IIBR-LIBOR Relationship and the Nature and Determinants of "Islamic Premium"

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Abstract:

This study investigates both the long-term equilibrium and dynamic relationships between two interbank offered rates: Islamic interbank benchmark rate (IIBR) and LIBOR, both in US dollar. Following this, the study analyses the nature and determinants of "Islamic premium", the IIBR-LIBOR spread offered by IIBR rate-setting banks. Using daily IIBR-LIBOR rates, news and rating data since the middle of November, 2011 to end of April 2013, standard Johansen cointegration method suggests that there is no long-term equilibrium relationship between the two rates and Engle's (2002) DCC method documents that the time-changing relationships between IIBR and LIBOR are either zero or negative and no contagion/transmission exists from either Islamic or conventional rate-setters. This implies two aspects: the IIBR is independently determined reflecting its unique characteristics and market conditions as opposed to those banks in London and the arbitragers rarely attempted to benefit from the absence of long-term and/or time-changing relationships. Following this, the study tests and supports the hypothesis that "Islamic premium" is a reflection of the cost of funding and profit potential of the participating IIBR rate-setters. To corroborate this finding, we model the determinants of the Islamic premium using market specific variables and news.

Keywords: IIBR; LIBOR; Islamic Premium;

JEL Classifications: G15

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1. Introduction

This is the first study that investigates the relationship between IIBR (Islamic Interbank Benchmark Rate) and LIBOR (London Interbank Offered Rate) both in US dollar. This is also the first of its kind to analyse the determinants of the IIBR-LIBOR spread or "Islamic premium".[1] In regards to the first research issue, this study focuses on long-term equilibrium and dynamic (time-varying) relationships between IIBR and LIBOR, using the daily data from the middle of November, 2011 to end of February 2013. For the long-term relationship, standard Johansen cointegration method is applied and for the dynamic relationship, Engle's (2002) dynamic conditional correlation (DCC) method is employed. Interestingly, in consistent with the Islamic Shariah law, there is no long-term relationship and a zero or negative time-varying correlation between the two markets (IIBR and LIBOR). What is more striking is the lack of arbitrage given the absence of long-term cointegration or dynamic relationship throughout the sample period. This invariably reflects two important aspects: the unique characteristics and market conditions of Islamic banks as opposed to conventional banks and the absence of arbitrage so far. Instead, the study tests and supports the hypothesis that IIBR-LIBOR spread or "Islamic premium" is a reflection of the cost of funding and profit potential of the participating IIBR rate-setters. To corroborate this finding, the study raises the second research issue, which searches and analyses the nature and determinants of "Islamic premium" offered by IIBR rate-setting banks. Empirical analysis shows that Islamic premium is explained by its market specific variables and news announcements of the participating panel banks.

Being an ethical financial system, Islamic finance disapproves all interest-related transactions and instruments as these are contradictory to the core principles of Islam and its Shariah law. With this view in mind, the first formal Islamic bank in modern days was

[1] The study finds that since the middle of April 2012, Islamic Interbank Benchmark rate-setters offer spread over the LIBOR for the corresponding maturities.

established in 1975. Since then, this specialised industry has grown so rapidly that it is too big to be ignored. While there is no competition in real terms between conventional finance and Islamic finance, the latter is now more than a $1 trillion industry (Burne (2011)) and its growth is expected to be double by 2015 (see S&P (2012)). The Gulf Cooperation Council (GCC) is known as the epic centre of this industry representing more than 80% of the total market share (DiVanna (2012)). However, given the size of the market, this specialised industry has been lacking a benchmark that can be applied to transactions compliant with Shariah law and principles. It took more than three decades to find a benchmark rate of their own. Recently (since 14th November 2011), some 16 banks from six Middle East countries in conjunction with the Thomson Reuters have decided to launch Islamic interbank benchmark rate (IIBR) in US dollar to provide a robust indicator of the average expected cost of short term interbank market funding for the Islamic finance industry.[2] As noted above, the reason to provide the IIBR in US dollar is to have uniformity across all contributors, which have substantial reserves in US dollars and five of the six countries peg their currencies to the US dollar. Moreover, Islamic financial markets and products could be more globally and economically integrated by a unique benchmark rate and gradually delinked from conventional interest based benchmark like LIBOR (Reuters (2013)).

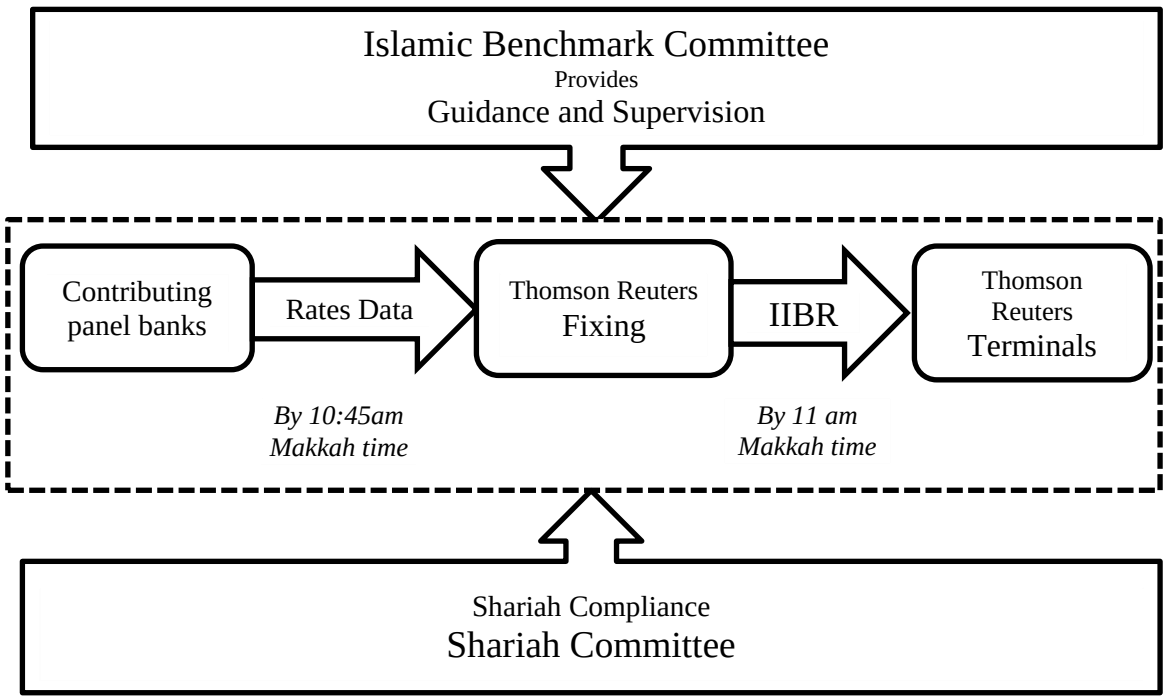
It is to be noted that prior to the IIBR, it was the LIBOR, which was used as the only available benchmark in pricing the Islamic financial instruments. This procedure was against the Islamic Shariah law and principle relating to interest, which is entirely prohibited. Thus, the absence of an IIBR required the Islamic banks and financial institutions to rely on conventional LIBOR in calculating their cost of funding. The Islamic banks, the practitioners and Shariah law advisers were much aware of this shortcoming of the Islamic finance

[2] The official Contributor Panel for the IIBR as of 22 November 2011 is comprised of 17 members as follows: Abu Dhabi Islamic Bank, Ahli United Bank, Al Baraka Bank, Al Hilal Bank, Dubai Islamic Bank, Noor Islamic Bank, Sharjah Islamic Bank, Al Salam Bank, Bahrain Islamic Bank, Ithmaar Bank, Kuwait Finance House, National Bank of Kuwait, Barwa Bank, Masraf Al Rayan, Qatar Islamic Bank, Alinma Bank, National Commercial Bank (Al Ahli).

industry and tried to come up with a benchmark different from conventional LIBOR. A relevant benchmark was also required to reflect the average expected cost of short term interbank Shariah compliant funding transactions (such as Murabaha, Mudaraba and Wakala). This resulted in some GCC high profile Islamic banks in collaboration with Thomson Reuters to commence a benchmark rate that is in congruent with the Islamic Shariah law and can provide a robust indicator of the average expected cost of short term interbank market funding. The procedure of fixing and final publication of the IIBR, as shown in Figure 1, is different from that of LIBOR.

Figure 1: Procedure of fixing and final publication of IIBR

This figure shows the process of fixing and final publication of the Islamic interbank benchmark rate (IIBR).



Source: Thomson Reuters (www.financial.thomsonreuters.com/islamicbenchmark)

As Figure 1 implies, the final rate fixing of IIBR is strictly guided by two committees: Shariah Committee and Islamic Benchmark Committee. On the one hand, Shariah Committee, comprised of four members, ensures that the IIBR is compliant with the principles of Islamic law (Shariah) and regulates the selection, admission and exclusion of

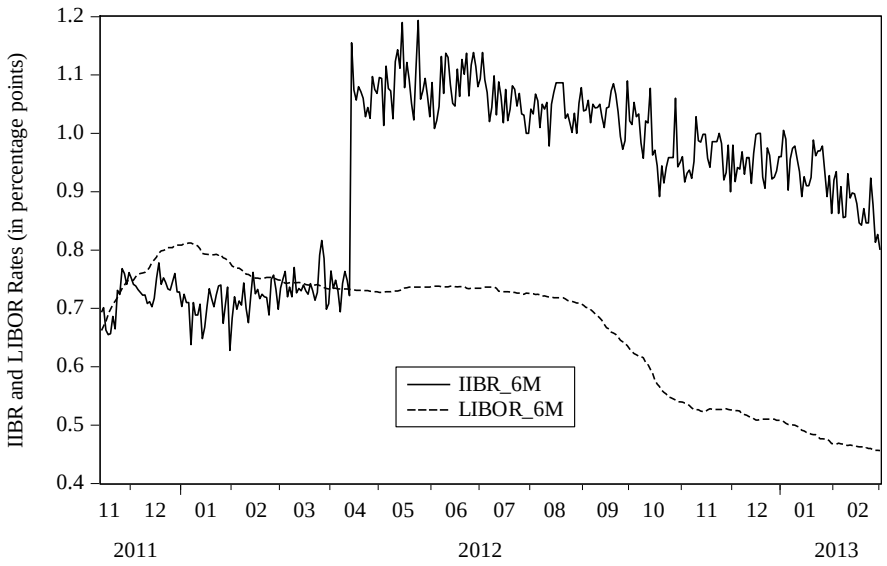
contributor panel banks. On the other hand, Islamic Benchmark Committee provides the commercial and technical advice required for the proper implementation and continuing integrity of the IIBR. In this figure, Islamic Benchmark Committee is comprised of contributor panel banks, internationally renowned Shariah scholars and organisations like Thomson Reuters, Islamic Development Bank and Accounting and Auditing Organisation for Islamic Financial Institutions (AAOIFI), among others. Unlike LIBOR, which measures an interest rate, these bodies confirm that the final IIBR is based on the actual rate of return on capital as practiced by Islamic banks or the opportunity cost of capital that is used as the basis for transacting in the market. Further, IIBR is the average profit rate at which bids are offered for interbank Shariah compliant funding transactions between prime Islamic banks and fully segregated Islamic banking windows within the Gulf Cooperation Council (GCC) interbank market. The panel banks contribute each working day, Sunday through Thursday, the profit rates to be expected from Shariah compliant funding transactions for various tenors.[3] To make the rates are genuine and error-free, Thomson Reuters undertakes both automated and manual audit and review procedures. In addition, the rates are based on a pre-defined question specified by Islamic Benchmark Committee and approved by Shariah Committee. The rates are snapped at 10:45 am (Makkah time, GMT+3) and sent to the Thomson Reuters Terminals at 11:00am similar to that of LIBOR. Pricing details are discussed in next section.

Interestingly, even though in the first few months after commencement, the IIBR rate was lower than that of LIBOR for a given maturity, from the middle of April 2012, it started to exceed LIBOR (see Figure 2 for 6-month IIBR and LIBOR rates). For some tenors, it even exceeded by more than 50 basis points. So, one may find it interesting to investigate the characteristics and determinants of the IIBR-LIBOR spread or Islamic premium, which is plotted in Figure 3.

[3] We have confirmed with Thomson Reuters that IIBR rates are moved to a Friday date from coming Sunday. Monday to Thursday IIBR match with LIBOR dating.

Figure 2: IIBR-LIBOR Rates (6-month)

This figure shows the daily 6-month Islamic interbank benchmark rate (IIBR) and London interbank offered rate (LIBOR) both in US dollar. The rates are shown in percentage points. The sample covers the daily data from November 14, 2011 through February 28, 2013. The figure is based on the data collected from DataStream.



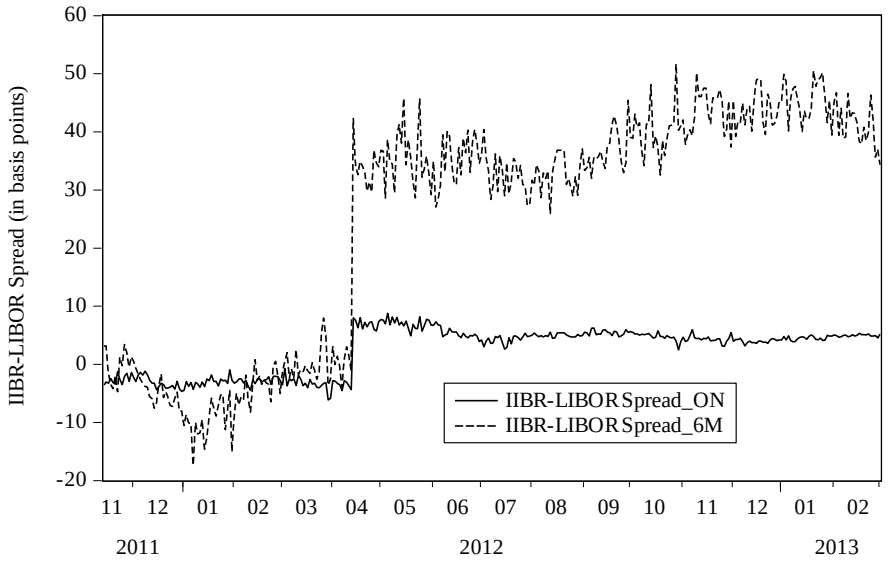
For a better visual inspection, Figure 3 plots only two tenors (overnight and 6-month) of the TIBOR-LIBOR spread spanning daily data from 14 November 2011 to 28 February 2013 with a total of 340 observations. It appears that until around April 2012, both the overnight and 6-month spreads are negative and fluctuate around 0 to -15 basis points. However, since mid-April 2012, all the spreads (only overnight and 6-month are shown in Fig 3) turn out to be positive and exceeded 50 basis points around October 2012. This positive IIBR-LIBOR spread may be thought of as an "Islamic premium." We model this "Islamic premium" using the structural model of credit spreads such as that developed by Longstaff and Schwartz (1995). A similar model is used by Covrig, Low and Melvin (2004) to investigate the determinants of TIBOR-LIBOR spread.[4] To facilitate the empirical investigation, we use the variables that are deemed to affect the Islamic premium. Our empirical analysis suggests that change in Treasury bill rate, slope (long-term minus short-term interest rate), stock returns and good news and credit upgrades of panel banks have a

[4] TIBOR = Tokyo interbank offered rate.

negative influence on the "Islamic premium", while volatility of stock price and bad news and credit downgrades of panel banks have a positive influence on the "Islamic premium". This reflects the unique characteristics of the determination of Islamic benchmark rates.

Figure 3: IIBR-LIBOR Spread for Overnight and 6-month Tenors

This figure shows the daily Islamic Premium (IIBR-LIBOR Spread) for overnight (ON) and 6-month maturities in US dollar. The spreads are shown in basis points. The Islamic Premium or IIBR-LIBOR Spread for a given maturity is calculated as the difference between Islamic interbank benchmark rate (IIBR) and London interbank offered rate (LIBOR). The data for calculating the spread are collected from DataStream. The sample covers the daily data from November 14, 2011 through February 28, 2013.



The remainder of this paper is organised as follows. Section 2 discusses the institutional details of the two markets namely IIBR and LIBOR, while Section 3 describes the hypotheses of this study. Section 4 provides a brief summary of data and methodology, while Section 5 presents and discusses the results. Section 6 concludes.

2. Institutional Details: IIBR and LIBOR Fixing

LIBOR, the London Interbank Offered Rate, is fixed by the British Bankers' Association (BBA) each day between 11:10 am and 11:59:59 am, London time. [5] The rate is the basis for the calculation of short-term interest rates globally and is used as the basis for

[5] We have been confirmed by Thomson Reuters regarding this timing.

settlement of interest rate contracts on many of the world's major futures and options exchanges. The determination of rate goes through some steps. First, each of the contributing panel members[6] supplies a rate shortly before 11:00am each business day. Second, these rates are ranked in order and only the middle two quartiles are averaged in determining LIBOR. According to recent BBA_LIBOR, there are currently 18 banks, which contribute quotes for the dollar LIBOR.

The IIBR, Islamic interbank benchmark rate, is defined as the profit rate that an individual Contributor Panel bank would perceive to be reasonable for Shariah compliant funding. IIBR is fixed at 11:00 am, Makkah time (GMT+3). Contributions for the IIBR are accepted from 9:00am-10:44am (Makkah time). Just in case if any contributing bank delays in sending the rates, Thomson Reuters sends 1st e-mail reminder to that bank at 10:00am (Makkah time) and 2nd e-mail reminder at 10:30 am (Makkah time). The rates for different tenors must be supplied to Thomson Reuters by 10:45am, Makkah time and a minimum of 8 banks need to contribute to each tenor. Banks must supply rates to all points on the curve (all tenors) on every day, Sunday through Thursday. A contributor is permitted to keep the same rates for one additional day. After collecting and processing the data, Thomson Reuters publishes the IIBR benchmark rates for different tenors. So far, 8 different tenors (*overnight, 1 week, 1 month, 2 months, 3 months, 6 months, 9 months, 12 months*) are introduced. To ensure that outliers do not influence the distribution, the rates are first ranked from highest to lowest and, then the top and bottom quartiles (25%) of the rates are excluded. The average of the remaining mid quartiles' rates is then calculated to produce the IIBR, rounded to 5 decimal places. This procedure of removing outliers is also followed by Thomson Reuters for fixing LIBOR. To summarise, the publication and settlement follow the following steps:

1. Accept rates for different tenors of IIBR from 9.00am - 10.44am (Makkah)

[6] Panel banks are selected based on their reputation, level of activity in the London market, and perceived expertise in the related currency.

2. The official snapping time is at 10.45am
3. An audit period begins from 10.45am -10.59am
4. Publication of the official rate for that particular day is at 11.00am
5. The value dates for settlement are T+0 for overnight funds and T+2 for all other tenors.

It is to be noted that the Panel banks come to know about the final rate only after the rate is published by Thomson Reuters. The current maximum time lag (assuming LIBOR updates at 11:59:59 am, London time) between IIBR and LIBOR is 4 hours. The implications arising out of this timing difference on the determination of the IIBR rates are explained in this paper. A snapshot of the IIBR pricing is shown in Appendix A.

3. Hypothesis Development

3.1 Relationship between IIBR and LIBOR

The discussion in Section 2 suggests that the principle differences between IIBR and LIBOR do not lie in pricing the benchmark rates. In effect, the differences between these two benchmark rates lie in the following ways:

1. LIBOR measure interest rates, whereas IIBR measures expected profit
2. Unlike LIBOR, IIBR reflects the cost of raising Shariah compliant funding
3. IIBR is based on returns generated by Shariah compliant assets, hence a reference to an Islamic banks' asset risk profile
4. Different from LIBOR, IIBR is expected to be directly linked to the economies of the Islamic world.

The distinction between the two markets/rates is important for two reasons (Reuters (2011)). First, on an economic level, conditions in Europe or the United States do not necessarily reflect the conditions in the Middle East funding market, although there may have some connection (e.g., some causal links between IIBR and LIBOR) between the two due to

integration of global financial markets. On an industry level, the use of an interest-based benchmark has long remained a point of contention, resulting in negative perceptions of the industry on the part of consumers. The IIBR is expected to remove these negative perceptions of customers of Islamic finance. Moreover, since the pace of development is enormous, Islamic finance now requires an independent rate to price their specialised products. This has been raised in both practitioners' discussion forum and academic literature (Iqbal (2002)). To delink the Islamic finance industry from the conventional LIBOR, Islamic finance industry should take all efforts to isolate them from the LIBOR pricing. In simple words, there should be less or no correlation with conventional benchmark rate. Taking these views in mind, we develop the first hypothesis as follows:

H1: There is a negative (or no statistical) relationship between Islamic interbank benchmark rate (IIBR) and conventional benchmark rate (i.e., LIBOR)

3.2 Cost of funding of Islamic finance

Another important difference between the two benchmark is that, compared to a conventional debt-based system where capital is rewarded on the basis of a rate fixed *ex-ante*, Islamic financial system rewards capital on the basis of *ex-post* return on capital (Iqbal (2002)). This is consistent with the principle ideology of Islamic financial system, which requires that all financial products are free from any fixed and pre-determined interest rate. By prohibiting interest, it does not necessarily restrict lawful business and profits and thus, its prohibitions do not imply that the opportunity cost of capital is zero (Iqbal (2002)). Instead, the system allows and promotes business, equity participation and direct sharing of risk and rewards. In Islamic finance framework, the incentive to invest depends on the prospective profitability, where the investor continues to invest until the marginal productivity of capital becomes equal to the marginal cost of capital (Iqbal (2002)). In line with this argument the

IIBR rate should be a reflection of the cost of funding and profit potential of the participating Islamic banks and financial institutions but not the reflection of the cost of capital of the conventional banking. Taking these views in mind, we develop the second hypothesis as follows:

H2: The IIBR and LIBOR spreads have a causal link with the stock returns of the contributor panel banks.

Hypotheses related to the determinants of the "Islamic premium" are discussed in the data and methodology section.

4. Data and Methodology:

To test two hypotheses raised above and to analyse the determinants of the Islamic premium, we use the daily IIBR and LIBOR rates of the following tenors: overnight, 1-week, 1-month, 2-month, 3-month, 6-month, 9-month and 12-month or 1-year. We collect these IIBR and LIBOR rates from DataStream International. The data covers the sample starting from 14 November, 2011 to 29th March 2013. These data are collected from DataStream. For testing long-term equilibrium and dynamic/time-changing relationship between the IIBR and LIBOR rates, we use the Johansen cointegration tests and dynamic conditional correlation (DCC) model of Engle (2002), respectively. For Johansen cointegration test, it is necessary to ensure that the series exhibit unit roots at the same degree of integration. To test for the presence of the unit roots, we use the standard Augmented Dickey-Fuller (ADF) unit root test. The DCC model for estimating a time-varying correlation between IIBR and LIBOR is explained in the Appendix B.

After analysing both long-term equilibrium relationship and dynamic/time-changing relationship, we then search for the determinants of the IIBR-LIBOR spread or "Islamic premium", *IP*. The *IP* can be defined as follows:

$$IP_{i,t} = IIBR_{i,t} - LIBOR_{i,t} \quad (1)$$

where $IP_{i,t}$ is the Islamic premium of maturity $i = 1, 2, 3, \ldots, 8$ (i.e., 1-day, 1-week, 1-month, 2-month, 3-month, 6-month, 9-month and 1-year) for day t. $IIBR_{i,t}$ is the Islamic Interbank Benchmark Rate of maturity i (same as above) for day t, while $LIBOR_{i,t}$ is the London Interbank Offered Rate of maturity i for day t. Once calculating the Islamic premium for each maturity, we follow the structural model of credit spreads such as that developed by Longstaff and Schwartz (1995) and used by Covrig et al. (2004) to analyse the determinants of the spread between TIBOR(Tokyo interbank offered rate)-LIBOR. The structural model suggests that firm value V follows the dynamic process as follows:

$$dV/V = (rf - \psi)dt + \sigma W + \lambda(dq - pdt) \quad (2)$$

where V is the value of the firm, rf is the risk-free interest rate, ψ is the payout rate to claimants in case of a default, σ is the firm volatility, W is a standard Wiener process, λ is a jump in the value of the firm, p is the risk-neutral probability of a jump, and the risk-neutral transition density of the jump process dq is equal to 1 (0) with probability $pdt(1 - pdt)$. If the value of the firm reaches a threshold value K, default occurs. Using the structural model of default risk, IIBR-LIBOR spread or Islamic premium can be determined by the interest rate rf and the firms return on equity. Hence, empirical models should include variables related to these two factors.

Following Collin-Dufresne, Goldstein and Martin (2001) and Covrig et al. (2004), the functional form for the determinants of the Islamic premium can be written as:

$$IP_{i,t} = a_0 + a_1 TR_{t-1} + a_2 slope_{t-1} + a_3 stock_{t-1} + a_4 vol_{t-1} + a_5 goodnews_t + a_6 badnews_t + a_7 upgrades_t + a_8 downgrades_t + \varepsilon_t \quad (3)$$

where the dependent variable is the Islamic premium $IP_{i,t}$ for maturity $i = 1, 2, 3, \ldots, 8$ (i.e., 1-day, 1-week, 1-month, 2-month, 3-month, 6-month, 9-month and 1-year) on day t. Explanatory variables are as follows:

TR = change in 3-month Treasury bill rate,

$slope$ = slope of yield curve,

$stock$ = change in log of stock price index,

vol = equity market volatility as measured by a GARCH model,

$goodnews$ = dummy for good news received,

$badnews$ = dummy for bad news received,

$upgrades$ = dummy for credit upgrades

$downgrades$ = dummy for credit downgrades.

It is to be noted that the explanatory variables other than news and credit rating are considered as lagged variables as these are public information released one day before the IIBR rates are set next day morning. However, news and rating variables are contemporary variables. More details on this will be explained later. Hypotheses related to the aforementioned determinants of "Islamic premium" are discussed in Table 1 with details of data structure and source of data. For the news and rating information, Bloomberg news pages are used to find the exact timing of the news announcement. This methodology allows one to place each event in the proper time period. For example, using the IIBR and LIBOR pricing details as noted in Section 2, news announced prior to 10:44am Makkah time is taken as a same day news and news announced beyond 10:45 is moved to next day news. Zero-one dummies are created for each good or bad news[7] and credit rating upgrades or downgrades.

[7] A good news example is "Dar Al Arkan's (Saudia Arabia) 5.75% five year sukuk has performed well in secondary markets" and a bad news example is "Abu Dhabi Islamic Bank share price dropped for the second time". An example of credit rating upgrade is "Dubai Islamic Bank sees upgrade to A from BB" and an example of downgrade is "Bahrain Islamic Bank downgraded into BA3".

Table 1: Explanatory variables, hypotheses, data structure and the source of data

This table discusses, in details, the explanatory variables, their predicted sign and hypotheses, the data that are used for analysis and the source of data.

Explanatory Variables	Predicted sign	Hypothesis	Data description	Source of data
TR	Negative	Longstaff and Schwartz (1995) suggest that an increase in the interest rate increases the drift of the risk-neutral process for V (value of the firm), which in turn makes the risk-neutral probability of a default lower. Hence, one can expect that a change in the interest rate will reduce the Islamic premium.	Change in 3-month Saudi Arabia Treasury bill rate.	Thomson Reuters (DataStream)
Slope	Negative	The level of interest rates and the slope of the term structure have been frequently used in empirical models of credit spreads (see, for a review of literature, Azad, Fang and Wickramanayake (2011)). The slope indicates expected future interest rate as well as an economic expansion or contraction. A positive/steeper slope is indicative of higher future short-term interest rate and lower credit spread. The reverse is true for a negative or inverted slope, which implies an expectation of interest rate fall and higher credit spread. Hence, we expect that the Islamic premium is associated negatively with the slope of the yield curve.	The difference between 7-year government bond yield (Saudi Arabia) and 3-month Treasury bill rate (Saudi Arabia).	Thomson Reuters (DataStream)
Stock	Negative	Changes in stock prices for panel banks should contain information related to the credit risk associated with interbank loans. An increase (decrease) in the stock index should have a negative (positive) impact on the Islamic premium.	Dow Jones Islamic world emerging markets price index	Thomson Reuters (DataStream)
Vol	Positive	While the theoretical pricing of default risk in Merton (1974) implies that stock price volatility and the associated higher volatility of firm value increases the default risk, the empirical studies including Rigobon and Sack (2003), Bedendo, Cathcart and El-Jahel (2004) and Churm and Panigirtzoglou (2005) among others show that default probability increases with stock market volatility. Accordingly, credit spreads (i.e., Islamic premium) should rise with volatility of firm value, which is reflected in stock price volatility.	Dow Jones Islamic world emerging markets return index (equity market volatility as measured by the conditional variance of stock market index returns from a GARCH model).	Thomson Reuters (DataStream)
Bad news and credit rating downgrade	Positive	Firm related bad news including credit rating downgrade by the rating agencies causes a higher probability of a negative jump in firm value and a rise in the credit spread. Hence a bad public news regarding panel banks performance and/or their credit rating downgrade are expected to increase Islamic premium.	Bad news related to panel banks and the downgrade of credit rating by either of the following rating agencies: Fitch, S&P, Moody's and Capital Intelligence. Used zero-one dummies.	Bloomberg
Good news and credit rating upgrade	Negative	Good news and credit rating downgrade should have an opposite effect than the bad news and credit downgrade. We expect that any good news causes a higher probability of a positive jump in the firm value and decrease the credit spread of the panel banks.	Good news related to panel banks and the upgrade of credit rating by either of the following rating agencies: Fitch, S&P, Moody's and Capital Intelligence. Used zero-one dummies.	Bloomberg

5. Results and Discussion

Before reporting the results related to hypotheses 1 and 2 and to the estimation of "Islamic premium" model, we present summary statistics and the correlation matrix for IIBOR and LIBOR in Table 1.

Panel A of Table 1 shows that, as expected, IIBOR has a higher mean than LIBOR. Over the sample period, IIBOR (LIBOR) reached a maximum value of 1.538 (1.130) and a minimum value of 0.092 (0.139) with 1-year and overnight rates, respectively. Based upon the Jarque-Berra statistics, we can reject the hypothesis of normality for each variable in terms of its skewness and kurtosis. Panel B of Table 1 shows that, exception is the overnight rate of LIBOR, which is positively correlated with all tenors of IIBR rates, the correlation between IIBR and LIBOR over the sample period is negative. So it is apparent that IIBR independently moves from LIBOR and thereby reflects its own unique characteristics and market conditions as opposed to those of banks in London. In the next sub-section, which shows the results of long-term equilibrium and dynamic relationship between the two benchmark rates, we will examine whether these results hold.

The sub-sections 5.1 and 5.2 report the results related to hypothesis 1 and 2, respectively.

Table 1: Descriptive Statistics and Correlation Matrix

Panel A of this table shows the descriptive statistics of the IIBR and LIBOR, while Panel B shows the correlation matrix between IIBR and LIBOR for eight different tenors The analysis is based on daily data since November 14, 2011 to April 29, 2013. All data are collected from DataStream International. * indicates significance at 1%.

Panel A: Descriptive Statistics

	IIBRON	IIBR1W	IIBR1M	IIBR2M	IIBR3M	IIBR6M	IIBR9M	IIBR1YR	LIBON	LIB1W	LIB1M	LIB2M	LIB3M	LIB6M	LIB9M	LIB1YR
Mean	0.178	0.261	0.416	0.536	0.668	0.916	1.092	1.274	0.153	0.189	0.236	0.325	0.424	0.667	0.830	0.991
Median	0.202	0.270	0.431	0.540	0.697	0.957	1.124	1.297	0.153	0.190	0.239	0.342	0.458	0.727	0.886	1.048
Maximum	0.235	0.353	0.600	0.703	0.850	1.193	1.354	1.538	0.171	0.216	0.296	0.429	0.583	0.812	0.968	1.130
Minimum	0.092	0.172	0.257	0.353	0.444	0.628	0.752	0.952	0.139	0.171	0.198	0.242	0.284	0.456	0.610	0.750
Std. Dev.	0.044	0.044	0.074	0.084	0.110	0.148	0.145	0.139	0.008	0.009	0.025	0.055	0.090	0.111	0.106	0.111
Skewness	-0.711	-0.252	-0.244	-0.126	-0.439	-0.299	-0.314	-0.187	0.242	0.232	0.559	-0.037	-0.117	-0.689	-0.749	-0.809
Kurtosis	1.695	1.973	1.966	1.843	1.748	1.664	1.716	1.590	2.614	3.087	2.752	1.954	1.786	1.903	2.047	2.200
Jarque-Bera*	52.821	18.556	18.533	19.860	33.128	30.380	28.949	30.145	5.433	3.169	18.596	15.568	21.672	43.932	44.613	46.195

Panel B: Correlation Matrix

	IIBRON	IIBR1W	IIBR1M	IIBR2M	IIBR3M	IIBR6M	IIBR9M	IIBR1YR	LIBON	LIB1W	LIB1M	LIB2M	LIB3M	LIB6M	LIB9M	LIB1YR
IIBRON	1	0.925	0.914	0.886	0.923	0.917	0.905	0.865	0.643	-0.458	-0.649	-0.636	-0.629	-0.494	-0.447	-0.451
IIBR1W		1	0.956	0.924	0.910	0.924	0.913	0.893	0.567	-0.217	-0.414	-0.386	-0.374	-0.235	-0.186	-0.190
IIBR1M			1	0.967	0.950	0.956	0.951	0.931	0.553	-0.228	-0.423	-0.382	-0.370	-0.212	-0.162	-0.165
IIBR2M				1	0.964	0.961	0.961	0.950	0.542	-0.204	-0.384	-0.329	-0.316	-0.138	-0.088	-0.090
IIBR3M					1	0.974	0.969	0.952	0.611	-0.323	-0.518	-0.475	-0.465	-0.284	-0.234	-0.234
IIBR6M						1	0.984	0.969	0.590	-0.269	-0.464	-0.420	-0.409	-0.225	-0.171	-0.171
IIBR9M							1	0.978	0.585	-0.267	-0.458	-0.414	-0.403	-0.213	-0.160	-0.159
IIBR1YR								1	0.560	-0.189	-0.377	-0.332	-0.325	-0.128	-0.072	-0.070
LIBON									1	-0.057	-0.385	-0.476	-0.468	-0.411	-0.356	-0.360
LIB1W										1	0.896	0.848	0.847	0.795	0.808	0.806
LIB1M											1	0.973	0.964	0.884	0.876	0.871
LIB2M												1	0.997	0.955	0.943	0.938
LIB3M													1	0.959	0.947	0.942
LIB6M														1	0.997	0.995
LIB9M															1	0.999
LIB1YR																1

5.1 Relationship between IIBR and LIBOR: No arbitrage so far?

The empirical analysis using full sample (November 14, 2011 to March 29, 2013) and two sub-samples (November 14, 2011 to April 13, 2012 and April 16, 2012 to March 29, 2013) suggests that there is no long-term equilibrium relationship between IIBR and LIBOR for all tenors. We draw this inference from Johansen cointegration technique that is frequently used to detect the long-term relationship between two series. Table 2 shows the Johansen cointegration test results for various maturities for the full sample and the second sub-sample. The sub-sample analysis is motivated by the fact that there is an obvious structural break sometimes in the middle of April 2012 as suggested by both Figures 2 and 3 in Section 1.

Further, to obtain robust results, we dropped the Friday data and run the Johansen tests using Monday to Thursday data. The reason to do this is that there is a date matching problem between IIBR and LIBOR. Middle Eastern markets are open on Sundays but are closed on Fridays, while London market is open on Fridays but is closed on Sundays. So a question arises, although Monday to Thursday IIBR exactly match with LIBOR dating, what is done for the Sunday IIBR rate to match with LIBOR. Thomson Reuters confirmed that IIBR rates are moved to a Friday date from coming Sunday.[8] Inclusion of Friday data, however, does not change the relationship between the IIBR and LIBOR rates.

To corroborate our findings from Johansen cointegration tests, we proceed on to investigating the dynamic relationship between IIBR and LIBOR rates. The dynamic relationship is investigated using Engle's two-stage DCC process. This method looks at the time-changing relationship between the two series. Overall, the results seem to be consistent with the Johansen cointegration test. In congruent with Hypothesis 1, all but 6-month rates

[8] A proof of e-mail correspondence with Thomson Reuters's staff could be provided on request.

have either negative or statistically insignificant correlation. The time-changing/dynamic relationship of 6-month IIBR and LIBOR rates is found to be positive.

The absence of both long-term and dynamic relationship between IIBR and LIBOR rates reflect two important phenomena: (1) the rates are independently determined hence reflecting their own market characteristics and (2) lack of arbitrage. Related to first aspect, we explained in Section 3 that the main objective at the commencement of IIBR was to delink Islamic finance industry from the conventional LIBOR. The lack of arbitrage is attributed to the strict usage of the benchmark rates among the Islamic banks.

5.2 Cost of capital of Islamic banks and the causal influence from stock returns

The discussion in sub-section 3.2 implies that the most important aspect is the equity participation and direct sharing of risk and rewards meaning that the opportunity cost of capital is not zero (Iqbal (2002)). According to this explanation, the IIBR rate should be a reflection of the cost of funding and profit potential of the participating panel members of the IIBR. That is, the stock price of the panel banks is expected to exert influence on the pricing of the IIBR rates and the IIBR-LIBOR spread. This hypothesis (H2) is tested using Granger causality test between IIBR-LIBOR spread and stock prices of the panel banks. The analysis suggests that the causal flow is largely one way from the stock price to the IIBR-LIBOR spread, further reflecting Islamic finance industry's unique characteristics in determining the Islamic benchmark rate. Table 4, which shows the Granger causality between Islamic bank returns and IIBR-LIBOR spread, indicates that most of the panel members are found to exert influence on the IIBR-LIBOR spread. A bi-directional causality is detected only between overnight rate and Abu Dhabi Islamic Bank. Also, one way causality from IIBR to stock price is found for Alinma Bank.

Table 2: Johansen Cointegration Results of IIBOR and LIBOR

This table shows the Johansen cointegration test results for full sample and sub-sample. Full sample includes the data from November 14, 2011 to March 29, 2013, while sub-sample includes the data from April 16, 2012 to March 29, 2013. The analysis excludes Friday observation due to holiday in the Middle Eastern markets on Friday. The cointegration tests are run on the 1st differenced series of IIBR and LIBOR. The data are collected from DataStream. The table reports results for testing the number of cointegrating relations. For each maturity, two types of test statistics are reported: *trace* statistics and *maximum eigenvalue* statistics. Critical values, as shown in parentheses, are reported in 5% level of significance.

Panel A: Full-sample

	Overnight		**1 week**		**1 month**		**6 month**		**1 year**	
Hypothesis	Trace stats (critical value)	Max-Eigen stats (critical value)	Trace stats (critical value)	Max-Eigen stats (critical value)	Trace stats (critical value)	Max-Eigen stats (critical value)	Trace stats (critical value)	Max-Eigen stats (critical value)	Trace stats (critical value)	Max-Eigen stats (critical value)
Ho: r=0	94.9013	63.5092	99.4618	55.0803	76.7867	58.7519	119.3170	100.9823	87.2156	68.3481
	(15.4947)	(14.2646)	(15.4947)	(14.2646)	(15.4947)	(14.2646)	(15.4947)	(14.2646)	(15.4947)	(14.2646)
H1: r=1	31.3921	31.3921	44.3814	44.3814	18.0348	18.0348	18.33469	18.33469	18.8675	18.8675
	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)
Panel B: Sub-sample										
Ho: r=0	64.1151	40.6643	71.1277	42.6504	78.2709	57.6327	86.9800	79.1928	64.5110	53.0368
	(15.4947)	(14.2646)	(15.4947)	(14.2646)	(15.4947)	(14.2646)	(15.4947)	(14.2646)	(15.4947)	(14.2646)
H1: r=1	23.4508	23.4508	28.4773	28.4773	20.6382	20.6382	7.7872	7.7872	11.4741	11.4741
	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)	(3.8415)

Table 3: Time-varying DCC Parameters

This table shows the coefficient, standard error and the level of significance of the two DCC parameters, θ_1 and θ_2. See Appendix B for details of the Engle's DCC approach. θ_1 indicates the effects of previous standardized shocks and θ_2 indicates the correlation persistence. Standard errors of the estimated coefficients are in parentheses. ** indicates that the time-varying correlation is significant at 5%. The analysis covers the daily data from November 14, 2011 to March 29, 2013.

Correlation Parameters	**Overnight**	**1Week**	**1month**	**2month**	**3month**	**6month**	**9month**	**1year**
θ_1	-0.047042**	-0.0124812	-0.044627**	-0.044627	-0.046676**	0.490970**	-0.011615	-0.036517**
	(0.022272)	(0.065145)	(0.032509)	(0.032509)	(0.020054)	(0.272384)	(0.012117)	(0.000201)
θ_2	0.931237**	0.096582	-0.0279538	-0.279538	1.008869**	0.490970	0.999587**	0.965495**
	(0.058243)	(12.464871)	(1.056056)	(1.056056	(0.002249)	(0.272384)	(0.008549)	(0.000925)

Table 4: Pairwise Granger Causality Tests

This table shows the pairwise Granger causality tests between IIBR-LIBOR spread and the stock returns of the panel banks. The analysis includes the daily data from November 14, 2011 to March 29, 2013.

Null Hypothesis:	F-Statistic	Prob.
ABU_DHABI_ISLAMIC_BANKSTOCK__ does not Granger Cause _1D	**2.94622**	**0.0539**
_1D does not Granger Cause ABU_DHABI_ISLAMIC_BANKSTOCKSTOCK__	**5.33098**	**0.0053**
ALINMA_BANKSTOCK does not Granger Cause _1D	**5.29879**	**0.0054**
_1D does not Granger Cause ALINMA_BANKSTOCK	**3.88164**	**0.0216**
DUBAI_ISLAMIC_BANKSTOCK___TOT does not Granger Cause _1D	**2.33884**	**0.0980**
_1D does not Granger Cause DUBAI_ISLAMIC_BANKSTOCK___TOT	0.07354	0.9291
ITHMAAR_BANKSTOCK_ does not Granger Cause _1D	**2.46504**	**0.0866**
_1D does not Granger Cause ITHMAAR_BANKSTOCK_	**4.98060**	**0.0074**
ALINMA_BANKSTOCK does not Granger Cause _1W	**4.16478**	**0.0163**
_1W does not Granger Cause ALINMA_BANKSTOCK	**3.08994**	**0.0468**
ITHMAAR_BANKSTOCK_ does not Granger Cause _1W	**4.19879**	**0.0158**
_1W does not Granger Cause ITHMAAR_BANKSTOCK_	**2.71281**	**0.0678**
KUWAIT_NATIONAL_BANKSTOCK does not Granger Cause _1W	**3.86358**	**0.0219**
_1W does not Granger Cause KUWAIT_NATIONAL_BANKSTOCK	1.29435	0.2755
AHLI_BANKSTOCK_I does not Granger Cause _1M	**2.32305**	**0.0996**
_1M does not Granger Cause AHLI_BANKSTOCK_I	1.00343	0.3677
ALINMA_BANKSTOCK does not Granger Cause _1M	**2.92193**	**0.0552**
_1M does not Granger Cause ALINMA_BANKSTOCK	1.56166	0.2113
ITHMAAR_BANKSTOCK_ does not Granger Cause _1M	**3.10664**	**0.0461**
_1M does not Granger Cause ITHMAAR_BANKSTOCK_	**3.48519**	**0.0318**
AL_BARAKA_BANKSTOCKING_GROUP_ does not Granger Cause _2M	0.04079	0.9600
_2M does not Granger Cause AL_BARAKA_BANKSTOCKING_GROUP_	**2.32292**	**0.0996**
ALINMA_BANKSTOCK does not Granger Cause _2M	**2.60778**	**0.0752**
_2M does not Granger Cause ALINMA_BANKSTOCK	1.43351	0.2399
ITHMAAR_BANKSTOCK_ does not Granger Cause _2M	**3.42566**	**0.0337**
_2M does not Granger Cause ITHMAAR_BANKSTOCK_	**2.98232**	**0.0520**
KUWAIT NATIONAL_BANKSTOCK__ does not Granger Cause _2M	**2.43831**	**0.0889**
_2M does not Granger Cause **KUWAIT** NATIONAL_BANKSTOCK_	0.88949	0.4118
ABU_DHABI_ISLAMIC_BANKSTOCK__ does not Granger Cause _3M	**1.91079**	**0.1496**
_3M does not Granger Cause ABU_DHABI_ISLAMIC_BANKSTOCK__	**2.85038**	**0.0592**
ALINMA_BANKSTOCK does not Granger Cause _3M	**2.61765**	**0.0745**
_3M does not Granger Cause ALINMA_BANKSTOCK	**2.62330**	**0.0741**
ITHMAAR_BANKSTOCK_ does not Granger Cause _3M	**3.31410**	**0.0376**
_3M does not Granger Cause ITHMAAR_BANKSTOCK_	**3.68043**	**0.0262**
ALINMA_BANKSTOCK does not Granger Cause _6M	**4.03702**	**0.0185**
_6M does not Granger Cause ALINMA_BANKSTOCK	**5.39987**	**0.0049**

ITHMAAR_BANKSTOCK_ does not Granger Cause _6M	**3.90432**	**0.0211**
_6M does not Granger Cause ITHMAAR_BANKSTOCK_	**2.76361**	**0.0645**
AHLI_BANKSTOCK_I does not Granger Cause _9M	**2.31962**	**0.0999**
_9M does not Granger Cause AHLI_BANKSTOCK_I	0.15874	0.8533
ALINMA_BANKSTOCK does not Granger Cause _9M	**5.17740**	**0.0061**
_9M does not Granger Cause ALINMA_BANKSTOCK	**5.49360**	**0.0045**
ITHMAAR_BANKSTOCK_ does not Granger Cause _9M	**5.37078**	**0.0051**
_9M does not Granger Cause ITHMAAR_BANKSTOCK_	**2.48465**	**0.0849**
AHLI_BANKSTOCK_I does not Granger Cause _1YR	**3.13448**	**0.0448**
_1YR does not Granger Cause AHLI_BANKSTOCK_I	0.42299	0.6554
AHLI_UNITED_BANKSTOCK___TOT_R does not Granger Cause _1YR	**2.32607**	**0.0993**
_1YR does not Granger Cause AHLI_UNITED_BANKSTOCK___TOT_R	0.12815	0.8798
ALINMA_BANKSTOCK does not Granger Cause _1YR	**4.31060**	**0.0142**
_1YR does not Granger Cause ALINMA_BANKSTOCK	**7.14699**	**0.0009**
ITHMAAR_BANKSTOCK_ does not Granger Cause _1YR	**4.88097**	**0.0081**
_1YR does not Granger Cause ITHMAAR_BANKSTOCK_	**2.54116**	**0.0803**
KUWAIT_NATIONAL_BANKSTOCK does not Granger Cause _1YR	1.73733	0.1776
_1YR does not Granger Cause KUWAIT_NATIONAL_BANKSTOCK	**3.19058**	**0.0424**

5.3 Determinants of Islamic premium: Evidence from structural model

Before we report the estimation results of the determinants of the Islamic premium, let us discuss the descriptive statistics including mean, standard deviation (Std.Dev.), minimum (Min) and maximum (Max) of both dependent and independent variables for our sample. The first two columns in Table 5, present the variables and number of observations, respectively. The dependent variables are the Islamic premium for different maturities ranging from overnight (ON) to one year (1yr). The minimum Islamic premium is 28 bps (basis points) with the shortest maturity (overnight), while the maximum premium is 303 bps with the longest maturity (1yr). Table 5 also presents the descriptive statistics for the explanatory variables, of which, good news are 272, bad news are 62, rating upgrades are 19 and rating downgrades are 8. The number of good news and rating upgrades are higher than the number bad news and rating downgrades, which implies that Middle Eastern countries and their Islamic banking exhibit a strong performance. It thus raises a question, why given these good

news and strong performance, Islamic interbank benchmark rates have been higher than that of LIBOR. The OLS estimation results of the credit spread model are expected to answer this question.

Table 5: Descriptive Statistics for the dependent and independent variables

This table presents the descriptive statistics of both dependent and explanatory variables. Dependent variables are the Islamic premiums for different maturities, obtained as the difference between IIBR and LIBOR of the corresponding maturity. The IIBR and LIBOR data are obtained from Thomson Reuters DataStream. Sample covers the daily data from November 14, 2011 to March 29, 2013. TR (the change in 3-month Saudi Arabia Treasury bill rate), Slope (the difference between 7-year Saudi Arabia Government bond and the 3-month Saudi Arabia Treasury rate), Stock (the change in Dow Jones Islamic world emerging markets price index), Vol (equity market volatility as measured by the conditional variance of Dow Jones Islamic world emerging markets return index from a GARCH model) are all obtained from DataStream. News and rating variables are obtained from Bloomberg. To match the IIBR pricing time, any news/rating of the panel banks beyond 10:45am (Makkah time) are moved to next day news. News and rating data are collected from November 14, 2011 through March 29, 2013.

Variable	Obs	Mean	Std. Dev.	Min	Max
ON	393	2.460	3.955	-6.133	8.800
1w	393	7.196	4.639	-1.820	16.290
1m	393	18.011	8.780	0.542	36.125
2m	393	21.080	11.410	-4.420	35.758
3m	393	24.440	17.197	-11.336	45.983
6m	393	24.928	20.395	-17.400	51.710
9m	393	26.255	19.256	-17.530	53.750
1yr	393	28.320	18.381	-14.370	53.517
TR	393	0.001	0.002	-0.009	0.01
Slope	393	1.34	0.08	1.254	1.543
Stock	393	0	0.009	-0.031	0.034
Vol	393	0.008	0.002	0.005	0.014
Good_news	272	0.539	0.499	0	1
Bad_news	62	0.156	0.363	0	1
Rate_up	19	0.053	0.224	0	1
Rate_down	8	0.022	0.148	0	1

Table 6: Correlation Matrix

This table presents the correlation matrix of both dependent and explanatory variables. Dependent variables are the Islamic premiums for different maturities, obtained as the difference between IIBR and LIBOR of the corresponding maturity. The IIBR and LIBOR data are obtained from Thomson Reuters DataStream. Sample covers the daily data from November 14, 2011 to March 29, 2013. TR (the change in 3-month Saudi Arabia Treasury bill rate), Slope (the difference between 7-year Saudi Arabia Government bond and the 3-month Saudi Arabia Treasury rate), Stock (the change in Dow Jones Islamic world emerging markets price index), Vol (equity market volatility as measured by the conditional variance of Dow Jones Islamic world emerging markets return index from a GARCH model) are all obtained from DataStream. News and rating variables are obtained from Bloomberg. To match the IIBR pricing time, any news/rating of the panel banks beyond 10:45am (Makkah time) are moved to next day news. News and rating data are collected from November 14, 2011 through March 29, 2013.

	ON	1w	1m	2m	3m	6m	9m	1yr	TR	Slope	Stock	Vol	Good_news	Bad_news	Rate_up	Rate_down
ON	1															
1w	0.96	1														
1m	0.95	0.96	1													
2m	0.94	0.92	0.97	1												
3m	0.90	0.86	0.92	0.97	1											
6m	0.92	0.87	0.91	0.96	0.98	1										
9m	0.91	0.86	0.91	0.96	0.98	0.99	1									
1yr	0.91	0.86	0.91	0.96	0.98	0.99	0.99	1								
TR	-0.26	-0.24	-0.25	-0.28	-0.29	-0.30	-0.30	-0.30	1							
Slope	-0.78	-0.72	-0.79	-0.87	-0.92	-0.89	-0.90	-0.89	0.299	1						
Stock	-0.03	-0.01	-0.03	-0.01	-0.01	-0.02	-0.03	-0.02	-0.036	-0.023	1					
Vol	0.49	0.41	0.50	0.58	0.66	0.64	0.66	0.63	0.250	0.798	0.01	1				
Good_news	-0.13	-0.13	-0.13	-0.15	-0.15	-0.14	-0.14	-0.14	0.189	0.153	-0.04	0.07	1			
Bad_news	-0.12	-0.12	-0.14	-0.15	-0.15	-0.15	-0.14	-0.15	0.070	0.163	0.04	0.10	0.10	1		
Rate_up	0.04	0.06	0.06	0.02	0.02	0.02	0.01	0.02	-0.011	0.004	0.07	0.02	0.09	0.04	1	
Rate_down	-0.06	-0.07	-0.05	-0.06	-0.05	-0.06	-0.05	-0.05	-0.002	0.045	-0.05	-0.01	-0.01	0.04	-0.04	1

The correlation matrix, as presented in Table 6, shows that the correlations between various spreads are very high with the closest maturities are relatively higher (between overnight and 1 week) than the distant maturities (overnight and 1 year). The correlations between dependent and explanatory variables are also consistent with our prediction with the exception of the news and rating dummies, which rather exhibit mixed results. This is somewhat similar to what we observed in the descriptive statistics. That is, given the higher number of good news and rating dummies, the Islamic premiums have been high.

We now present and analyse the OLS regression results in Table 7. The results show that the negative coefficients of the Treasury bill rate and the stock return are consistent with our prediction, however, statistically significant in only Model-1, suggesting that the Treasury bill rate and stock returns have more influence on the overnight rate than the other maturities. The coefficients of Slope and Vol are also significant and negative, which are consistent with our expectation. However, the size of the coefficient of the stock return volatility is the highest of all explanatory variables suggesting that the stock market volatility is the most determining factor in Islamic premium. This articulates the very different nature of the Islamic finance, where the most important aspect is the equity participation and direct sharing of risk and rewards (Iqbal (2002)). Finally, as observed in descriptive statistics, the good/bad news and rating up/down grades have little influence on the determination of the Islamic premium. The highest adjusted R^2 is observed with 3-month spread followed by 1-year and 6-month.

Table 7: Determinants of Islamic Premium

This table presents the OLS estimation results of the following credit spread (Islamic premium) model:

$$IP_{i,t}=a_0 + a_1 TR_{t-1} + a_2 slope_{t-1} + a_3 stock_{t-1} + a_4 vol_{t-1} + a_5 goodnews_t + a_6 badnews_t + a_7 upgrades_t + a_8 downgrades_t + \varepsilon_t$$

where, Dependent variables are the Islamic premiums for different maturities, obtained as the difference between IIBR and LIBOR of the corresponding maturity. The IIBR and LIBOR data are obtained from Thomson Reuters DataStream. Sample covers the daily data from November 14, 2011 to March 29, 2013. TR (the change in 3-month Saudi Arabia Treasury bill rate), Slope (the difference between 7-year Saudi Arabia Government bond and the 3-month Saudi Arabia Treasury rate), Stock (the change in Dow Jones Islamic world emerging markets price index), Vol (equity market volatility as measured by the conditional variance of Dow

Jones Islamic world emerging markets return index from a GARCH model) are all obtained from DataStream. News and rating variables are obtained from Bloomberg. To match the IIBR pricing time, any news/rating of the panel banks beyond 10:45am (Makkah time) are moved to next day news. News and rating data are collected from November 14, 2011 through March 29, 2013. The numbers in parentheses represent the standard errors which are adjusted for autocorrelation and heteroskedasticity by using the Newey-West method with two lags. *** and ** denote 1% and 5% significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	ON	1w	1m	2m	3m	6m	1yr
TR	-0.9473**	-0.7800	-0.8614	-0.7487	-2.0282	-2.7774	-2.0699
	(0.4604)	(0.6622)	(1.2976)	(1.3237)	(1.6614)	(2.0601)	(1.7936)
Slope	-0.5019***	-0.5934***	-1.1427***	-1.5491***	-2.2993***	-2.5854***	-2.4378***
	(0.0514)	(0.0608)	(0.1029)	(0.1128)	(0.1465)	(0.2194)	(0.1811)
Stock	-0.2739*	-0.3199	-0.5398	-0.3988	-0.5887	-1.0182	-0.8459
	(0.1586)	(0.2029)	(0.3512)	(0.3800)	(0.5012)	(0.7222)	(0.5985)
Vol	6.2388***	8.9329***	14.2413***	16.0236***	16.9279***	17.0116**	20.0226***
	(1.8741)	(2.2584)	(3.8633)	(3.9995)	(4.2961)	(6.5742)	(5.1441)
Good_news	0.0007	0.0004	0.0016	0.0004	0.0007	0.0027	0.0043
	(0.0024)	(0.0030)	(0.0049)	(0.0051)	(0.0064)	(0.0092)	(0.0085)
Bad_news	0.0010	0.0010	-0.0016	-0.0012	-0.0018	-0.0037	-0.0060
	(0.0035)	(0.0044)	(0.0073)	(0.0076)	(0.0091)	(0.0128)	(0.0114)
Rate_up	0.0050	0.0092	0.0204	0.0104	0.0104	0.0136	0.0113
	(0.0070)	(0.0084)	(0.0148)	(0.0161)	(0.0174)	(0.0273)	(0.0229)
Rate_downe	-0.0020	-0.0053	0.0023	0.0003	0.0094	-0.0092	0.0100
	(0.0051)	(0.0065)	(0.0118)	(0.0144)	(0.0222)	(0.0331)	(0.0248)
Constant	0.6447***	0.7911***	1.5894***	2.1525***	3.1883***	3.5774***	3.3846***
	(0.0526)	(0.0614)	(0.1041)	(0.1198)	(0.1688)	(0.2475)	(0.2070)
Observations	359	359	359	359	359	359	359
R-squared	0.6505	0.5904	0.6785	0.7926	0.8719	0.8148	0.8225

5.4 Robustness to alternative specifications

A natural question arises as to whether the results obtained are robust to alternative specification of stock market volatility. Interestingly, taking the stock return volatility does not change the relationship between the Islamic spread and the explanatory variables. The sign, size and significance of the coefficients and the adjusted R^2 remain unchanged. The related results are reported in Table 8.

Table 8: Robustness of the Determinants of Islamic Premium

This table presents the OLS estimation results of the following credit spread (Islamic premium) model with a different proxy of the stock market volatility (see Table 7 for details of other variables):

$$IP_{i,t}=a_0 + a_1 TR_{t-1} + a_2 slope_{t-1} + a_3 stock_{t-1} + a_4 vol_{t-1} + a_5 goodnews_t + a_6 badnews_t + a_7 upgrades_t + a_8 downgrades_t + \varepsilon_t$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	ON	1w	1m	2m	3m	6m	1yr

TR	-0.9456**	-0.7776	-0.8577	-0.7466	-2.0258	-2.7735	-2.0669
	(0.4607)	(0.6619)	(1.2974)	(1.3236)	(1.6615)	(2.0601)	(1.7935)
Slope	-0.5021***	-0.5937***	-1.1432***	-1.5495***	-2.2998***	-2.5865***	-2.4386***
	(0.0514)	(0.0607)	(0.1028)	(0.1127)	(0.1464)	(0.2192)	(0.1809)
Stock	-0.2730*	-0.3166	-0.5359	-0.4003	-0.5968	-1.0338	-0.8598
	(0.1586)	(0.2029)	(0.3512)	(0.3802)	(0.5015)	(0.7228)	(0.5994)
Vol	6.2471***	8.9418***	14.2569***	16.0367***	16.9492***	17.0490***	20.0540***
	(1.8724)	(2.2563)	(3.8585)	(3.9963)	(4.2924)	(6.5679)	(5.1373)
good_dum	0.0007	0.0004	0.0016	0.0004	0.0007	0.0027	0.0043
	(0.0024)	(0.0030)	(0.0049)	(0.0051)	(0.0064)	(0.0092)	(0.0085)
bad_dum	0.0010	0.0010	-0.0016	-0.0012	-0.0018	-0.0037	-0.0060
	(0.0035)	(0.0044)	(0.0073)	(0.0076)	(0.0091)	(0.0128)	(0.0114)
rate_upgrade	0.0050	0.0092	0.0204	0.0104	0.0105	0.0136	0.0114
	(0.0070)	(0.0084)	(0.0148)	(0.0161)	(0.0174)	(0.0273)	(0.0228)
rate_downgrade	-0.0020	-0.0053	0.0023	0.0003	0.0094	-0.0092	0.0100
	(0.0051)	(0.0065)	(0.0118)	(0.0144)	(0.0222)	(0.0331)	(0.0248)
Constant	0.6450***	0.7914***	1.5899***	2.1529***	3.1889***	3.5786***	3.3855***
	(0.0525)	(0.0613)	(0.1040)	(0.1198)	(0.1686)	(0.2473)	(0.2067)
Observations	359	359	359	359	359	359	359
R-squared	0.6504	0.5903	0.6785	0.7926	0.8719	0.8149	0.8226

Standard errors in parentheses (adjusted for HAC)
*** p<0.01, ** p<0.05, * p<0.1

6. Concluding Remarks:

Up until, mid-November 2011, there have been times when there was no such thing as the interbank benchmark/interest rate on the Islamic financial products. Hence, Islamic banks and financial institutions had had to rely on London interbank offered rate (LIBOR) to price their products including short-term lending rates. This was against the principle/essence of Islamic shariah law. Interestingly, although this specified industry got its own benchmark rates (i.e., IIBR) since the middle of November 2011, with the exception of first few months, Islamic interbank rate has always been found to be above the LIBOR for any given maturity. This might have created arbitrage: borrowing cheap in LIBOR and lending in IIBR. To investigate that, we analysed both the long-term cointegrating relationship and dynamic relationship between Islamic interbank benchmark (IIBR) and London interbank offered bank (LIBOR) in US dollar. Surprisingly, no long-term relationship was found between the two benchmark rates. Also, with one exception, the dynamic relationships between the two rates were found to be either negative or insignificant. This implies two aspects: the IIBR is independently determined reflecting its unique characteristics and market conditions as

opposed to those banks in London and the arbitragers rarely attempted to benefit from the pricing anomalies between these markets. Following this, the study tested and supported the hypothesis that "Islamic premium" is a reflection of the cost of funding and profit potential of the participating IIBR rate-setters. To corroborate this finding, we modelled the determinants of the Islamic premium as a function of determinants of bank default and firm value suggested by a theory of credit spreads. These determinants include interest rate and stock market effects along with good and bad news reported in the business press regarding panel banks and a separate category of news for panel banks' credit downgrades and upgrades. We find the following systematic effects on the spread: i) a flatter yield curve raises the premium and ii) more volatile stock prices raise the premium. Banks related good or bad news and credit rating upgrades and downgrades were found to have no significant influence in determining the Islamic premium. Overall, we found that the stock market volatility is the most determining factor as to increase the IIBR over LIBOR for corresponding maturities. This is consistent with the argument that "Islamic premium" is a reflection of the cost of funding and profit potential of the participating IIBR rate-setters.

Appendix A: A snapshot of the IIBR pricing (obtained from Thomson Reuters)

USDIIBRFIX02 TR IIBR Fix

Thomson Reuters Islamic Interbank Benchmark Rate (IIBR)

Contributed Rates

ISLAMIC USD RATE AS OF 11.00AM MAKKAH TIME

	ON	SW	1M	2M
Fixings	0.20000	0.25333	0.40167	0.51667
Abu Dhabi Isl Bk				
Al Salam Bk	0.22000	0.35000	0.55000	0.65000
Ahli United Bk	0.20000	0.25000	0.40000	0.55000
Bahrain Isl Bk				
Al Baraka Bk	0.26000	0.27000	0.32000	0.38000
Barwa Bk	0.35000	0.55000	0.75000	0.85000
Dubai Isl Bk				
Al Hilal Bk	0.21000	0.23000	0.27000	0.32000
Alinma Bk	0.18000	0.27000	0.47000	0.68000
Kuwait Finl Hse	0.20000	0.25000	0.30000	0.35000
Masraf Al Rayan				
Natl Bk of Kuwait				
Saudi Natl Com Bk	0.18000	0.25000	0.40000	0.50000
Noor Isl Bank	0.15000	0.20000	0.40000	0.50000
Qatar Isl Bank	0.22000	0.27000	0.42000	0.52000
Ithmaar Bk				
Sharjah Isl Bk	0.19000	0.23000	0.48000	0.73000
Islamic Dev Bk	0.09000	0.13000	0.17000	0.25000

Appendix B: Modelling Time-varying Correlations between IIBOR and LIBOR

This appendix explains Engle's (2002) DCC approach, which is used to calculate the correlation between the IIBOR and LIBOR (both in US$). To explain Engle's (2002) DCC model, let $y_t = \left[y_{1,t} y_{12,t}\right]'$ be a 2 × 1 vector containing changes in the IIBOR and LIBOR series for different tenors. The conditional distribution of these series/tenors can be modelled using the Engle's DCC approach as follows:

$$y_t = \varepsilon_t \sim N(0, H_t) \; \forall \; t = 1, \ldots, T \qquad \text{(B.1)}$$

$$\varepsilon_t = D_t \eta_t \qquad \text{(B.2)}$$

where, $\varepsilon_t = (\varepsilon_{1t}\ ,\ \varepsilon_{2t})'$, $\eta_t = (\eta_{1t}\ ,\ \eta_{2t})'$and H_t is a conditional variance co-variance matrix, which is explained below. $D_t = diag\left[\sqrt{h_{1,t}}, \sqrt{h_{2,t}}\right]$ is a 2×2 diagonal matrix of time-varying standard deviations from univariate GARCH models and η_t is the standardized shock. The elements in equation (B.2) follow the univariate GARCH (1,1) processes in the following manner:

$$h_{i,t} = c_{0i,t} + c_{1i,t}\varepsilon_{i,t-1}^2 + c_{2i,t}h_{i,t-1} \quad \forall i = 1,2 \tag{B.3}$$

$$H_t = E + (\varepsilon_t \varepsilon_t' | F_{t-1}) = D_t R_t D_t \tag{B.4}$$

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1} \tag{B.5}$$

$$Q_t = (1 - \theta_1 - \theta_2)\bar{Q} + \theta_1 \eta_{t-1}\eta_{t-1}' + \theta_2 Q_{t-1} \tag{B.6}$$

where $h_{i,t}$ is the conditional variance of IIBOR and LIBOR rates $i = 1,2$ (i.e., IIBOR and LIBOR) $Q_t^* = \begin{pmatrix} \sqrt{q_{11}} & 0 \\ 0 & \sqrt{q_{22}} \end{pmatrix}$ is the diagonal component of the square root of the diagonal elements of $Q_t = \begin{pmatrix} q_{11} & q_{12} \\ q_{21} & q_{22} \end{pmatrix}$. The key element of interest in R_t is $\rho_{12,t} = q_{12}/\sqrt{q_{11,t}q_{22,t}}$, which represents the time varying conditional correlation between the two reference rates. The conditional covariance is updated by equation (B.6). The scale parameters θ_1 and θ_2 represent the effects of previous standardized shock and conditional correlation persistence, respectively. Whether time-varying correlation exists between the two benchmarks rates of two financial system (Islamic vs Non-Islamic) is examined through the significance of either of these scale parameters.

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