk (Azmat, Skully, and Brown 2014; Hanifa, Masih, and Bacha 2015); country-level determinants (Smaoui and Khawaja 2017); the relationship between Sukuk and economic development (Smaoui and Nechi 2017); the effect of Sukuk on the stock market (Ashhari, Chun, and Nassir 2009; Alam, Hassan, and Haque 2013; Godlewski, Turk-Ariss, and Weill 2013; Hassan et al. 2017); Sukuk structures and risks (Tarik and Dar 2007); and Sukuk versus conventional bonds (Cakir and Raei 2007).

A growing literature investigates the stability of IBs and CBs and compares, among other risks, their insolvency risk (Čihák and Hesse 2010; Beck, Demirgüç-Kunt, and Merrouche 2013; Zins and Laurent 2017). Identifying the complete list of determinants affecting the risks of IBs and CBs is still work in progress, but the literature has generally categorized these determinants into internal and external factors. The internal factors are those related to the characteristics inherent to banks whereas the external factors include the financial market, macroeconomic, industrial, regulatory and institutional environments.

This paper extends this nascent literature by highlighting a new channel through which bank's insolvency risk might be affected, namely the emergence of Sukuk markets. The impact of Sukuk on the banking sector is a relatively new research field. Smaoui, Mimouni, and Temimi (2017) show that the presence of a well-functioning banking sector hampers the development of Sukuk markets, supporting the existence of competition between Sukuk

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[1]The 2018 IFSI stability report.

markets and banking. Mimouni et al. (2019) show that Sukuk market development negatively affects the profitability of IBs whereas the performance of CBs is unaffected. We contribute to this growing literature by studying the impact of Sukuk on the insolvency risk of banks.

The 2008 financial crisis has negatively affected investor confidence in banks (DeYoung et al. 2015; Thakor 2015) as the crisis originated in the banking sector. Banks had to slash lending due to a substantial decrease in deposit levels (Ivashina and Scharfstein 2010). Accordingly, this may have generated a shift from the banking sector to Sukuk markets after the crisis. On the other hand, however, Sukuk issuances by IBs after the crisis allowed them to strengthen their capital holdings and diversify their financing sources (Haron, Archer, and Karim 2018). Hence, Sukuk may have contributed to the stability of the banking sector after the crisis. It would be therefore of interest to empirically investigate the impact of Sukuk on the insolvency risk of banks after the crisis.

Against this background, we investigate the following questions: Do Sukuk markets expansion affect bank insolvency risk? Do they impact IBs and CBs' insolvency risk equally? Does the impact of Sukuk on bank insolvency risk depend on the size of banks? Do corporate Sukuk and sovereign Sukuk exert the same effects on the insolvency risk of the banking sector? Did the financial crisis affect the relationship between Sukuk market development and bank insolvency risk?

Specifically, we explore four hypotheses. The first conjectures that the issuance of Sukuk has a significant impact on the banking sector insolvency risk.[2] The second hypothesis posits that the impact of Sukuk will be different between IBs and CBs as the two categories of banks have different business models and their risk is expected to be driven by different determinants. The third hypothesizes that the effects of Sukuk on bank insolvency risk will be different between small and large banks.[3] Finally, our fourth hypothesis posits that the effect of Sukuk on bank insolvency risk will be influenced by the 2008 crisis.

Our results reveal some novel findings. The development of Sukuk markets adversely affects the insolvency risk of IBs only. We also show that large IBs experience higher insolvency risk than large CBs. This may be due to the fact that IBs have limited access to hedging instruments compared to CBs and to the fact that the monitoring of agent-entrepreneurs is harder for IBs (Iqbal and Llewellyn 2002). Finally, our analysis reveals that the 2008 crisis amplified the adverse effects of Sukuk on bank insolvency risk, as expected.

The rest of the paper proceeds as follows. Section 2 provides a brief review of the literature and the hypotheses. Section 3 describes the variables used in the empirical analysis. Section 4 presents the data and estimation technique. Section 5 reports and discusses the results. Finally, Section 6 concludes.

II. Literature review and hypotheses

While there is a consensus that Islamic finance has performed relatively well in the midst of the 2008 global financial crisis (Čihák and Hesse 2010; Hassan and Dridi 2010), the debate on whether IBs are less risky than CBs is inconclusive. The existing literature has identified some arguments supporting that IBs may be riskier than CBs. First, the profit/loss sharing (PLS) feature in Islamic banking makes depositors vulnerable to panics during business cycles which increases the bank risks and forces them to carry more liquidity (Beck, Demirgüç-Kunt, and Merrouche 2013). Second, the fact that some banks offer a variable rate of return on savings/investments and cannot guarantee the value of their assets may lead to depositors' withdrawal decisions. This risk is known in the banking industry as the withdrawal risk. Ahmed and Khan (2007) report that neither a principal nor a return is guaranteed on IBs' investments compared to CBs. This uncertainty leads to an increase in the fund withdrawal risk from IBs depositors. Third, unlike CBs, IBs have limited access to hedging instruments that are Sharia-compliant (Čihák and Hesse 2010; Zins and Laurent 2017). The market for Islamic derivatives is thin and far

[2]The effect could be a reduction in bank risk given that Sukuk represent a potential tool to avoid liquidity shortages and to diversify operations for both IBs and CBs. The effect could also be an increase in bank insolvency risk since Sukuk may compete with the banking sector and deprive banks from market share.

[3]Čihák and Hesse (2010) document that the risks of banks vary considerably by size (small/large).

from providing adequate banks hedging tools. Fourth, IBs suffer from the absence of a liquid Islamic capital market, such as a liquid secondary Sukuk market, that would potentially secure a buffer to overcome liquidity constraints and securitize part of the bank assets. Finally, IBs encounter a large operational risk since any negligence regarding the compliance to Sharia renders the contracts void and results ultimately in huge losses for banks (El Tiby 2014). Together, these risks increase the vulnerability of IBs compared to CBs and contribute to overall higher risk for these banks.

However, another strand of literature asserts that IBs are less risky than CBs in many facets. For instance, the PLS feature in Islamic banking implies that any risks resulting from investing in projects will be transferred to clients, whereas, within the conventional banking industry, all loan losses are fully absorbed by banks (Khan and Ahmed 2001). Additionally, for religious commitments, the credit risk may be lower for IBs as their clients are usually more disciplined, avoid fraud, and try their best to repay banks even in cases of financial difficulty (Baele, Farooq, and Ongena 2014).

When comparing the risks of CBs and IBs, the literature finds that the conclusions vary according to several factors like the size of the bank. Čihák and Hesse (2010) find that small IBs are more stable than small CBs but large IBs and CBs have similar risks. Abedifar, Molyneux, and Tarazi (2013) report that IBs have, in general, lower credit risk than CBs and that small IBs have a lower insolvency risk than their conventional counterparts. On the contrary, Beck, Demirgüç-Kunt, and Merrouche (2013) results do not reveal any differences in the risk profiles of both types of banks independently of the size.

To analyze bank insolvency risk, the literature has identified further important determinants and classified them in two categories: internal and external factors. The internal determinants of insolvency risk include among others: the size of the bank, the cost-to-income ratio, and the loans-to-total-assets ratio (Čihák and Hesse 2010; Beck, Demirgüç-Kunt, and Merrouche 2013; Zins and Laurent 2017), whereas the external factors affecting bank insolvency risk include the macroeconomic environment (GDP growth and inflation), and the market power of banks (Lerner index or the Herfindahl index). Studies using external factors include, for instance, the work of Čihák and Hesse (2010), Beck, Demirgüç-Kunt, and Merrouche (2013), and Zins and Laurent (2017). Table 1 summarizes some of the recent literature findings on bank stability.[4]

Most of the relevant comparative literature on CBs and IBs stability do not split the estimation sample into IBs and CBs and do not run separate regressions for each type of banks. If done, this would allow to identify which determinants matter for each type of

Table 1. Summary of the literature.

Author(s)		Countries	Methodology	Main Findings
Abedifar, Molyneux, and Tarazi (2013)	1999–2009	24 countries	Random Effects	Small IBs have lower insolvency risk than small CBs. Large IBs have the same insolvency risk as CBs.
Čihák and Hesse (2010)	1993–2004	19 countries	Different Panel regression models	Small IBs are more stable than small CBs while large CBs are more stable than large IBs.
Beck, Demirgüç-Kunt, and Merrouche (2013)	1995–2009	22 countries	Fixed Effects	IBs have higher asset quality and are better capitalized than CBs. IBs were more resilient than CBs during the 2008 financial crisis.
Alam (2012)	2006–2010.	11 countries	Fixed Effects	Higher capital requirements lower the risk of CBs and IBs.
Srairi (2013)	2005–2009	10 countries	Two-stage least squares	CBs have a higher risk exposure than IBs
Hassan and Dridi (2010)	2007–2010	8 countries	Descriptive	IBs credit and asset growth performed better than CBs in 2008–2009.
Zins and Laurent (2017)	2007–2013	24 countries	Difference in Difference	IBs risk is affected by the regulatory framework.
Mollah et al. (2016)	2005–2013	14 countries	Random effects GLS & two-step GMM	IBs are better capitalized than CBs and take higher risk.
Olson and Zoubi (2017)	1996–2014	22 countries	Fixed Effects	The financial crisis had a different effect on the risk and assets of IBs and CBs.
Ibrahim and Rizvi (2017)	2000–2014	45 IBs in 13 countries	GMM estimator	Capital regulation has a positive effect on the stability of IBs.

This Table summarizes the main research on the bank stability of CBs and IBs, the sample period, the number of countries in the study, the methodology employed, and the main findings. For a comprehensive literature review, see Hassan and Aliyu (2018).

[4]For a comprehensive literature review, see Hassan and Aliyu (2018).

banks. Rather, the literature employs the same set of determinants for both IBs and CBs and includes a dummy variable for IBs that detects whether the stability levels are similar across these groups of banks. Occasionally, researchers use interactive terms to identify the differential effect of certain determinants (see for instance Čihák and Hesse 2010) and distinguish between small banks and large banks. Accordingly, one of the main contributions of our paper is to allow the effects of several bank-specific and country-specific determinants to be different between IBs and CBs thanks to the use of interactive variables. Employing interactive terms would reveal the existence of variations in the determinants' impact on the insolvency risk of IBs and CBs.

Specifically, we contribute to this growing literature by studying a new channel (Sukuk) affecting bank insolvency risk. We investigate the impact of Sukuk on bank insolvency risk using a sample of 72 IBs and 145 CBs belonging to 15 countries spanning the period 2003 to 2014. Smaoui, Mimouni, and Temimi (2017) and Mimouni et al. (2019) find that Sukuk development has an impact on the banking sector. Smaoui, Mimouni, and Temimi (2017) report that countries in which banks play a key role in the economy issue less Sukuk, while Mimouni et al. (2019) find that Sukuk adversely affect the profitability of IBs only. These findings represent a good starting point to unveil the relationship between Sukuk and the banking sector. However, more facets of this relationship are still uncovered and need to be investigated further. Smaoui, Mimouni, and Temimi (2017) and Mimouni et al. (2019) results point to a competition effect between Sukuk and banks. Accordingly, we may suggest that Sukuk issuance increases the insolvency risk of the banking sector. However, Sukuk also provide a platform for banks to securitize their loans and to access short-term liquidity. Moreover, several IBs have recently issued Sukuk that qualify for Tier 1 (or Tier 2) capital[5]. This suggests that the presence of a well-developed Sukuk market may increase the ability of IBs to improve their capital adequacy ratios, thereby reducing their insolvency risk. Which effect prevails is not obvious and requires further study. This discussion leads to our first hypothesis:

H1: Sukuk market development has a significant impact on bank insolvency risk.

If our first hypothesis is confirmed, whether the magnitude of the effects of Sukuk on CBs and IBs is the same remains unclear. Since IBs are more vulnerable to bank runs resulting from the PLS characteristic inherent to these banks, Sukuk offer in this case a buffer to acquire short-term financing when needed lowering the risk of panics. However, Mimouni et al. (2019) show that Sukuk expansion adversely affects the profitability of IBs while the performance of CBs is unaffected. It follows that Sukuk development may increase the risk of IBs more than CBs. Hence, more investigation is needed to fully uncover whether IBs and CBs are equally affected by Sukuk expansion. We, therefore, conjecture:

H2: Sukuk market development affects differently the risks of IBs and CBs.

Čihák and Hesse (2010) and Abedifar, Molyneux, and Tarazi (2013) find that there are some disparities between the risk profiles of small and large banks. Abedifar, Molyneux, and Tarazi (2013) investigate the risk characteristics of IBs using a sample of 553 banks from 24 countries for the sample period 1999 to 2009. They find that small IBs, which are either levered or located in countries with mostly Muslim populations, have lower credit risk than CBs. They also report that small IBs appear to be more stable in terms of insolvency risk. Čihák and Hesse (2010) use 19 banking systems with a large predominance of Islamic banking. They find that small IBs tend to be financially stronger than small CBs whereas large CBs tend to be financially stronger than large IBs. Additionally, the authors document that small IBs tend to be financially stronger than large IBs reflecting the challenges to manage the credit risk in relatively large IBs. These findings suggest that small and large banks' risk profiles are different and justify an investigation of

[5]For instance, Qatar Islamic Bank, Abu Dhabi Islamic Bank, Dubai Islamic Bank, Boubyan Bank, and Noor bank have issued perpetual Sukuk eligible for Tier 1 capital, while Asya Bank and Kuveyt Turk have issued Tier 2 Sukuk.

whether banks of a different size may react differently to Sukuk issuance. Consequently, we formulate our third hypothesis as follows:

H3: The effects of Sukuk market development on risk are different depending on the size of the bank.

DeYoung et al. (2015) and Thakor (2015) document that the 2008 crisis had a negative effect on the confidence of investors in banks as the crisis originated in the banking sector. As banks experienced a substantial decrease in deposit levels, they had to reduce lending (Ivashina and Scharfstein 2010). Therefore, this may have led to a shift from the banking sector to Sukuk markets after the crisis. On the other hand, however, Sukuk issuances by IBs after the crisis may have allowed them to strengthen their capital and diversify their financing sources (Haron, Archer, and Karim 2018). Hence, Sukuk may have affected the risk of the banking sector after the crisis. Therefore, we hypothesize:

H4: The effects of Sukuk market development on risk are affected by the financial crisis.

III. Variables description

We provide below a brief review of the dependent and independent variables used in the empirical analysis.

The dependent variable: insolvency risk

We employ the z-score to measure the insolvency risk of a bank. The z-score represents the number of standard deviations by which a bank return must decrease before all bank's equity is depleted. Therefore, the z-score relates negatively to the probability of insolvency. Currently, several variants of the z-score measure exist in the literature. The generic form of the z-score is defined as:

$$z - score = \frac{ROA + CAR}{\sigma_{ROA}} \quad (1)$$

While the literature agrees that a bank is insolvent when its losses cannot be offset by the available capital, the techniques used to calculate returns and capital vary considerably[6]. Following Beck and Laeven (2006) and Hesse and Čihák (2007), we combine the current measure of ROA and CAR and use the standard deviation of ROA calculated over the full sample.

The control variables

The control variables are categorized into two groups: bank-specific variables and country-specific variables.

We employ several variables to control for the bank-specific determinants. The first is the total-loans-to-total-assets ratio (*tlta*) used as a proxy for the bank activity' structure. A high *tlta* ratio may indicate that the bank is focused on lending activity with little diversification. This leads to higher operational risks as loan businesses historically witnessed several severe crises. In addition, this may potentially lead to weaker screening of clients with no or little collateral requirements (Dell'Ariccia and Marquez 2006; Ogura 2006). Thus, the increased specialization of the bank can ultimately lead to higher insolvency risk. Hence, we expect a negative relationship between *tlta* and the z-score.

The presence of qualified management tends to have a negative impact on bank insolvency risk. Good management within the bank would result in higher income and lower cost, thereby reducing the risks encountered by banks (Kwan and Eisenbeis 1997; Berger and DeYoung 1997). Management Efficiency is proxied by the cost-to-income ratio (*cosinr*) (Abedifar, Molyneux, and Tarazi 2013; Zins and Laurent 2017). We expect a negative relationship between the variables *cosinr* and the z-score.

The results on the relationship between size and risk in the literature are mixed. Large banks benefit from economies of scale and have a more diversified activity (Hughes, Mester, and Moon 2001). However, large banks can also have increased risks resulting from the Too-Big-To-Fail safety net subsidies (Kane 2010). We measure size (*size*) by the logarithm of total assets. Since the results of the previous literature on the effects

[6]See for instance (Yeyati and Micco 2007; Lepetit and Strobel 2013).

of *size* on the z-score are mostly inconclusive, we leave the determination of its sign to the data.

Risks can be affected by banks' level of liquidity. Banks with higher access to liquidity buffers have less risk of insolvency and default (Milne and Whalley 2001; Peura and Keppo 2006; Bolton, Chen, and Wang 2011; Hugonnier, Malamud, and Morellec 2017). Liquidity buffers include easy access to external equity financing, excess reserves held with central banks, or any holdings of liquid assets. Čihák and Hesse (2010) use liquid assets divided by deposits as a proxy for liquidity. They find that, overall, large banks holding more liquidity buffers are more stable than small banks. They also find that liquidity benefits toward stability are more pronounced for large IBs. The authors relate this to the fact that IBs have little access to the interbank market and to the scarcity of Islamic hedging instruments. In this study, we measure liquidity (*liquid*) using the ratio of liquid assets to short-term funds. We expect a positive relationship between the variables *liquid* and z-score. Finally, we control for whether the bank is listed on the stock exchange or closely held as this feature may impact the solvency of the bank and its ability to deal with unexpected financial shortages through the raise of public financing. We use a dummy variable that takes the value of 1 if the bank is listed on a stock exchange and the value of 0 if it is closely held. We expect a positive relationship between the variables *listed* and the z-score.

In addition to the bank-specific determinants of risk discussed above, we control for several country-specific variables. Our focal variable in this paper is the degree of Sukuk market development (*smd*). We measure *smd* with the ratio of Sukuk market capitalization as a share of GDP (Smaoui and Nechi 2017; Smaoui, Mimouni, and Temimi 2017). We argue that *smd* may have an ambiguous effect on bank insolvency risk. On one hand, *smd* increases bank risk since Sukuk markets may absorb part of banks' market share. This results in higher competition in the banking sector and leads to narrower bank margins, thereby forcing banks to take on more risk. On the other hand, however, banks may benefit from Sukuk in different ways. First, they can invest in Sukuk issued by other firms leading to more diversified bank asset portfolios, hence lower insolvency risk. Second, they can be part of the investment banking activities related to Sukuk issuance. Third, the pecking order theory implies that Sukuk financing is less costly than common equity known to suffer from underpricing and negative signaling.[7] Hence, banks can lower their cost of capital by using Sukuk instead of common equity. Finally, banks may benefit from Sukuk development by issuing Sukuk that qualify for Tier 1 or Tier 2 capital, thereby ameliorating their capital adequacy ratios, hence reducing their insolvency risk (Smaoui and Ghouma 2018). Accordingly, banks may consider Sukuk expansion as an opportunity rather than being solely a threat. Thus, the impact of Sukuk development on bank insolvency risk remains an empirical question, which we leave to the data and the empirical model.

We also control for the level of market competition. A higher concentration of the banking system would ultimately provide banks with more freedom to set margins. Banks will also have more power to select clients and decline bad borrowers. Hence, a higher market power would result in an overall lower risk (Berger, Klapper, and Turk-Ariss 2009; Fungacova and Weill 2013; Abedifar, Molyneux, and Tarazi 2013; Zins and Laurent 2017). We measure the market power of the banking sector using the Lerner index (*lerner*).[8] We expect a positive relationship between the variables *lerner* and the z-score.

The third country-specific variable employed in this study is economic growth (*growth*). Economic growth is a desirable condition that usually reduces default and enhances business activities increasing bank profits and reducing their risks. We measure economic growth using the growth of real per capita GDP. We expect a positive relationship between *growth* and the z-score.

Additionally, we control for inflation (*inf*) as it may have a negative effect on bank insolvency

[7]According to Nagano's (2010), Sukuk share features from debt and equity. The author asserts that the information cost related to Sukuk lies between that of using debt and issuing equity. Hence, Nagano (2010) concludes that issuing conventional debt is preferred to Sukuk which is preferred to equity.

[8]We also used the Herfindahl–Hirschman Index (HHI) instead of the Lerner index to measure banking competition and the overall results of this study remain unchanged. The unreported results are available from the corresponding author upon request.

risk. Higher inflation (anticipated) would lead to an increase in loans interest rates charged to clients (Hanson and Rocha 1986; Demirguc-Kunt and Huizinga 1998; Denizer 2000; Claessens, Demirguc-Kunt, and Huizinga 2001). Hence, anticipated inflation risk is totally or partially transferred to the bank customers. Unanticipated inflation, however, results in a higher cost of financing for banks lowering their intermediation margins and increasing their risks.

We also control for the country's degree of religiosity using the share of Muslims in the population (*muslim*) and the legal system of the country (*legal*). The legal system variable takes the value of 2 if the legal system is based on Sharia, the value of 1 if it based on a mix of Sharia and common or civil law, and the value of 0 otherwise. Abedifar, Molyneux, and Tarazi (2013) argue that religious bank clients tend to be more loyal to their bank, more committed to repaying their loans, ready to accept poor returns on investment, and refuse to withdraw their deposits even when the bank exhibits poor performance. Hence, religiosity may affect bank insolvency risk. We expect that the variables *muslim* and *legal* will load positive in relation to z-score.

Our last country-specific variable is the control of corruption (*corr*). We expect less insolvency risk for banks operating in countries where corruption is mitigated. Hence, the relationship between *corr* and z-score is expected to be positive.

IV. Sample and methodology

Sample

We examine the impact of Sukuk market development on the insolvency risk of IBs and CBs using a panel data set spanning the period 2003–2014. Our sample includes all countries with an active Sukuk market and a dual-type banking system. The final sample covers IBs and CBs in the following countries: Bahrain, Bangladesh, Brunei, Gambia, Indonesia, Kuwait, Malaysia, Oman, Pakistan, Qatar, Saudi Arabia, Singapore, Turkey, UAE, and Yemen.

Bank-level data were gathered from the Bankscope Bureau Van Dijk Database. To ensure accuracy, we cross-checked the Bankscope's classification of banks as either CBs or IBs using the Bloomberg Database, the Thomson Reuters Zawya Database, as well as the banks' websites. CBs with Islamic windows have been classified as CBs. The data on Sukuk issuances were obtained from the Bloomberg database, while country-level variables were retrieved from the World Bank's World Development Indicators database. The share of the Muslim population is taken from the Pew Research Center (2009) and the data on the Control of Corruption is gathered from the International Country Risk Guide (ICRG). Our final sample comprises 72 IBs and 145 CBs, for a total of 1,780 bank-year observations over the period 2003–2014. Table 2 reports the list of sampled countries and the number of CBs and IBs in each country.

Methodology

To test our hypotheses on the impact of Sukuk market development on bank insolvency risk while controlling for the control variables discussed earlier, we estimate the following panel model:

$$\begin{aligned} ln(zscore_{ijt}) = {} & \alpha + \beta_1 ib + \beta_2 smd_{jt} + \beta_3 size_{ijt} \\ & + \beta_4 tlta_{ijt} + \beta_5 cosinr_{ijt} + \beta_6 liquid_{ijt} \\ & + \beta_7 listed + \beta_8 ib * smd_{jt} + \beta_9 lerner_{jt} \\ & + \beta_{10} growth_{jt} + \beta_{11} inf_{jt} + \beta_{12} muslim_j \\ & + \beta_{13} legal_{jt} + \beta_{14} corr_{jt} + \beta_{15} ib * size_{ijt} \\ & + \sum_{y=1}^{12} \beta_{16,y} time\ dummies_{t,y} + \mu_{ij} + \varepsilon_{ijt} \end{aligned} \quad (2)$$

Table 2. Sample countries.

Country	IBs	CBs	Total
Bahrain	6	6	12
Bangladesh	6	22	28
Brunei	2	0	2
Gambia	1	6	7
Indonesia	14	38	52
Kuwait	5	5	10
Malaysia	14	19	33
Oman	2	0	2
Pakistan	4	14	18
Qatar	5	5	10
Saudi Arabia	3	7	10
Singapore	1	0	1
Turkey	2	12	14
UAE	3	7	10
Yemen	4	4	8
Total	72	145	217

This table reports the list of sample countries and the number of IBs and CBs per country over the period 2003–2014.

Where $\ln(zscore_{i,j,t})$ stands for our measure of insolvency risk of bank i in country j at time t; ib is a dummy variable that takes the value of 1 if the bank is an Islamic bank and 0 otherwise; $smd_{j,t}$ denotes Sukuk market development for country j at time (t); the remaining bank-level and country-level control variables are as described earlier; μ_{ij} denotes the unobserved bank-specific effect; and $\varepsilon_{i,j,t}$ is the zero-mean disturbance term.

Since the distribution of the z-score is highly skewed (Laeven and Levine 2009), we use the natural logarithm of the z-score. Lepetit and Strobel (2015) argue that the log-transformed z-score could be considered as a bank insolvency risk measure and is proportional to the log odds of insolvency. For brevity, in the remainder of the paper, we will refer to the natural logarithm of the z-score with the label '"z-score"'.

We tested for the presence of serial correlation and heteroscedasticity in the series of residuals, $\varepsilon_{i,j,t}$, using respectively the Wooldridge (2002) test and the modified Wald test. The results point out to the presence of serial correlation and heteroscedasticity in the series of residuals. To overcome these econometric problems as well as the potential endogeneity[9] of the explanatory variables, we estimate our model (2) using the system-GMM procedure of Blundell and Bond (1998) and Arellano and Bover (1995). This procedure combines, within a system, the equation in levels and the equation in first differences, each with its appropriate set of instruments. For the regression in levels, the bank-specific effect is not eliminated but must be controlled for with the use of instrumental variables, namely the lagged differences of the endogenous and exogenous variables. For the regression in first differences, the instruments are the lagged exogenous and endogenous variables prior or equal to (t-2). The Sukuk market development variable (*smd*) is treated as endogenous since the instability of a country's banking system is likely to hamper the development of the local Sukuk market. Likewise, the variable *listed* is assumed to be endogenous since a bank could be delisted from the Stock Exchange due to its high insolvency risk. All the remaining explanatory variables are treated as exogenous.

The consistency of our system-GMM estimator depends on two assumptions: the instruments used are exogenous and the residuals do not exhibit second-order serial correlation. We use two tests to check both hypotheses. First, the Hansen test tests the null hypothesis of the overall validity of the instruments, i.e. uncorrelated with the residuals. Second, the Arellano and Bond (1991) test (AR2, hereafter) examines the null hypothesis that the residuals exhibit no second-order serial correlation. The non-rejection of the null hypotheses under the Hansen and AR2 tests implies that our system-GMM estimator is consistent.

In order to tackle the problem of the small sample bias of the system-GMM estimator (Roodman 2009), we employ both the Windmeijer (2005) small sample correction and the procedure of Calderon, Chong, and Loayza (2000) which collapses the size of the instrument matrix, thereby mitigating the overfitting problem.

Finally, all our variables are winsorized at the 5th and 95th percentiles within each country in order to mitigate the potential effect of the outliers on the results.

V. Empirical results

Estimation results

Table 3 reports the summary statistics of our key variables for the sample of IBs, CBs, and the full sample. We notice that the average z-score for the sample of IBs (2.896) is higher than that of the sample of CBs (2.698), indicating that CBs display, on average, higher insolvency risk than IBs. For instance, profits must fall by 18.1 times their standard deviation to deplete the equity of IBs; however, profits must decrease only by 14.8 times their standard deviation to fully absorb CBs' equity. Moreover, IBs are, on average, slightly larger than CBs (14.416 versus 14.167). Furthermore, we find that the average *tlta* for our sample of IBs is

[9]Endogeneity encompasses measurement errors, omitted variables bias, simultaneity and reverse causality problems (Ullah, Akhtar, and Zaeferian 2018).

Table 3. Summary statistics.

Islamic Banks	N	Mean	Median	Std. Dev.	Min	Max
zscore	1228	2.896	2.974	.82	1.084	4.189
ib	1246	0	0	0	0	0
smd	1246	.801	.024	2.252	0	9.665
size	1246	14.416	14.513	1.91	10.891	17.472
tlta	978	53.556	58.06	16.563	10.35	75.68
costinr	979	50.171	47.28	20.356	20.97	92.9
liquid	980	34.264	26.215	23.856	7.9	96.2
listed	1246	.543	1	.498	0	1
muslim	1246	87.194	88.2	10.396	60.4	99.1
legal	1246	.357	0	.479	0	1
lerner	1119	33.945	32	12.671	11	58
growth	1246	2.129	3.267	3.044	−5.971	6.085
inf	1173	6.371	6.244	3.256	.968	13.109
corr	1246	2.492	2.5	.684	1	4
Conventional Banks						
zscore	529	2.698	2.832	.906	1.084	4.189
ib	534	1	1	0	1	1
smd	534	1.506	.075	2.938	0	9.665
size	534	14.167	14.458	1.725	10.891	17.472
tlta	436	51.635	57.295	20.551	10.35	75.68
costinr	430	52.936	51.39	19.769	20.97	92.9
liquid	426	33.791	26.87	23.69	7.9	96.2
listed	534	.421	0	.494	0	1
muslim	534	82.048	88.2	15.916	14.92	99.1
legal	534	.429	0	.495	0	1
lerner	428	36.544	36	14.54	11	58
growth	534	1.698	2.815	3.266	−5.971	6.085
inf	499	5.302	4.61	3.565	.968	13.109
corr	534	2.494	2.5	.651	1	4.5
Full Sample						
zscore	1757	2.837	2.938	.851	1.084	4.189
ib	1780	.3	0	.458	0	1
smd	1780	1.012	.051	2.498	0	9.665
size	1780	14.341	14.499	1.859	10.891	17.472
tlta	1414	52.964	57.88	17.903	10.35	75.68
costinr	1409	51.015	48.67	20.212	20.97	92.9
liquid	1406	34.121	26.43	23.798	7.9	96.2
listed	1780	.506	1	.5	0	1
muslim	1780	85.65	88.2	12.534	14.92	99.1
legal	1780	.379	0	.485	0	1
lerner	1547	34.664	33	13.261	11	58
growth	1780	1.999	3.267	3.118	−5.971	6.085
inf	1672	6.052	5.669	3.385	.968	13.109
corr	1780	2.493	2.5	.674	1	4.5

This table includes the descriptive statistics of the dependent and independent variables for the sample of 145 CBs and 72 IBs over the period 2003–2014.

higher than that of their conventional counterparts, suggesting that the assets' portfolio of CBs is more diversified than that of the IBs. We also notice from Table 3 that IBs display, on average, lower cost-to-income ratio than CBs, implying that IBs are more efficient than CBs. Finally, 54.3 percent of our sample of IBs are listed on an exchange versus 42.9 percent for our sample of CBs.

Table 4 reports some important findings. The development of Sukuk markets (*smd*) has no impact on the insolvency risk measured using the z-score for the overall sample as the estimate related to this variable is not statistically significant at the 5 percent significance level in 6 out of 7 specifications. Hence, we reject our hypothesis H1 for the overall sample of IBs and CBs. This result is at first surprising given that any expansion of Sukuk markets may deprive banks from attracting more clients and reduces, therefore, their ROA. However, in a recent study, Mimouni et al. (2019) find that Sukuk development does not affect the profitability of all banks alike. This may also be the case in the current study that focuses on the risk factor. Indeed, a closer inspection of the interactive term *ib*smd* in Table 4 reveals a negative and significant effect across all our specifications while the *smd* variable remains insignificant, suggesting that Sukuk markets expansion adversely affects the insolvency risk of IBs only. We, therefore, confirm our hypothesis H2.

The increase of the insolvency risk of IBs related to Sukuk markets expansion may be attributed to

Table 4. First results.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	z-score	z-score	z-score	z-score	z-score	z-score	z-score
ib	0.496	0.695	0.040	−0.186	−0.158	−0.029	3.357**
	(0.510)	(0.479)	(0.183)	(0.581)	(0.542)	(0.209)	(1.339)
smd	0.054	0.103	0.018	0.038	0.051	−0.049	−0.102**
	(0.091)	(0.078)	(0.066)	(0.054)	(0.061)	(0.037)	(0.049)
size	−0.614**	−0.507**	−0.269**	−0.328**	−0.135**	−0.126**	0.111
	(0.302)	(0.213)	(0.110)	(0.161)	(0.066)	(0.064)	(0.087)
tlta	0.034**	0.030**	0.011**	0.013**	0.010*	0.010**	0.011***
	(0.016)	(0.015)	(0.004)	(0.006)	(0.005)	(0.005)	(0.004)
cosinr	−0.037**	−0.034**	−0.003	−0.007	−0.009*	−0.004	−0.006
	(0.015)	(0.013)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
liquid	0.012	0.011	0.002	0.001	0.001	0.005	0.008**
	(0.014)	(0.014)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
listed	2.854**	2.295**	0.883*	0.907*	0.108	0.666	−0.030
	(1.146)	(0.911)	(0.489)	(0.491)	(0.472)	(0.505)	(0.445)
ib*smd		−0.434**	−0.465***	−0.412**	−0.498***	−0.271***	−0.652***
		(0.209)	(0.129)	(0.174)	(0.174)	(0.091)	(0.111)
muslim			−0.003				
			(0.016)				
legal				0.033			
				(0.204)			
lerner					0.015**	0.010	0.006
					(0.007)	(0.007)	(0.008)
growth					0.028***	0.025***	0.030***
					(0.010)	(0.008)	(0.009)
inf					−0.059*	−0.042	−0.023
					(0.031)	(0.035)	(0.029)
corr						0.175**	
						(0.073)	
ib*size							−0.223**
							(0.089)
constant	9.688**	8.647**	6.462***	7.174***	4.548***	3.388***	0.529
	(4.587)	(3.421)	(2.101)	(2.159)	(1.179)	(0.915)	(1.209)
Obs.	1383	1383	1263	1263	1092	1092	1092
Hansen test	0.261	0.359	0.448	0.206	0.545	0.132	0.398
AR2 test	0.944	0.971	0.573	0.993	0.271	0.182	0.656
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table shows the results of the regressions estimated with the GMM in system procedure of Blundell and Bond (1998) for our sample of 72 IBs and 145 CBs for the period 2003–2014. The dependent variable is the ln(z-score) denoted z-score. The definitions of our variables appear in Section 3. The standard errors appear in parentheses below the estimated coefficients. Two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5 and 10% levels of significance respectively.

two factors. First, as a country's Sukuk market further develops, IBs face a higher level of competition, which may crowd-out their intermediation business, thereby reducing their profit margins and forcing them to take on more risk. Second, the result may also be explained in light of Minhat and Dzolkarnaini (2017) findings. Using a sample of firms of developing countries for the 2005–-2009 period, the authors find that less profitable firms tend to issue more debt and less equity with a preference for Islamic financial instruments over conventional debt. The best among these less profitable firms will tend to issue Sukuk. In fact, bank loans are preferred by firms with high ex-ante default risk (Berlin and Mester 1992) as they can renegotiate their terms compared to market-based instruments. In summary, the least profitable (and potentially likely to default firms) will turn to bank loans (Denis and Mihov 2003) in which case Islamic banking products are preferred (Minhat and Dzolkarnaini 2017). This low-quality portfolio of clients reduces the performance of IBs (Mimouni et al. 2019) and may increase the volatility of their earnings. Combined, these two effects will reduce the z-score of IBs.

Our results suggest that Sukuk markets do not affect the insolvency risk of CBs. Indeed, Sukuk markets expansion represents an opportunity for CBs. Several CBs included in this study have an Islamic banking business (including businesses involving Sukuk) in addition to their conventional operations. This allows CBs to diversify their banking activities. For instance, Qatar National Bank (QNB), the largest conventional financial

institution in the MENA region, has an investment banking business run by QNB Capital that arranged several high profile Sukuk issuances including Ooredoo QSC 2018 and Qatar Telecom 2028. Thus, Sukuk might represent an opportunity for CBs to earn substantial profits rather than a direct threat. Our results reveal, therefore, some important patterns. As discussed in the variables description section, Sukuk may have ex-ante a positive or/and a negative effect on banks' risk. Our findings highlight that the negative effect prevails for IBs whereas those effects seem to offset each other for CBs.

For the other control variables, we find that the insolvency risk is not significantly different between Islamic and conventional banks as the *ib* dummy variable is insignificant in 6 out of 7 specifications. This result is consistent with Zins and Laurent (2017) and Beck, Demirgüç-Kunt, and Merrouche (2013) who find that IBs and CBs do not have a significant difference in their overall risk profiles.

Turning to our bank-specific factors, we find that the cost-to-income ratio is expectedly negative and significant at the 5 percent level in 2 specifications and at the 10 percent level in 1 specification. This result implies that higher management inefficiency leads to lower z-score and hence higher insolvency risk. The size has a negative and highly significant effect on the z-score for both CBs and IBs, which is consistent with the Too-Big-To-Fail safety net subsidies argument (Kane 2010). When we introduce the interactive term ib*size in specification 7, the resulting coefficient is negative (−0.223) and statistically significant at the 5 percent significance level, suggesting that the effect of size is more pronounced for IBs. Accordingly, large IBs experience higher insolvency risk than large CBs, thus confirming our hypothesis H3. This may be due to the fact that IBs have limited access to hedging instruments compared to CBs and to the fact that the monitoring of agent-entrepreneurs is harder for IBs (Iqbal and Llewellyn 2002). These problems are more pronounced for larger banks as they tend to take on more risk (Too-Big-To-Fail) and engage simultaneously in a large number of profit-loss sharing projects with reduced legal means to monitor borrowers. The total-loans-to-total-assets ratio (*tlta*) has a positive and significant impact on the z-score, indicating that more bank specialization reduces the insolvency risk in our sample. A plausible explanation is that as the bank becomes more specialized in granting loans, it acquires more expertise in this business and becomes more profitable lowering the insolvency risk. Finally, the variable *listed* is positive and significant at the 5 percent level in 2 specifications and at the 10 percent level in 2 other specifications. Hence, banks exhibit less insolvency risk given that they have easier access to capital than closely held banks and thus are less likely to become insolvent.

Regarding the country-specific variables, we find that, as expected, the GDP growth has a positive effect on the z-score. This result supports the idea that an expanding economy leads to more wealth and lower insolvency rates. Interestingly, the results in the literature are mixed for this variable. For instance, Abedifar, Molyneux, and Tarazi (2013) find that higher GDP per capita leads to lower bank stability while Čihák and Hesse (2010) document that GDP growth does not affect bank stability. Inflation is negatively and significantly associated with z-score. Unanticipated inflation results have little support for the fact that a higher cost of financing for banks lowers their intermediation margins and harms their solvency. Our results also suggest that the control of corruption positively and significantly relates to the z-score. Banks operating in countries where corruption is mitigated have lower insolvency risk, as expected. Finally, we find that the country's legal system and Muslim population do not significantly affect the z-score suggesting that the degree of religiosity does not reduce the bank insolvency risk. This result is different from the findings of Abedifar, Molyneux, and Tarazi (2013) where religious clients in their study tend to be more loyal to their bank, more committed to repaying their loans, and refuse to withdraw their deposits even when the bank exhibits poor performance.

Further analysis

The 2008 crisis has had a profound impact on the stability of all banks and the economy at

large. For instance, the MENA region experienced sharp declines in their stock markets ranging from around 10 percent to more than 55 percent within the crisis year. Additionally, all banks in the region witnessed liquidity shortages and tightened their credit policies. Hence, it would be interesting to investigate whether our results are amplified or attenuated by the crisis. To do so, we include a dummy variable that takes the value of 1 after the 2008 crisis and 0 otherwise to control for any potential effects of the crisis on the average z-score. We also include the interactive terms *crisis*smd* and *ib*crisis*smd* to capture the interactions of the crisis with the focal variable.

Table 5 reports some interesting results. The crisis dummy coefficient is not statistically significant at conventional levels, suggesting that average z-score before and after the crisis are roughly similar. Accordingly, the 2008 global financial crisis did not sensibly increase the average bank insolvency risk.

Table 5. Further results.

	(1)	(2)	(3)	(4)	(5)	(6)
	z-score	z-score	z-score	z-score	z-score	z-score
ib	0.020	−0.030	0.016	2.852**	−0.277	0.268
	(0.189)	(0.167)	(0.212)	(1.442)	(2.230)	(0.362)
smd	0.085	0.027	−1.268	0.033	0.034	−0.292
	(0.097)	(0.064)	(0.792)	(0.064)	(0.065)	(0.189)
crisis	−0.020	1.554	0.013	0.004	0.025	0.000
	(0.078)	(0.983)	(0.080)	(0.077)	(0.116)	(0.153)
size	−0.147*	−0.077	−0.097	0.022	0.001	−0.047
	(0.084)	(0.085)	(0.086)	(0.104)	(0.109)	(0.102)
tlta	0.003	0.003	−0.001	0.017***	0.016***	0.008
	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.007)
cosinr	−0.014***	−0.016***	−0.012**	−0.011**	−0.012**	−0.011**
	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
liquid	−0.003	−0.003	−0.005	0.014***	0.013***	0.002
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.007)
listed	−0.345	−0.378	−0.885	−0.061	−0.114	−0.809
	(0.648)	(0.645)	(0.719)	(0.471)	(0.605)	(0.544)
ib*smd	−0.527***	−0.517***	−0.415***	−0.482***	−0.488***	0.003
	(0.150)	(0.151)	(0.154)	(0.145)	(0.157)	(0.213)
crisis*smd	−0.055					0.446**
	(0.070)					(0.200)
lerner	0.017**	0.018**	0.015*	0.013	0.015*	0.016*
	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.009)
growth	0.025***	0.026***	0.021**	0.007	0.009	0.003
	(0.008)	(0.008)	(0.009)	(0.013)	(0.013)	(0.013)
inf	−0.018	−0.015	−0.013	−0.014	−0.017	0.011
	(0.022)	(0.022)	(0.024)	(0.022)	(0.022)	(0.021)
size*crisis		−0.102				
		(0.064)				
smd*size			0.082			
			(0.051)			
ib*size				−0.198**	0.028	
				(0.099)	(0.158)	
ib*crisis					4.214**	−0.295
					(2.063)	(0.528)
ib*size*crisis					−0.302**	
					(0.142)	
ib*crisis*smd						−0.480***
						(0.168)
Constant	5.457***	4.482***	5.256***	1.483	1.904	3.545**
	(1.322)	(1.302)	(1.281)	(1.442)	(1.619)	(1.411)
Obs.	1092	1092	1092	1092	1092	1092
Hansen test	0.489	0.386	0.821	0.349	0.458	0.710
AR2 test	0.876	0.748	0.691	0.725	0.669	0.687
Year dummies	No	No	No	No	No	No

This table shows the results of the regressions estimated with the GMM in system procedure of Blundell and Bond (1998) for our sample of 72 IBs and 145 CBs for the period 2003–2014. The dependent variable is the ln(z-score) denoted z-score. The definitions of our variables appear in Section 3. The standard errors appear in parentheses below the estimated coefficients. Two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5 and 10% levels of significance respectively.

We now highlight the impact of our focal variable (*smd*) on the insolvency risk of banks prior to and after the crisis. Column 1 in Table 5 shows that the expansion of Sukuk markets equally affected z-score before and after the crisis as can be inferred from the insignificant coefficient related to the interactive term *crisis*smd* (−0.055). Furthermore, the adverse effect of *smd* on IBs found in Table 4 is more pronounced after the crisis as can be seen in Column 6 as the interactive term ib**crisis***smd* is negative and significant at 1 percent level. Accordingly, our results confirm our hypothesis H4 and suggest that the crisis amplified the adverse effects of Sukuk on IBs.

Robustness checks

We carry further analysis to explore the sources of risk affecting the banking sector. First, we split the z-score into z-score part 1 $\left(\frac{ROA}{\sigma_{ROA}}\right)$ and z-score part 2 $\left(\frac{CAR}{\sigma_{ROA}}\right)$.[10] The z-score part 1, which focuses simultaneously on the level and volatility of banks' profitability, is usually used to measure the banks' portfolio risk. The z-score part 2, which represents the extent of bank's capital to cover a given level of risk, is used to assess the leverage risk. Both parts 1 and 2 of the z-score are employed as potential measures of insolvency risk. The results in Tables

Table 6. Dependent variable: z-score part1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	z-score1	z-score1	z-score1	z-score1	z-score1	z-score1	z-score1
ib	−0.397	0.035	−0.001	−0.948	−0.049	−0.059	−4.520
	(0.261)	(0.069)	(0.250)	(0.640)	(0.208)	(0.203)	(4.098)
smd	−0.050	0.088	0.064	0.138**	0.063	0.031	−0.031
	(0.056)	(0.069)	(0.073)	(0.070)	(0.095)	(0.094)	(0.069)
size	−0.527***	−0.232**	−0.269**	−0.376**	−0.129**	−0.132*	−0.182*
	(0.182)	(0.118)	(0.125)	(0.190)	(0.060)	(0.072)	(0.107)
tlta	0.029***	0.008*	0.009*	0.009	0.006	0.005	0.004
	(0.009)	(0.003)	(0.005)	(0.008)	(0.044)	(0.004)	(0.005)
cosinr	−0.026**	−0.025***	−0.018**	−0.027***	−0.033***	−0.032***	−0.032***
	(0.010)	(0.008)	(0.007)	(0.008)	(0.007)	(0.006)	(0.007)
liquid	0.017*	−0.005	−0.004	−0.006	0.001	0.001	−0.001
	(0.009)	(0.003)	(0.002)	(0.004)	(0.003)	(0.031)	(0.003)
listed	1.286	0.239	0.669	0.832	0.420	0.653	0.711
	(0.953)	(0.578)	(0.505)	(0.587)	(0.539)	(0.455)	(0.561)
ib*smd		−0.857***	−0.837***	−0.664***	−0.723***	−0.580**	−0.539***
		(0.258)	(0.225)	(0.221)	(0.245)	(0.229)	(0.202)
muslim			−0.013				
			(0.017)				
legal				0.047			
				(0.254)			
lerner					0.006	0.005	−0.003
					(0.006)	(0.006)	(0.006)
growth					0.039***	0.033***	0.042***
					(0.013)	(0.011)	(0.011)
inf					−0.010	−0.005	−0.000
					(0.032)	(0.033)	(0.032)
corr						0.318*	
						(0.162)	
ib*size							0.311
							(0.283)
constant	7.164***	4.921***	6.156***	7.133***	3.475***	2.531**	4.411***
	(0.099)	(1.706)	(2.121)	(2.618)	(1.059)	(1.25)	(1.586)
Obs.	1305	1197	1197	1197	1040	1040	1040
Hansen test	0.370	0.234	0.654	0.795	0.839	0.777	0.755
AR2 test	0.600	0.089*	0.085*	0.679	0.554	0.414	0.492
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table shows the results of the regressions estimated with the GMM in system procedure of Blundell and Bond (1998) for our sample of 72 IBs and 145 CBs for the period 2003–2014. The dependent variable is the ln(z-score part1) denoted z-score1. The definitions of our variables appear in Section 3. The standard errors appear in parentheses below the estimated coefficients. Two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5 and 10% levels of significance respectively.

[10]See (Crouzille, Lepetit, and Tarazi 2004; Barry, Lepetit, and Tarazi 2011).

Table 7. Dependent variable: z-score part2.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	z-score2	z-score2	z-score2	z-score2	z-score2	z-score2	z-score2
ib	0.514	1.236	0.103	−0.061	−0.049	−0.073	1.899
	(0.431)	(1.024)	(0.199)	(0.467)	(0.191)	(0.207)	(2.877)
smd	0.054	0.032	0.011	0.038	−0.047	−0.049	−0.046
	(0.089)	(0.061)	(0.066)	(0.053)	(0.035)	(0.037)	(0.043)
size	−0.596**	−0.423*	−0.258**	−0.320*	−0.121*	−0.127	−0.096
	(0.301)	(0.231)	(0.113)	(0.168)	(0.062)	(0.078)	(0.088)
tlta	0.034**	0.020***	0.011**	0.013**	0.011**	0.010**	0.012***
	(0.016)	(0.008)	(0.004)	(0.006)	(0.004)	(0.004)	(0.004)
cosinr	−0.034**	0.003	−0.001	−0.005	−0.002	−0.001	−0.002
	(0.015)	(0.009)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
liquid	0.013	0.006	0.003	0.002	0.005	0.005	0.006*
	(0.015)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
listed	2.784**	1.734*	0.855*	0.967**	0.606	0.582	0.591
	(1.143)	(0.979)	(0.467)	(0.490)	(0.485)	(0.503)	(0.535)
ib*smd		−0.510*	−0.449***	−0.394**	−0.275***	−0.251***	−0.271***
		(0.278)	(0.128)	(0.169)	(0.087)	(0.088)	(0.095)
muslim			−0.005				
			(0.014)				
legal				0.024			
				(0.250)			
lerner					0.010	0.012	0.012*
					(0.007)	(0.008)	(0.007)
growth					0.027***	0.013	0.027***
					(0.008)	(0.013)	(0.009)
inf					−0.047	−0.045	−0.050
					(0.033)	(0.033)	(0.033)
corr						0.162**	
						(0.078)	
ib*size							−0.135
							(0.201)
constant	9.233**	6.605**	6.174***	6.717***	3.587***	3.241***	3.063**
	(4.387)	(2.832)	(2.180)	(2.344)	(0.912)	(1.082)	(1.345)
Obs.	1384	1264	1264	1264	1093	1093	1093
Hansen test	0.258	0.082*	0.359	0.177	0.104	0.099*	0.156
AR2 test	0.814	0.827	0.821	0.757	0.577	0.207	0.512
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table shows the results of the regressions estimated with the GMM in system procedure of Blundell and Bond (1998) for our sample of 72 IBs and 145 CBs for the period 2003–2014. The dependent variable is the ln(z-score part2) denoted z-score2. The definitions of our variables appear in Section 3. The standard errors appear in parentheses below the estimated coefficients. Two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5 and 10% levels of significance respectively.

6 and 7 reveal some important findings. Tables 6 and 7 highlight that our main conclusions regarding the focal variable *smd* in the baseline regression are robust to the use of both part 1 and 2 of the z-score. The results for the control variables are qualitatively similar to our baseline results.

Second, we investigate whether the issuer of Sukuk matters for the insolvency risk of banks. Sukuk can be issued by corporate firms (corporate Sukuk) or by the government (sovereign Sukuk). We study whether the negative interactive term of Sukuk on IBs originates from corporate Sukuk, sovereign Sukuk, or both.

Both corporate Sukuk and sovereign Sukuk issuances impact negatively the insolvency risk of IBs as reported in Tables 8 and 9. While the corporate issuance of Sukuk impact on IBs is understandable within the least profitable firm's argument developed above, the negative effect of sovereign Sukuk on IBs' insolvency risk is puzzling. The issuance of sovereign Sukuk attracts the savings of households and institutions who would otherwise invest these funds in several IBs financial products. By issuing Sukuk, the government deprives IBs from such clientele. Additionally, the government may use Sukuk as an alternative way of financing instead of contracting loans from the local banking sector. Accordingly, the issuance of Sukuk would potentially harm the business of IBs. The results for the other control variables in Tables 8 and 9 remain unchanged and are in line

Table 8. Corporate Sukuk (csmd).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	z-score	z-score	z-score	z-score	z-score	z-score	z-score
ib	0.155	0.446	−0.008	0.108	0.780	−0.095	0.665
	(0.443)	(0.362)	(0.200)	(0.651)	(0.699)	(0.140)	(1.636)
csmd	0.117	0.185*	0.015	0.012	0.240*	0.034	0.074
	(0.104)	(0.098)	(0.158)	(0.107)	(0.134)	(0.120)	(0.111)
size	−0.541*	−0.386**	−0.124	−0.193	0.012	0.009	0.003
	(0.291)	(0.195)	(0.109)	(0.157)	(0.081)	(0.066)	(0.134)
tlta	0.031**	0.027**	0.009***	0.013**	0.011*	0.006	0.011**
	(0.013)	(0.012)	(0.003)	(0.005)	(0.007)	(0.005)	(0.005)
cosinr	−0.028**	−0.030**	−0.005	−0.007	−0.015**	−0.002	−0.002
	(0.014)	(0.013)	(0.006)	(0.006)	(0.007)	(0.005)	(0.005)
liquid	0.014	0.007	−0.001	−0.003	−0.001	0.002	0.005
	(0.013)	(0.014)	(0.003)	(0.004)	(0.005)	(0.003)	(0.004)
listed	3.126***	1.704**	0.211	−0.360	−0.428	−0.038	−0.302
	(1.195)	(0.790)	(0.404)	(0.514)	(0.675)	(0.544)	(0.575)
ib*csmd		−0.398***	−0.378**	−0.407**	−0.671***	−0.308**	−0.376***
		(0.140)	(0.151)	(0.163)	(0.188)	(0.126)	(0.129)
muslim			−0.011				
			(0.017)				
legal				0.238			
				(0.255)			
lerner					0.005	0.003	0.006
					(0.005)	(0.008)	(0.008)
growth					0.035***	0.016**	0.012
					(0.013)	(0.008)	(0.010)
inf					0.019	0.042**	0.028
					(0.020)	(0.018)	(0.021)
corr						0.152*	
						(0.079)	
ib*size							−0.053
							(0.112)
constant	8.179*	7.356**	5.639**	5.793**	2.543*	1.837*	2.089
	(4.499)	(3.318)	(2.580)	(2.506)	(1.413)	(0.986)	(1.918)
Obs.	1383	1383	1263	1263	1092	1092	1092
Hansen test	0.259	0.423	0.366	0.212	0.841	0.412	0.522
AR2 test	0.646	0.458	0.276	0.410	0.973	0.109	0.116
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table shows the results of the regressions estimated with the GMM in system procedure of Blundell and Bond (1998) for our sample of 72 IBs and 145 CBs for the period 2003–2014. The dependent variable is the ln(z-score) denoted z-score. The definitions of our variables appear in Section 3. The standard errors appear in parentheses below the estimated coefficients. Two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5 and 10% levels of significance respectively.

with the findings of the baseline regression in Table 4.

To sum up, our results are robust and show that *smd* affects the insolvency risk of IBs only, even when we employ different measures of the z-score. Accordingly, the gap between CBs and IBs in terms of insolvency risk is widening due to the development of Sukuk markets. Moreover, both corporate Sukuk and sovereign Sukuk adversely impact the z-score ratios of IBs only.

VI. Conclusion

In this paper, we empirically examine the effects of the development of Sukuk markets on the insolvency risk of banks, measured using the z-score. To the best of our knowledge and despite the tremendous growth of Sukuk certificates, no single study has shed light on the potential effect of Sukuk markets on the risk-taking behavior of banks. We posit four hypotheses drawn from the recent literature on bank risk. First, we conjecture that Sukuk market development negatively affects bank insolvency risk due to increased competition. In the second hypothesis, we argue that the effect Sukuk on bank risk is different depending on whether the bank is Islamic or Conventional. The third hypothesis suggests that the effects of Sukuk development on bank insolvency risk depend on the size of the bank, while the fourth hypothesis highlights the effect of the 2008

Table 9. Sovereign Sukuk (ssmd).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	z-score	z-score	z-score	z-score	z-score	z-score	z-score
ib	0.140	0.291	0.042	−0.477	−0.434	−0.332	3.080
	(0.309)	(0.263)	(0.234)	(0.690)	(0.566)	(0.273)	(2.095)
ssmd	0.090	0.345*	0.205	0.188	0.387**	0.217*	0.127
	(0.114)	(0.207)	(0.137)	(0.122)	(0.171)	(0.130)	(0.128)
size	−0.288*	−0.246*	−0.276***	−0.244	−0.155**	−0.160**	−0.048
	(0.168)	(0.137)	(0.100)	(0.161)	(0.065)	(0.072)	(0.107)
tlta	0.018***	0.019***	0.012***	0.009*	0.015**	0.012**	0.009
	(0.005)	(0.007)	(0.005)	(0.005)	(0.007)	(0.005)	(0.007)
cosinr	−0.014**	−0.016**	−0.006	−0.007	−0.008	−0.003	−0.004
	(0.006)	(0.007)	(0.005)	(0.006)	(0.005)	(0.007)	(0.007)
liquid	0.003	0.002	0.000	0.000	0.002	0.005	0.004
	(0.006)	(0.009)	(0.003)	(0.003)	(0.004)	(0.004)	(0.005)
listed	1.777**	1.001*	0.737*	0.709*	0.508	0.932	1.215**
	(0.697)	(0.607)	(0.392)	(0.407)	(0.626)	(0.583)	(0.550)
ib*ssmd		−0.770***	−0.683***	−0.610**	−0.760***	−0.528**	−0.411**
		(0.292)	(0.218)	(0.259)	(0.201)	(0.206)	(0.202)
muslim			0.008				
			(0.012)				
legal				−0.070			
				(0.179)			
lerner					0.011*	0.014*	0.009
					(0.007)	(0.007)	(0.005)
growth					0.010	0.015*	0.023**
					(0.008)	(0.008)	(0.011)
inf					0.012	0.011	0.002
					(0.016)	(0.017)	(0.016)
corr						0.021	
						(0.121)	
ib*size							−0.230
							(0.146)
constant	5.573**	5.460**	5.779***	6.341***	4.050***	3.431***	2.177
	(2.822)	(2.216)	(1.872)	(2.353)	(1.272)	(0.966)	(1.658)
Obs.	1383	1383	1263	1263	1092	1092	1092
Hansen test	0.587	0.316	0.608	0.321	0.922	0.500	0.781
AR2 test	0.540	0.904	0.318	0.305	0.709	0.345	0.237
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table shows the results of the regressions estimated with the GMM in system procedure of Blundell and Bond (1998) for our sample of 72 IBs and 145 CBs for the period 2003–2014. The dependent variable is the ln(z-score) denoted z-score. The definitions of our variables appear in Section 3. The standard errors appear in parentheses below the estimated coefficients. Two-step system GMM estimator is used. Windmeijer (2005) finite-sample correction to the two-step covariance matrix is employed. Robust standard errors consistent in the presence of heteroskedasticity and autocorrelation within the panel are reported. The Hansen (1982) test tests the overall validity of our instruments, while AR2 is the Arellano and Bond (1991) test of the absence of second-order autocorrelation in the differenced residuals. ***, **, * refer to the 1, 5 and 10% levels of significance respectively.

financial crisis on the relationship between Sukuk market development and bank insolvency risk.

Using a sample of 72 IBs and 145 CBs from 15 countries adopting dual banking spanning the period 2003–2014, we find that Sukuk market development has no effect on the insolvency risk of our sample of IBs and CBs. Hence, we find no support for our hypothesis H1. However, when we introduce the interaction between our measure of Sukuk development and the dummy variable for IBs, we find that Sukuk market development adversely affects the insolvency risk of IBs, while that of the CBs remains unchanged. This result confirms our hypothesis H2 and suggests that as a country's Sukuk market expands further, IBs face a higher level of competition, which may crowd-out their intermediation business, thereby reducing their profit margins and forcing them to take on more risk. Consistent with our hypothesis H3, our results point to a negative and significant effect of the size on the insolvency risk of both CBs and IBs, thus confirming the well-documented Too-Big-To-Fail hypothesis. Furthermore, this size effect is more pronounced for IBs. Moreover, our results show that the 2008 financial crisis has exacerbated the negative effect of Sukuk market development on bank insolvency risk, which supports our fourth hypothesis. Finally, we find that listed banks exhibit lower insolvency risk than private banks and that management inefficiency, measured by the cost-to-income ratio, leads to higher insolvency risk, as expected.

A number of policy implications flow from our findings. While Sukuk issuances may allow banks to diversify their financing sources and improve their

capital adequacy ratios as suggested by Haron, Archer, and Karim (2018), the evidence in this paper shows that the expansion of Sukuk issuances exacerbates the risk-taking behavior of IBs in their quest of higher profit margins, which could jeopardize the stability of the country's banking system. This effect is more pronounced after the recent financial crisis. This research highlights that CBs business seems to benefit from Islamic market-based financing vehicles. Innovations in Islamic capital markets, namely Sukuk, do not represent a long-term threat for conventional financial institutions. IBs, however, saw their risk rise due to the increased popularity of Sukuk issuances. It is self-evident that innovations in Islamic finance capital markets are expected to grow at a faster pace to accommodate the higher demand for Sharia-compliant market-based products. Sukuk are now a fact that IBs have to live with and take advantage of in the same way CBs do. Therefore, IBs are required to continuously innovate, invest in enforcing the bank-client relationship especially with the corporate clientele, and be a more aggressive partner in the Sukuk business.

It is evident that governments and policymakers in emerging countries are striving to develop their banking systems and improve their resilience to external shocks. In doing so, they should develop and implement new policies and regulations to thwart the adverse effects on the risk-taking behavior of banks resulting from the increased competition arising from the emergence of new financing instruments such as Sukuk certificates, Fintech, or crowdfunding.

Disclosure statement

No potential conflict of interest was reported by the authors.

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References

Abedifar, P., P. Molyneux, and A. Tarazi. 2013. "Risk in Islamic Banking." *Review of Finance* 17 (6): 2035–2096.

Ahmed, H., and T. Khan. 2007. "Risk Management in Islamic Banking." In *Handbook of Islamic Banking*, edited by M. K. Hassan and M. K. Lewis, 144–158. USA: Edward Elgar.

Alam, N. 2012. "Regulations and Bank Risk Taking in Dual Banking Countries." *Journal of Banking Regulation* 15: 105–116.

Alam, N., M. K. Hassan, and M. A. Haque. 2013. "Are Islamic Bonds Different from Conventional Bonds? International Evidence from Capital Market Tests." *Borsa Istanbul Review* 13: 22–29.

Arellano, M., and O. Bover. 1995. "Another Look at the Instrumental Variable Estimation of Error-components Models." *Journal of Econometrics* 68 (1): 29–51.

Arellano, M., and S. Bond. 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *Review of Economic Studies* 58 (2): 277–297.

Ashhari, M. Z., L. S. Chun, and A. Nassir. 2009. "Conventional Vs Islamic Bond Announcements: The Effects on Shareholders' Wealth." *International Journal of Business and Management* 4 (6): 105–111.

Azmat, S., M. Skully, and K. Brown. 2014. "Issuer's Choice of Islamic Bond Type." *Pacific Basin Finance Journal* 28: 122–135.

Baele, F., M. Farooq, and S. Ongena. 2014. "Of Religion and Redemption: Evidence from Default on Islamic Loans." *Journal of Banking and Finance* 44 (7): 141–159.

Barry, T. A., L. Lepetit, and A. Tarazi. 2011. "Ownership Structure and Risk in Publicly Held and Privately Owned Banks." *Journal of Banking and Finance* 35 (5): 1327–1340.

Beck, T., A. Demirgüç-Kunt, and O. Merrouche. 2013. "Islamic Vs. Conventional Banking: Business Model, Efficiency and Stability." *Journal of Banking and Finance* 37 (2): 433–447.

Beck, T., and L. Laeven. 2006. "Resolution of Failed Banks by Deposit Insurers: Cross–Country Evidence". *World Bank Policy Research Working Paper No 3920*.

Berger, A., L. Klapper, and R. Turk-Ariss. 2009. "Bank Competition and Financial Stability." *Journal of Financial Services Research* 35 (2): 99–118.

Berger, A., and R. DeYoung. 1997. "Problem Loans and Cost Efficiency in Commercial Banks." *Journal of Banking and Finance* 21: 849–870.

Berlin, M., and L. Mester. 1992. "Debt Covenants and Renegotiation." *Journal of Financial Intermediation* 2 (2): 95–133.

Blundell, R., and S. Bond. 1998. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics* 87: 115–143.

Bolton, P., H. Chen, and N. Wang. 2011. "A Unified Theory of Tobin's Q, Corporate Investment, Financing, and Risk Management." *Journal of Finance* 66: 1545–1578.

Cakir, S., and F. Raei. 2007. "Sukuk Vs. Eurobonds: Is There a Difference in Value-at-Risk?" *IMF Working Paper WP/07/237*.

Calderon, C., A. Chong, and N. Loayza. 2000. "Determinants of Current Account Deficits in Developing Countries". *World Bank Research Policy Working Paper no 2398*.

Čihák, M., and H. Hesse. 2010. "Islamic Banks and Financial Stability: An Empirical Analysis." *Journal of Financial Services Research* 38 (2–3): 95–113.

Claessens, S., A. Demirguc-Kunt, and H. Huizinga. 2001. "How Does Foreign Entry Affect the Domestic Banking Markets?" *Journal of Banking and Finance* 25: 891–911.

Crouzille, C., L. Lepetit, and A. Tarazi. 2004. "Bank Stock Volatility, News and Asymmetric Information in Banking: An Empirical Investigation." *Journal of Multinational Financial Management* 14 (4): 443–461.

Dell'Ariccia, G., and R. Marquez. 2006. "Lending Booms and Lending Standards." *The Journal of Finance* 61: 2511–2546.

Demirguc-Kunt, A., and H. Huizinga. 1998. "Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence." *World Bank Economic Review* 13: 379–408.

Denis, D. J., and V. Mihov. 2003. "The Choice among Bank Debt, Non-bank Private Debt, and Public Debt: Evidence from New Corporate Borrowings." *Journal of Financial Economics* 70 (1): 3–28.

Denizer, C. 2000. "Foreign Entry in Turkey's Banking Sector, 1980–97." *Policy Research Working Paper Series 2461*. World Bank.

DeYoung, R., A. Gron, G. Torna, and A. Winton. 2015. "Risk Overhang and Loan Portfolio Decisions: Small Business Loan Supply before and during the Financial Crisis." *The Journal of Finance* 70 (6): 2451–2488.

El Tiby, A. M. 2014. *Islamic Banking: How to Manage Risk and Improve Profitability*. USA: Wiley.

Fungacova, Z., and L. Weill. 2013. "Does Competition Influences Bank Failures? Evidence from Russia." *Economics of Transition* 21 (2): 301–322.

Godlewski, C., R. Turk-Ariss, and L. Weill. 2013. "Sukuk Vs. Conventional Bonds: A Stock Market Perspective." *Journal of Comparative Economics* 41 (3): 745–761.

Hanifa, M., M. Masih, and O. Bacha. 2015. "Why Do Issuers Issue Sukuk or Conventional Bond? Evidence from Malaysian Listed Firms Using Partial Adjustment Models." *Pacific-Basin Finance Journal* 34: 233–252.

Hansen, L. P. 1982. "Large Sample Properties of Generalized Method of Moments Estimators." *Econometrica* 50 (4): 1029–1054.

Hanson, J. A., and R. R. Rocha. 1986. "High Interest Rates, Spreads, and the Cost of Intermediation: Two Studies." *World Bank Industry and Finance Series no 18*.

Haron, A., S. Archer, and R. A. A. Karim. 2018. "Sukuk Issued as Regulatory Capital Instruments for Basel III Compliance–A Case Study." *Islamic Capital Markets and Products: Managing Capital and Liquidity Requirements Under Basel III: 280–296*.

Hassan, M. K., A. Paltrinieri, A. Dreassi, S. Miani, and A. Sclip. 2017. "The Determinants of Co-movement Dynamics between Sukuk and Conventional Bonds." *The Quarterly Review of Economics and Finance* 68: 73–84.

Hassan, M. K., and J. Dridi. 2010. "The Effects of the Global Crisis on Islamic and Conventional Banks: A Comparative Study." *IMF Working Paper No: 10/201*.

Hassan, M. K., and S. Aliyu. 2018. "A Contemporary Survey of Islamic Banking Literature." *Journal of Financial Stability* 3: 12–43.

Hesse, H., and M. Čihák. 2007. "Cooperative Banks and Financial Stability." *IMF Working Paper* 07/2. International Monetary Fund.

Hughes, J. P., L. Mester, and C. Moon. 2001. "Are Scale Economies in Banking Elusive or Illusive: Evidence Obtained by Incorporating Capital Structure and Risk-taking into Models of Bank Production." *Journal of Banking and Finance* 25: 2169–2208.

Hugonnier, J., S. Malamud, and E. Morellec. 2017. "Bank Capital, Liquid Reserves, and Insolvency Risk." *Journal of Financial Economics* 125 (2): 266–285.

Ibrahim, M. H., and S. A. R. Rizvi. 2017. "Do We Need Bigger Islamic Banks? an Assessment of Bank Stability." *Journal of Multinational Financial Management* 40: 77–91.

Iqbal, M., and D. T. Llewellyn, eds. 2002. *Islamic Banking and Finance: New Perspectives on Profit Sharing and Risk*. UK: Edward Elgar Publishing.

Islamic Financial Services Industry Stability Report. 2018. https://www.ifsb.org/download.php?id=4811&lang=English&pg=/index.php

Ivashina, V., and D. Scharfstein. 2010. "Bank Lending during the Financial Crisis of 2008." *Journal of Financial Economics* 97 (3): 319–338.

Kane, E. 2010. "Redefining and Containing Systemic Risk." *Atlantic Economic Journal* 38: 251–264.

Khan, T., and H. Ahmed. 2001. *Risk Management: An Analysis of Issues in Islamic Financial Industry*. Jeddah: IRTI.

Kwan, S. H., and R. E. Eisenbeis. 1997. "Bank Risk, Capitalization and Inefficiency." *Journal of Financial Services Research* 12 (2): 117–131.

Laeven, L., and R. Levine. 2009. "Bank Governance, Regulation and Risk-taking." *Journal of Financial Econonmics* 93 (2): 259–275.

Lepetit, L., and F. Strobel. 2013. "Bank Insolvency Risk and Time-varying Z-score Measures." *Journal of International Financial Markets, Institutions and Money* 25: 73–87.

Lepetit, L., and F. Strobel. 2015. "Bank Insolvency Risk and Z-score Measures: A Refinement." *Finance Research Letters* 13: 214–224.

Mapping the Global Muslim Population. Pew Research Center, Washington, D. C. October 9, 2009. https://www.pewforum.org/2009/10/07/mapping-the-global-muslim-population/

Milne, A., and E. Whalley. 2001. "Bank Capital Regulation and Incentives for Risk-Taking." *Working Paper*. Cass Business School.

Mimouni, K., H. Smaoui, A. Temimi, and M. Al-Azzam. 2019. "The Impact of Sukuk on the Performance of Conventional and Islamic Banks." *Pacific-Basin Finance Journal* 54: 42–54.

Minhat, M., and N. Dzolkarnaini. 2017. "Which Firms Use Islamic Financing?" *Economics Letters* 150: 15–17.

Mollah, S., M. K. Hassan, O. Al Farooque, and A. Mobarek. 2016. "The Governance, Risk-taking, and Performance of Islamic Banks." *Journal of Financial Services Research* 51 (2): 1–25.

Nagano, M. 2010. "Islamic Finance and the Theory of Capital Structure." *MPRA Paper 24567*. Germany: University Library of Munich.

Ogura, Y. 2006. "Learning from a Rival Bank and Lending Boom." *Journal of Financial Intermediation* 15: 535–555.

Olson, D., and T. Zoubi. 2017. "Convergence in Bank Performance for Commercial and Islamic Banks during and after the Global Financial Crisis." *Quarterly Review of Economics and Finance* 65: 71–87.

Peura, S., and J. Keppo. 2006. "Optimal Bank Capital with Costly Recapitalization." *Journal of Business* 79: 2163–2201.

Roodman, D. 2009. "How to Do Xtabond2: An Introduction to Difference and System GMM in Stata." *The Stata Journal* 9 (1): 86–136.

Smaoui, H., and H. Ghouma. 2018. "Sukuk and Islamic Bank's Capital Ratios." *Working Paper*. Qatar University.

Smaoui, H., K. Mimouni, and A. Temimi. 2017. "Sukuk, Banking System, and Financial Markets: Rivals or Complements?" *Economics Letters* 161: 62–65.

Smaoui, H., and M. Khawaja. 2017. "The Determinants of Sukuk Market Development." *Emerging Markets Finance and Trade* 53 (7): 1501–1518.

Smaoui, H., and S. Nechi. 2017. "Does Sukuk Market Development Spur Economic Growth?" *Research in International Business and Finance* 41: 136–147.

Srairi, S. 2013. "Ownership Structure and Risk-taking Behaviour in Conventional and Islamic Banks: Evidence for MENA Countries." *Borsa Istanbul Review* 13: 115–127.

Tarik, A., and H. Dar. 2007. "Risks of Sukuk Structures: Implications for Resource Mobilization." *Thunderbird International Business Review* 49: 203–223.

Thakor, A. V. 2015. "The Financial Crisis of 2007–2009: Why Did It Happen and What Did We Learn?" *The Review of Corporate Finance Studies* 4 (2): 155–205.

Ullah, S., P. Akhtar, and G. Zaeferian. 2018. "Dealing with Endogeneity Bias: The Generalized Method of Moments (gmm)for Panel Data." *Industrial Marketing Management* 71: 69–78.

Windmeijer, F. 2005. "A Finite Sample Correction for the Variance of Linear Efficient Two-step GMM Estimators." *Journal of Econometrics* 126 (1): 25–51.

Wooldridge, J. M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press.

Yeyati, E. L., and A. Micco. 2007. "Concentration and Foreign Penetration in Latin American Banking Sectors: Impact on Competition and Risk." *Journal of Banking and Finance* 31 (6): 1633–1647.

Zins, A., and W. Laurent. 2017. "Islamic Banking and Risk: The Impact of Basel II." *Economic Modelling* 64: 626–637.