Sukuk pricing dynamics - factors influencing yield curve of the Malaysian Sukuk

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26 August 2015

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Abstract

The greater financial integration particularly over the past decade has led to more synchronized movements of financial markets across the globe. As the domestic debt capital market, particularly the Malaysian Government Securities (MGS) and Government Investment Issue (GII or Government Sukuk), shariah compliant Malaysian sovereign papers deepen, the movements of the domestic yield curve are expected to be increasingly influenced by movements in foreign bond yields as both domestic and foreign investors respond to global developments and sentiments. Based on standard time series techniques, our findings tend to indicate that GII as well as MGS are weakly endogenous subject to changes in US Treasury which are most probably transmitted through changing their investment preference and expectation of liquidity and risk premium that they are willing to pay by holding local currency bonds and sukuk. This may create shifting in yield curve and significant capital outflows or inflows that may destabilize financial condition that requires policy changes. Finally, the findings also reaffirmed that the sukuk is still priced based on the conventional way of pricing bonds.

Key words: Sukuk, Yield curve; Malaysian Government Securities (MGS), Government Investment Issue (GII); time series techniques

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1.0 Introduction: motivation and objective of the study

The greater financial integration particularly over the past decade has led to more synchronized movements of financial markets across the globe. As the domestic debt capital market, particularly the Malaysian Government Securities (MGS) and Government Investment Issue (GII or Government Sukuk), a shariah compliant Malaysian sovereign papers, deepens, the movements of the domestic yield curve are expected to be increasingly influenced by movements in foreign bond yields as both domestic and foreign investors respond to global developments and sentiments. Such inter-linkages may have resulted in stronger correlations between MGS and Sukuk yields and other sovereign yields. Therefore there is possibility that at any given point in time, the shape of the Sukuk yield curve could be influenced by a change in foreign yields that are responding to shocks that may not have any influence on macroeconomic factors in Malaysia.

Based on the above, we are motivated to study on Sukuk yield, in this particular the GII, whether the movement in the yield curve in advance economy and in this case US Treasury will have certain degree of influence on the domestic Sukuk yield.

This study is important on the premise of the importance of Sukuk for Malaysian financial market as the size of government Sukuk is growing to surpass the size of conventional banks. As at 2014, the Sukuk outstanding represents more than 50% of the total Bond and Sukuk outstanding in the domestic bonds and sukuk market. Bond and Sukuk plays a critical role in the development of the capital market in the country. As the yield curve provides important information on expectations of the economic conditions, it is therefore important to understand the extent of the co-movement between the domestic and foreign yield curves. Given this motivation, this study attempts to assess the importance of foreign yields, i.e. US Treasury in influencing the domestic Sukuk yield curve. The findings of the study, apart enriching the finance literature particularly in the Islamic capital market in the Malaysian context, is expected to contribute significantly to the benefit of investors, portfolio managers as well as regulators to better understand the underlying factors influencing the yield curve which may not only be affected by the movement of the domestic macroeconomic factors such as inflation, interest rates etc. as suggested by other literature in the past. For example, policy makers may have to consider other external factors when drawing up monetary policy as this external factors such as yield movement in other economy may in turn affect the yield spread of the domestic financial market.

2.0 Theoretical framework

The yield curve is a plot of yields on securities of different maturities at a particular point in time. These maturities range from the shortest period of one month, up to ten, or even thirty years. The movement of the yield is based on the expectation hypothesis. Yield expectations can be affected by a variety of factors. Yield curve especially short term yield curve are predominantly driven by the interest rate policy adopted by the central bank. Therefore, the relevant expectations are formed based on expected future trends in macroeconomic variables considered by the central bank (expected future inflation, expected changes in real economic variables) and the measures taken in response (central bank reaction function). For emerging currencies, exchange rate risk may be another important determinant of short-term yields, along with the sovereign default risk, which is factored into the prices of instruments denominated in the given country's currency.

However, besides future yield expectations, the shape of the yield curve may also be affected by a number of other factors, collectively referred to as the term premium. Most empirical research in recent decades has found positive term premia – i.e. market yield curves were above those derived from real yield expectations – and the rate of the premium varied across maturities and in time (Fama-Bliss, 1987)

The term premium may comprise a number of factors; one represents the component linked to the uncertainty of yield expectations as well as from liquidity and structural factors. The uncertainty of yield expectations stems from the uncertainty of factors determining future yields. Accordingly, the term premium is affected by uncertainties relating to future trends in macroeconomic factors (such as inflation and real economic activity), uncertainties relating to the monetary policy reaction function and uncertainties relating to exchange rate and sovereign default risks. For example, Backus and Wright (2007) argue that the flattening of the yield curve between 2004 and 2006 stemmed, for the most part, from an increasing predictability of the macroeconomic environment and monetary policy, through a decline in the term premium. The other factors that determine the term premium may also link to liquidity risk. Investors require liquidity premia on their long-term investments (liquidity preference theory), because they may happen to need cash during the maturity period and quickly selling their longer-term investments is bound to entail certain expenses. This may be the case when, as a consequence of a systemic shock, many investors find themselves in need of cash at the same time. For instance, the funding liquidity shortage witnessed during the 2007–2008 financial crisis caused such a systemic supply shock with regard to bonds of longer maturities in emerging markets (Horvath, Kalman, 2014).

The term premium may also be affected by structural factors of supply and demand. If arbitrage is not or is only partly functioning across different maturities (for example because market participants have a preferred investment horizon from which they only depart under a strong price stimulus – preferred habitat theory), market supply and demand in the longer maturity segments may deflect yields from the expectations.

Some theoretical framework of Sukuk Pricing

Some practitioners as well as some Islamic scholars assume that theories and models that have been developed over 60 years for conventional bonds are also applicable to value Sukuk securities with no necessary modifications to accommodate the significant design differences as dictated by Shariah requirements for the Sukuk securities. Thus many simply describe Sukuk and bond certificates as being equivalent to conventional bond certificates (Safar, Arif, Mohamad, 2013).
Conventional theory suggests that Sukuk are priced as per the bond valuation theory (Williams 1938). This theory suggests the theoretical value to bondholder of a conventional bond is the present value of the stream of payments – the interest coupons and the redemption value as face value - discounted by the market interest rate.

The market analysts apply the conventional bond valuation theory to price Sukuk. Therefore, it is expected that Sukuk pricing will also be reflected with factors affecting the bonds yield.

3.0 **Literature review**

Typically, the yield curve depicts a line that rises from lower interest rates on short term bonds to higher interest rate on longer term bonds. Empirical studies reveal that more than 99% of the movements of various Treasury bond yields are captured by three factors, which are often called "level, ""slope," and "curvature" (Litterman and Scheinkman 1991) referring to the shift of yield curve or change in shape in response to a shock such as changes in the interest rates. The level component refers to the effect of the shock on long-term yields and such an effect is normally reflected in parallel shifts in yields of all maturities. A shift in the level component reflects structural influences such as a change in the market perceptions on a country's long-term inflation outlook, or a change in the assessment of credit worthiness of a country. The slope component reflects the effect of the shocks to short-term yields that will result in a change in the degree of steepness of the yield curve. The key factor that often alters the slope of the yield curve is a change in market expectations about domestic monetary policy decisions. As central banks generally target a very short-term interest rate, a shift in the market's expectations towards a lower future policy rate for example, will cause the yield curve to flatten, reflecting lower short-term interest rates in the future. The curvature component refers to the effect of the shock on medium-term yields compared to other maturities, which would cause the yield curve to become more 'hump-shaped'.

The shapes of the yield curve provide an indication of market expectations of the future interest rates. A yield curve can be divided into a few form. Under normal circumstances, a yield curve is supposed to be upward sloping as longer-maturity bonds would carry higher yields due to an increase in risk associated inflation and interest rate and other factors over the longer horizon time period. Nonetheless, there are situation whereby the market experiencing a steepening yield curve, in which short term rate increasing faster than long term rates. This normally reflects the market expectations of higher short-term rates in the future underpinned by anticipation of a higher policy rate i.e. overnight policy rate following expectations of rising inflation. The other form is a flattening yield curve. Under this circumstances, the long term rates coming down faster than the short terms and this

normally indicates the long term inflation outlook is stabilized with expected stable economic growth over long term horizon.

The yield curve should also shift in a parallel manner whereby both short-term and long-term yields move in tandem. In the case of sovereign yields this may happen due to the changes in the perceived risk premium that the investor willing to pay for holding the bonds of the sukuk of a particular sovereign issuances. The risk premium for government bonds refers to the added compensation needed for investors to hold domestic bonds given the overall risk profile of a country, including its default risk, credit risk and liquidity risk. A country with weak fiscal discipline and rising credit risk, for instance, would have to offer a higher yield to draw investors into holding its bonds. For instance, a foreign investors may invest in Malaysian sovereign sukuk and bonds if the return from the investment is attractive enough as compared to other sovereign bonds such as US Treasury after taking into consideration all the risk associated with the cross border investment such as sovereign credit outlook, exchange rate risks, yield spreads, etc.

Movement of yield curve has been the subject of much research in the finance literature, because it is the natural starting point for pricing fixed-income securities and other financial assets (Wu, 2003). Wu 2003, has summarized that most literature generally agrees on the effects of macroeconomic variables, especially those of monetary policy such as inflation and interest rate, on the slope of the yield curve. For instance, a monetary policy tightening generates high nominal short-term interest rates initially, but, because of its anti-inflationary effects, these rates quickly fall back; since long-term rates embed expectations of this behavior of short-term rates, they rise by only a small amount. As a result, the slope of the yield curve declines when contractionary monetary policy shocks occur.

Ang and Piazzesi (2001) examine the influences of inflation and real economic activity on the yield curve in an asset-pricing framework. In their model, bond yields are determined not only by the three unobservable factors—level, slope, and curvature— but also by an inflation measure and a real activity measure. They find that incorporating inflation and real activity into the model is useful in forecasting the yield curve's movement. However, such effects are quite limited. Inflation and real activity and medium-term bond yields (up to a maturity of one year), but most movements of long-term bond yields are still accounted for by the unobservable factors. Therefore, they conclude that macroeconomic variables cannot substantially shift the level of the yield curve. Nonetheless, it is interesting to note that Evan and Marshall (2001) findings was not in line with Ang Piazessi whereby they found that that macroeconomic factors account for most of the movement in nominal Treasury yields of maturities ranging from one month through five years with the inflation effect playing the dominant role.

The vast majority of the literature studies a single country's yield curve in isolation and relates domestic yields to domestic yield factors, and more recently, to domestic macroeconomic factors (e.g., Ang and Piazzesi, 2003; Diebold, Rudebusch and Aruoba, 2006).

Little is known, however, about whether common global yield factors are operative, and more generally, about the nature of dynamic cross-country bond yield interactions. One might naturally conjecture the existence and enhanced importance of global yield factors in recent decades, due to

enhanced global bond market integration. Conversely, understanding global bond yield factors (if any) are surely crucial for understanding global bond market integration. Either way, the existence and nature of global bond yield factors are of great interest as to find answers to various questions as a result of improved and more advanced financial integration across various economies from developed economies to emerging economies. Numerous questions arise including but not limited to what are the implications for cross-country yield curve interactions? How much of country yield factor variation is explained by global factors, and how much by country-specific factors, and does the split vary across countries in an interpretable way?

One of the recent studies in this area of financial integration in Malaysia context was by Bank Negara Malaysia. It has published in its Annual Report for 2012, the study done to determine the responsiveness of the MGS to movement of the Sovereign Bonds Yield abroad. The results from the variance decomposition approach show the significant co-movements between foreign government bond yields and the MGS yields. In terms of the long-term yields, it appears that both regional and advanced markets collectively contribute by about 80% of the total variations in the long-term MGS yields with the advanced markets alone accounting for about 45% of the total variations. For the short-term MGS yields, the regional and advanced markets together contribute over two-third to the total variations in MGS yields. These results generally conform to empirical findings for financially open capital markets in which variations in yield curves globally could account for the majority of the variations in the slope and level factors (Diebold, Lie and Yue (2008). In particular, the strong co-movement of yields reflects the importance of the advanced markets in influencing global asset prices (including sovereign yields). This is supported by the IMF Spillover Report for the US, which highlights that the US market represents close to two-thirds of the total equity and government bond market turnover of the five large and systemically-important economies. Such a global dominance of the US financial markets has often contributed to large spillover effects of asset prices in the US on other markets.

4.0 **Development of sukuk market**

This recent decade has witnessed the accelerated development of the global sukuk market. The global sukuk market which has now reached USD$270 billion outstanding is evolving to become a distinct platform for fostering greater international economic and financial linkages. The success of the sukuk market reflects its ability to meet the changing and differentiated demands of the modern economy, to develop innovative and cutting edge structures and products, and to achieve such issuances at competitive pricing.

The sukuk market has drawn increasing interest from sovereigns, multilateral institutions, multinational and national corporations both from developed and emerging economies to finance investments in a wide range of economic activities and development projects. The advantage of sukuk is that they are compliant with shariah Islamic law (Wilson, 2004). Sukuk are therefore attractive investment instruments for Islamic banks, takaful Islamic insurance companies and shariah managed funds that cannot invest in conventional securities that involve payment of riba or interest. In addition

there are an increasing number of Muslims of high net worth who want their asset holdings to comply with Islamic law.

The geographical reach of the sukuk market has also become more extensive, with the global sukuk outstanding now being domiciled in more than 20 countries, while the investor base that spans from Asia, the Middle East and Europe. In addition to issuances in international reserve currencies that includes the US Dollar, the British Pound and Euro, more recently in Malaysia has been the issuance of sukuk in Renminbi. In June 2014, the UK became the first western country to issue a sovereign sukuk while Senegal priced its maiden sovereign sukuk in July. According to media report, other sovereigns including Luxembourg, Oman, South Africa and Tunisia are also expected to make debut issuances. In the Sukuk market spaces, In 2013 Malaysia continues to dominate the global sukuk market with 69% share of total. Malaysian Ringgit-denominated sukuk represented 67% of total sukuk issuances in 2013, totalling USD80.38 billion, followed by US Dollars with a 15% share worth USD17.98 billion.

For the investors, the sukuk offers the diversification into multiple asset classes and different techniques used to structure medium to long term instruments. Given that the sukuk is based on underlying assets, it discourages over-exposure of the financing beyond the value of the underlying assets. Issuers are thus discouraged from leveraging in excess of the asset value. The prospect of over-indebtedness and its consequences on financial stability are thus reduced. There is also potential for direct participation of investors in the project, thereby granting investors beneficial ownership in the underlying assets, with the rights to receive a share of profits or rental income from the underlying asset of the sukuk while taking the associated risk of such ownership.

The sovereign sukuk is generally the first inroad into Shariah compliant funding in the capital market, enabling the creation of reference prices over time, to which private sector entities can benchmark their fund raising activities. Governments have for the most part, remained the most active issuers in the history of the global sukuk market with sovereign issuances accounting for more than 80 percent of the global sukuk issuances. This recent few years has also seen a number of jurisdictions in developed economies strengthening their legal, regulatory and governance framework to facilitate such sukuk issuances.

Back to Malaysian front, the Islamic capital market in Malaysia has been systematically developed to ensure accessibility whilst ensuring the protection of investors and efficiency in the intermediation process. The initiatives to develop the market are also strongly backed by the legal and Shariah framework which is further supported by a robust financial infrastructure, including the settlement and bond information system that enables Malaysia to provide a complete sukuk issuance and trading platform.

Malaysian first sukuk was issued in 1990. Since then the sukuk outstanding in the Malaysian marketplace is now US$158 billion. In 2002, the Malaysian government issued its inaugural global sovereign sukuk, raising US$600 million, which became an international benchmark for the issuance of global sovereign sukuk. The marketplace has now been liberalised to allow for multilateral financial institutions, multinational and national corporations from other jurisdictions to issue both

ringgit and non-ringgit denominated sukuk in our sukuk market with increasing foreign investor participation in such issuances. Regular sukuk issuances with different maturities by the Malaysian government has also created a benchmark yield curve for market reference, of which is complimented by the establishment of a number of indices for non-ringgit and ringgit denominated sukuk that serve as benchmarks to track the performance of sukuk. These initiatives have progressively contributed towards creating a vibrant secondary sukuk market in Malaysia, with increased depth and liquidity.

The Malaysian bond market, at RM1 trillion, is the third-largest in Asia relative to the size of the economy. The depth of the market provided absorptive capacity for portfolios to be rebalanced across maturities in an orderly manner. Over time there have been increasing issuances of longer duration bonds which is consistent with global expectations and the growing importance of the capital market in providing long-term financing.

5.0 **Empirical model and data collection**

The empirical model applies the time series techniques following strictly steps by steps to achieve the objective in determining the movement of Sukuk yield curve. We use the following variables for our lead-lag analysis. The data collected is for the period from July 2008 to January 2015 to for selected variables as follows:-

Variables	Description	Data Source
US Treasury (UST)	Month end closing YTM for 10 year UST	Bloomberg
Malaysia Government Bond (MGS)	Month end closing YTM for 10 year MGS	Bond Pricing Agency (BPAM)
Government Investment Issue (GII)	Month end closing YTM for 10 year GII	BPAM
Exchange rate US/MYR		Bloomberg

The methodology starts with unit root test of each variables based on Augmented Dickey Fuller or ADF test and Phillips Perron Test. The test is to ensure that the data are fit to follow the required steps for the chosen model. The objective of the unit root test is to affirm that the variables are non-stationary in the level form and stationary in difference form. Number of lag order will be identified using VAR before proceeding to co-integration test.

Causality and movement of each variable or Co-integration test of the variable are based on the Johansen Juselius (JJ) ML Cointegration Test (Johansen Test). Once the null hypothesis that the variable are not co-integrated are rejected or the number of co-integration has been identified; this cointegrating estimated vectors will then be subjected to exactly identifying and over-identifying restriction based on theory. The test of cointegration is designed to examine the long-run theoretical or equilibrium relationship and to rule out spurious relationship among variables. Long Run Structuring Model has been applied to test the long run relationship between variables by testing the coefficient to be significant or not in the model followed by Vector Error Correction Model (VECM) and VDC to differentiate between exogenous and endogenous and their relative strength of the

variables. Finally, the impulse response function and persistence profiles will be applied. Both are respectively designed to map out the dynamic response path of a variable due to shock on another variable and give the information about how long it will take for system to get back to equilibrium by using a system-wide shock.

6.0 **Discussions of results**

6.1 Unit Root Test

Table 1 shows the results of Augmented Dickey Fuller (ADF) test for unit roots of the variables and first differences of the natural log values. The results indicate that the null hypothesis of the presence of the non-stationery data cannot be rejected. However, at first difference the null hypothesis can be rejected in all cases with the t-statistics statistically significance at 5% level. This indicates that at first difference all series are stationery. Therefore the series can be said to be integrated of order 1,I (1). We also applied Phillips Perron (PP unit root test) as alternative way and to firm up the result of stationery test of the variables. The results of PP's test at level are found to be almost consistent with ADF test and this has reaffirmed the findings of the series of variables are integrated of order 1, I (1) which enable us to proceed with the necessary steps required for the empirical study.

Table (1) : Unit Root Test for the selected variables

Augmented Dickey Fuller (ADF) test for unit roots

A) Level Form (variable is in natural log values as given in "L")

Variable	Test Statistic	CV	AIC	Result
LGII	-3.1961	-3.3918	111.1217	Non-stationery
LUST	-2.4389	-3.3918	59.0490	Non-stationery
LMGS	-3.0951	-3.4345	118.6826	Non-stationery
LUMYR	-.72640	-3.4345	178.9807	Non-stationery

B) Difference Form (variable as given by "D" is a Difference of natural log value ie t - ti)

Variable	Test Statistic	CV	AIC	Result
DGII	-7.5885	-2.8218	110.4736	Stationery
DUST	-4.4415	-2.7764	60.5723	Stationery
DMGS	-7.7832	-2.8218	116.6985	Stationery
DULMYR	-6.7109	-2.8218	174.9583	Stationery

Phillips-Perron Unit Root Test

A) Level form

Variable	Test Statistic	CV	Result
LGII	-3.0913	-3.4331	Non-stationery
LUST	-2.2625	-3.4331	Non-stationery
LMGS	-2.9335	-3.4331	Non-stationery
LMYR	-.98667	-3.4331	Non-stationery

B) Difference form

Variable	Test Statistic	CV	Result
DGII	-10.8608	-2.8718	Stationery

DUST	-7.6232	-2.8718	Stationery
DMGS	-11.1014	-2.8718	Stationery
DUMYR	-8.9964	-2.8718	Stationery

6.2 Optimal Lag Order Selection

Below is the result of the optimal lag order selection. VAR order of 2 is selected based on the highest AIC. Please note that highest SBC pointed out to the order of 0, which are contradicting to AIC result and this may be due auto correlation problem in the variables as shown in the Table 2 which is evidenced in Table 3 below.

Table 2 : VAR order selection test

Order	AIC	SBC
6	557.2181	442.0148
5	552.5642	455.7935
4	556.3062	477.9680
3	564.0629	504.1572
2	570.4338	528.9606
1	568.4264	545.3858
0	562.4850	557.8768

Table 3 : Serial correlation test

Variable	P-Value	Result
DGII	0.14	No serial correlation problem
DUST	0.03	serial correlation problem
DMGS	0.002	Serial correlation problem
DUMYR	0.446	No serial correlation problem

6.3 Co- Integration Analysis (Johansen Juselius Cointegration Test)

Tables (4) show the trace statistics and maximum eigenvalue statistics from the Johansen and Juselius (1990) (JJ) for the variables.

Similarly Eigenvalue statistics result (Table 5) reject the null hypothesis of no co-integrating equation. As shown in Table below, the null hypothesis of no cointegration (r = 0) is rejected by the Trace statistics and Maximum Eigenvalue statistics at 5% significant level. Both tests indicate the presence of a single co-integrating vector in the model, confirming the existence of a long-run stable linear equilibrium relationship among the variables. Below is the Johansen ML results for multiple conintegrating vectors – GII, UST Treasury, MGS and exchange rate USD/MYR

Table 4 : Maximal Eigenvalue Result

Maximal Eigenvalue				
Null	Alternative	Statistics	95% Critical Value	90% Critical Value
r = 0	r = 1	41.5272	31.7900	29.1300
r<=1	r = 2	17.0659	25.4200	23.1000
r<=2	r = 3	6.5957	19.2200	17.1800
r<=3	r = 4	1.7064	12.3900	10.5500

Table 5 : Trace Statistic Result

Trace Statistics				
Null	Alternative	Statistics	95% Critical Value	90% Critical Value
r = 0	r >= 1	66.8952	63.0000	59.1600
r<=1	r >= 2	25.3680	42.3400	39.3400
r<=2	r >= 3	8.3021	25.7700	23.0800
r<=3	r >= 4	1.7064	12.3900	10.5500

The presence of the co-integration implies that the relationships among the selected variables are not spurious or in other words, there is theoretical relationships among the variables and that they are in equilibrium. The findings of the presence of the co-integration is importance for this study which are useful to provide information to investors or regulators as each variables in this study contains information for the prediction of the variables. For example, investor may use this information for portfolio diversification by holding optimal investment in US Treasury, MGS or GII while managing investment risks efficiently. As for policy, the result that shows there are co-integration among variables provides information that in making any decision making especially on monetary policy, inflation targeting, exchange rate stabilization policies etc other external factors such as US Treasury movement must be taken into consideration as it may have impact on the domestic level of interest rate. It should be noted that risk free rate is the key benchmark for pricing other interest or profit bearing instruments in the market.

As the co-integration test is not able to tell us the direction of Granger-causation as to which variable is leading (exogenous) and which variable is lagging (endogenous), we have applied a Long Run Structuring Model (LRSM) as further explained in the following Section.

6.4 Long Run Structural Model.

LRMS endeavours to estimate theoretically meaningful long run (or co-integrating) relation by imposing on those long-run relations (and then testing) both exactly identifying and over identifying restrictions based on theories and information relevant for the studies.
Upon determination of the number of the cointegration using JJ model as discussed earlier, Long Run Structural Modelling (LRSM) have been carried with the objective to determine whether they are statistically significant or not by imposing on those long-run relations exact-identifying and over-identifying restrictions based on theories. Based on the one co-integration that was found using JJ co-integration test as explained above, LR test of imposing general restriction (ie exact-identifying restriction) on the co-integration vectors has been carried out followed by the over identifying restriction. Steps by step of the LR test and the results are given as below:-

a) For exact identification, LGII is treated as dependent variable being the focus of the study to determine its responsiveness on the changes on the UST and other factors. The result of the exact identification is given in Panel A as the table below.

Table 6 : Exact and Over-identifying restrictions on the cointegrating vector

Variables/Panel	Panel A A1=1 (Exact-identifying)	PANEL B A1=1; A4=0 (Over-identifying)
LGII	1.0000 (None)	1.0000 (None)
LUST	-0.48067* (0.18664)	-0.48212* (0.01938)
LMGS	-0.86007* (0.057719)	-0.84844* (0.058615)
LUMYR	0.038231** (0.040365)	-0.0000 (None)
TREND	0.3609E-3 (0.1323E-3)	0.3260E-3 (0.1312E-3)
LR Test Restriction Result		CHSQ (1) = 0.88102 P-Value(0.348)

* significant at 95% confidence level
** not significant

b) Based on the result from exact identification, over-identifying restriction has been added to the LR test for those vectors whose the coefficients are not significant, in this case LUMYR (please see Panel A above). Given that the P-Value is more than 5% the null that restriction is correct and cannot be rejected. Therefore the long run equation given in Panel B can be accepted. What make us wonders in this long run equation is that the negative coefficient of US Treasury and MGS against dependent variable ie GII. Intuitively, this could be due to reduction in the risk premia as a result of

better liquidity and demand supply dynamic (demand is more than supply) of GII resulting in yield compression over long term term horizon.

6.5 Vector Error Correction Model

The objective of the ECM model is to determine the exogeneity or endogeneity of the corresponding dependent variable. The error correction term stands for the long term relations among the variable in which at least one of the error correction terms should be significant for the validity of the co-integrating relationship among the variables in the long term. If the error correction term in any equation is insignificant or P-Value greater than 5, that implies that the corresponding dependent variable of that equation is 'exogenous' (ie it does not depend on the deviations of other variables). It also implies that it is a leading variable and initially receives the exogenous shocks resulting in deviations from equilibrium and transmits the shocks to other variables). But if that coefficient is significant, that implies that the corresponding dependent variable is 'endogenous' (ie it does depend on the deviations of other variables. It also implies that the dependent variable bears the brunt of short-run adjustment to bring about the long term equilibrium among the cointegrating variables)

The result of the ECM for this study clearly shows that only UST is exogenous or leader and the rest of variable are endogenous as given by the P-Value.

The result are tabulated the table below.

Table 7 : Error Correction Model – GII, UST, MGS and MYR

Dependent Variable	DLGII T-Ratio [P-Value]	DLUST T-Ratio [P-Value]	DLMGS T-Ratio [P-Value]	DLUMYR T-Ratio [P-Value]
DLGII1	1.7691[0.81]	0.54785(0.988)	1.6111(0.111)	2.5290[0.14]
DLUST1	3.8317[0.000]*	0.67224(0.504)	3.7086 (0.000)*	0.2940[0.769]
DLMGS1	-1.8604[0.67]	-0.54255(0.589)	-1.8678(0.066)	-2.5495[0.13]
DLMYR1	-0.25469[0.80]	-1.8462 (0.69)	-0.36663(0.715)	-0.78399[0.436]
Serial correlation	4.2643[0.978]	12.6338[0.396]	7.1194[0.850]	13.4554[0.337]
Functional Form	16.5242[0.000]	1.0328[0.310]	16.6336[0.000]	2.6116[0.106]
Normality	14.0091[0.001]	0.50265[0.778]	34.0694[0.000]	2.4622[0.292]
Heteroscedasticity	27.2826[0.000]	3.5056[0.61]	27.9872[0.000]	0.063583[0.801]
ECM(-1)	-4.5470 [0.000]	-0.081205 [0.936]	-3.0397 [0.003]	-2.9898 [0.004]
P Values	< 5%	>5%	<5%	<5%
Intepretation	Endogenous	Exogenous	Endogenous	Endogenous

* significant at 99% level.

Note : The data above do not have problem with serial correlation. However DLGII and DLMGS may have problems with functional form, normality and heteroscedasticity and may not be well specified.

The above table shows that US Treasury is expected to Granger cause the movement in GII and MGS. The positive sign is in line with the theory expectation in which if the US Treasury yield increases investors are expected to react and to rebalance their position by selling their holding in GII and MGS to shift their investment back to US Dollar which is giving higher yield as to adjust to their risk premium back to the acceptable level. The decision by the investors may also be driven by the expectation that Bank Negara Malaysia may also revisit its monetary policy adjusting to the necessary structural changes in global market. The increase in US Treasury will result its yield to be more attractive for investment holding.

Most important thing to note is that the different result of coefficient of MGS and US Treasury under long run equation which are negative but under short run it is positive. This could be explained by the immediate reaction of investors in the movement in US Treasury to reposition its portfolio and the movement could be stabilize and goes back to equilibrium on long term basis.

Notwithstanding the above, the study is more focus in looking at the exogeneity and endogeneity of the variables and the policy implication. Although ECM is able to indicate exogeneity or endogeneity of the variables, it are unable to distinguish the relative degree of endogeneity or exogeneity of variables.

6.6 Variance Decompositions (VDCs)

It is important to note that VECM as discussed above are not able to specify the relative degree of exogeneity or endogeneity among the variable. Therefore variance decomposition test is required. The VDC decomposes (or partitions) the variance of the forecast error of a particular variable into proportions attributable to shocks (or innovations) in each variable in the system including its own. The variables which are mostly explained by their own past shocks are considered to be the most leading variable of all and the least explained by its own past shocks is the weakest lagging variable. Variance decompositions (VDCs) are made up of orthogonalized VDC and generalized VDC. For this study we are preferred to use generalized VDC as orthogonalised although the sum of value is equal to 100%, the result are always bias towards first variable in the equation.

The relative exogeneity or endogeneity of a variable can be determined by the proportion of the variance explained by its own past. The variable that is explained mostly by its own shocks (and not by others) is deemed to be the most exogenous of all. In our table, at the end of the forecast horizon number 6 for instance, the contributions of own shocks towards explaining the forecast error variance of each variable are as follows (6 months horizon): GII variable (32%), US Treasury variable (52%) and MGS (41%). This result shows that US treasury is the exogenous than can explain 30% and 26% respectively of the variance in the GII and MGS respectively.

We wish to highlight that the exogenous variable is ranked second after Endogenous variable as identified at the VECM level test. This is not in line with the expectation as the result should be consistent with the result of VECM in which Exogenous should be ranked above the Endogenous variable. This requires further investigations.

Table 8 : Generalised forecast error variance decomposition

HORIZON (MONTHS)	VARIABLES	LGII	LUST	LMGS	LUMYR	TOTAL
6	LGII	64%	60%	74%	3%	201%
6	LUST	31%	97%	25%	33%	186%
6	LMGS	62%	51%	79%	2%	195%
6	LUMYR	4%	2%	3%	85%	94%

HORIZON (MONTHS)	VARIABLES	LGII	LUST	LMGS	LUMYR	TOTAL
18	LGII	60%	60%	74%	3%	197%
18	LUST	31%	97%	25%	35%	188%
18	LMGS	60%	52%	78%	3%	192%
18	LUMYR	5%	3%	3%	81%	93%

HORIZON (MONTHS)	VARIABLES	LGII	LUST	LMGS	LUMYR	TOTAL
36	LGII	59%	60%	74%	29%	222%
36	LUST	31%	97%	25%	35%	188%
36	LMGS	59%	52%	78%	3%	191%
36	LUMYR	6%	4%	4%	80%	93%

HORIZON (MONTHS)	VARIABLES	LGII	LUST	LMGS	LUMYR	TOTAL
60	LGII	58%	60%	74%	29%	222%
60	LUST	31%	97%	25%	4%	156%
60	LMGS	58%	52%	78%	3%	190%
60	LUMYR	6%	4%	4%	80%	93%

Table 9 : Ranking of Exogenous and Endogenous Variables

HORIZON	VARIABLES	LGII	LUST	LMGS	LUMYR	TOTAL	Rank
6	LGII	32%	30%	37%	1%	100%	4
6	LUST	17%	52%	13%	18%	100%	2
6	LMGS	32%	26%	41%	1%	100%	3
6	LUMYR	4%	2%	3%	90%	100%	1

HORIZON	VARIABLES	LGII	LUST	LMGS	LUMYR	TOTAL	Rank
18	LGII	30%	31%	38%	1%	100%	4
18	LUST	17%	52%	13%	19%	100%	2
18	LMGS	31%	27%	41%	1%	100%	3
18	LUMYR	6%	4%	4%	87%	100%	1

HORIZON	VARIABLES	LGII	LUST	LMGS	LUMYR	TOTAL	Rank
36	LGII	27%	27%	33%	13%	100%	4
36	LUST	17%	51%	13%	19%	100%	2
36	LMGS	31%	27%	41%	1%	100%	3
36	LUMYR	6%	4%	4%	86%	100%	1

HORIZON	VARIABLES	LGII	LUST	LMGS	LUMYR	TOTAL	Rank
36	LGII	26%	27%	33%	13%	100%	4
36	LUST	20%	62%	16%	2%	100%	2
36	LMGS	31%	27%	41%	1%	100%	3
36	LUMYR	6%	4%	4%	86%	100%	1

6.7 IMPULSE RESPONSE FUNCTIONS

IRF holds the exact same formation as VDC, except that VDC is presented in the form of figures tabulation, while the result of IRF is given in the form of graphs to explain the impact to other variable from the shocks of a variable. The graph below shows the impact on other variables and how long to get back to equilibrium when each of variables is shocked.

Figure 1

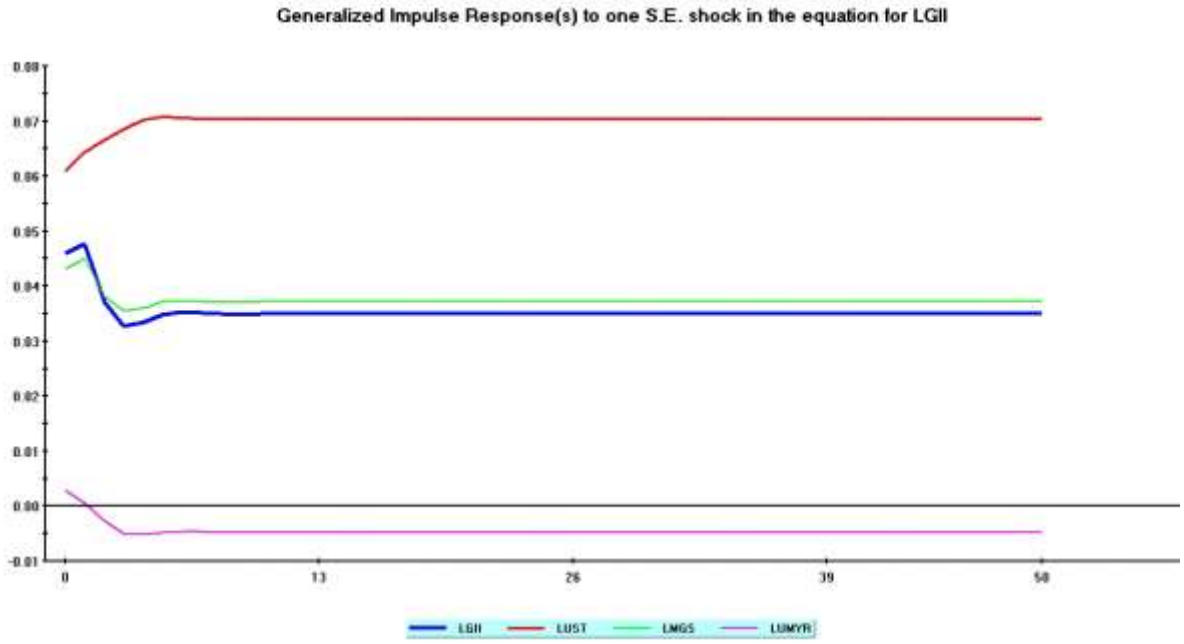


Figure 2

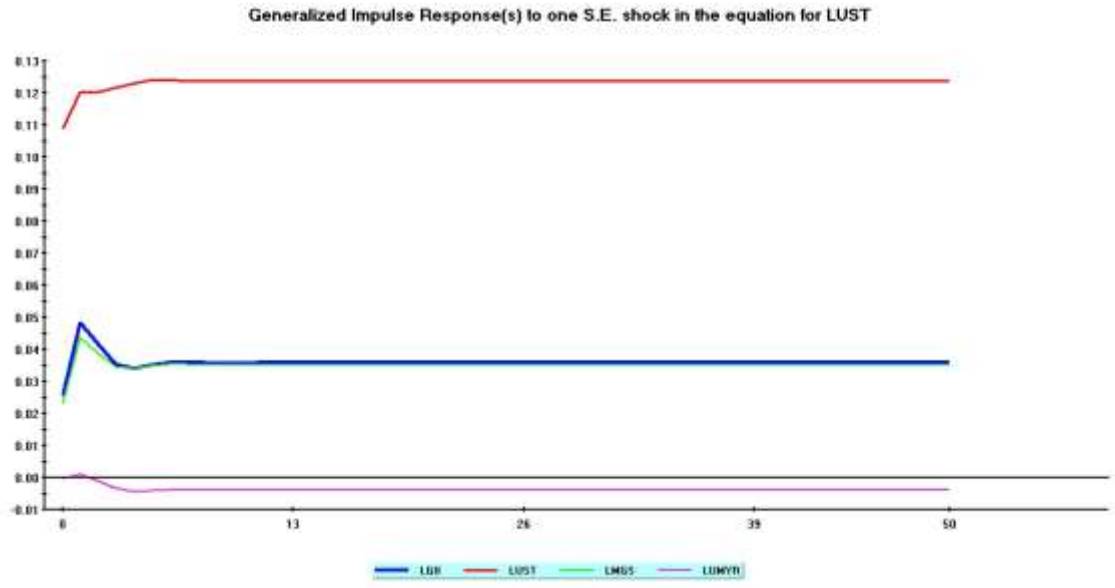


Figure 3

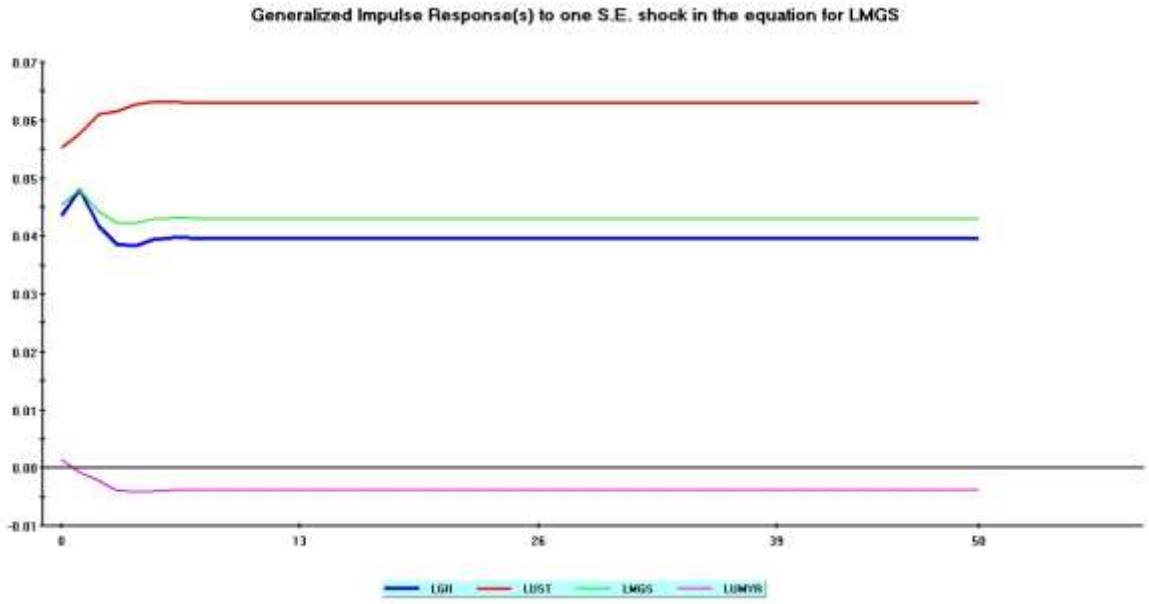
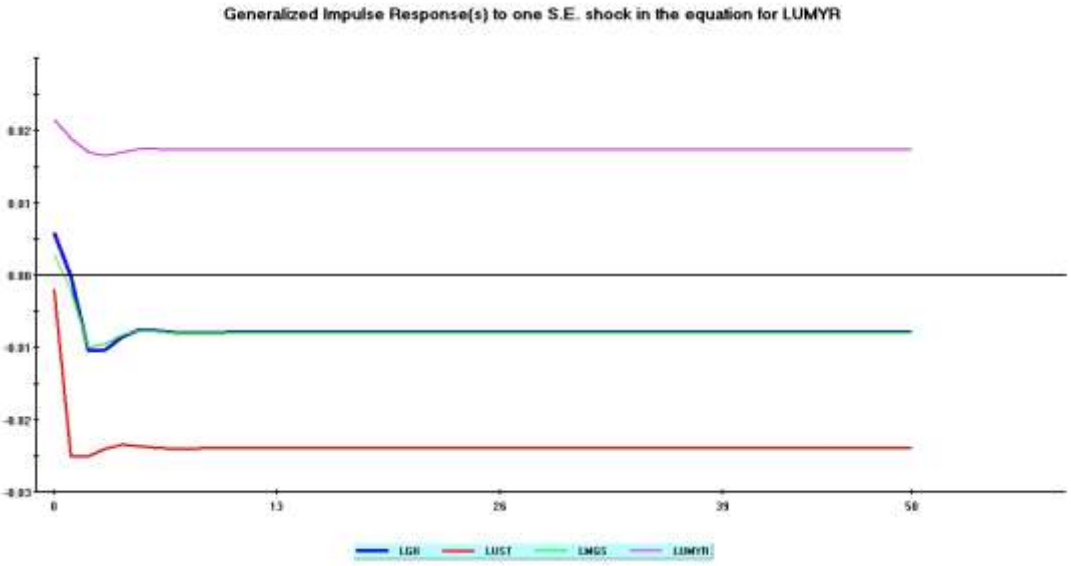


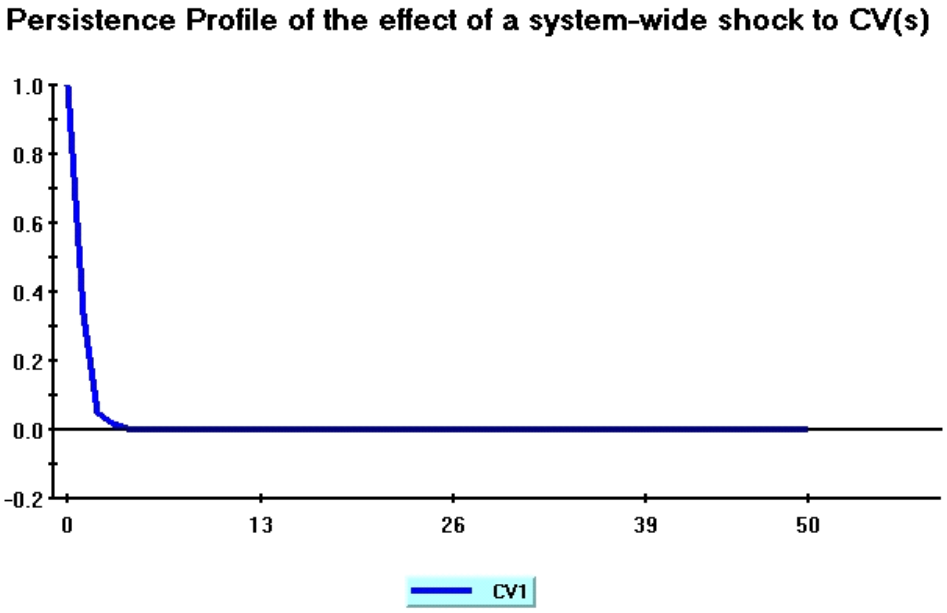
Figure 4



6.8 Persistence profile (PP)

The persistence profile will indicate the time horizon required for all variables to get back to equilibrium when a system-wide shock occurs. The main difference between the persistence profiles and IRFs is that the persistence profiles trace out the effects of a system-wide shock on the long-run

relations. On the other hand, the IRFs trace out the effects of a variable-specific shock on the long run relations. In the persistence profiles, we shock our whole equation whereby this shock comes from external factor outside our equation or our system. Then, we see how many periods it takes for all variables to get back to the equilibrium.
When we give the external shock to our equation, the result shows that all variables will deviate from the equilibrium, meaning that each of variables will move differently in the short run. They are temporarily not cointegrated. However, according to Figure 5 all variables in the cointegrating equation will require 4-6 months for them to cointegrate again and return to the long-run equilibrium



7.0 **Conclusions and policy implications**

The general objective of the research is to analyse the trend and behavior and influencing factors of the Sukuk pricing dynamics in the Malaysia Sukuk, by looking at the movement internal and external factors and other macroeconomic factors in this case MGS, US Treasury and the exchange rate between US Dollar and Ringgit Malaysia.

This paper utilizes time series techniques of cointegration, causality, VECM, VDC, and IRF to evaluate the pricing dynamic of Sukuk yield using GII and its relationship with other variables externally and internally particulary the movement in US Treasury. The findings from cointegration test suggested that there is a common path that ties these variables together in the long run.
The VECM test indicates that US Treasury is the only exogenous variables while the rest of variables are endogenous. This means any shocks in US Treasury will result in the movement in other endogenous variables under this study. The exogenous of US Treasury in the context cross border investment can be explained by looking at the degree of foreign holding in MGS. We strongly believe that the investors are sensitive to any movement of US Treasury, which will transmit such movement

into MGS and GII by changing their investment preference and expectation of liquidity and risk premium that they are willing to pay by holding local currency bonds and sukuk. The findings also indicate that Sukuk (being endogenous under this study) is still being priced according to the conventional bonds and contradict with the findings of Safari, Ariff and Shamsher (2013) in which Sukuk is priced differently implying that it should be classified as different asset class all together.

There are some policy implications from the results of the study which are outlined below:-

i) Regulator

The close monitoring of US Treasury being the exogenous variable is utmost importance as it will provide indication the appropriate policy to be implemented to address the influx of short term capital going and out to Malaysia as a result in the shock in the US treasury. For example, the shock in US rate or increase uncertainty in the advance market such as US would cause domestic and foreign investors to liquidate their assets in Malaysia in favour of more liquid assets in other market especially in the US market. Some measures such as changes in monetary policy to stabilize the capital flows may have to be implemented to address this issues.

ii) Investors and issuers

The component of corporate Sukuk yield pricing consist the risk free rate plus some spread. The investors should not only rely on the internal macroeconomic factors only to predict the likelihood movement and expected changes in yield to support their decision in the bond/sukuk portfolio management but also must look into US treasury expected yield movement. Two information signals from the significant movement of US Treasury may lead to monetary changes or increasing/decreasing risk premium to be reflected in the type and slope of the yield curve.

Other key finding comes to our intention that worth to highlight is the coefficient of LUST and LMGS which are negative against LGII in the long run (please refer to Table 6). This indicates negative relationship with GII even though in theory it may suggest that there should be positive long run relationships on the following reasons:-

In theory, the pricing of GII has always been benchmark against MGS as per the usual market practice especially in the primary market.

Any movement in US Treasury may cause MGS to move in the same direction. For instance, if the US Treasury increases, foreign investors may sell MGS and/or Sukuk in order to shift the investment back to US Treasury from Ringgit bonds resulting the MGS/Sukuk yield to increase. In other words other shock movement in the US Treasury market is transmitted to MGS yield through risk premium adjustments.

Notwithstanding the above, while the result is considered a mind-boggling as it contradicts with market understanding and theories as explained above, such a long run negative relationship may be intuitively explained by the supply and demand dynamics. The Sukuk is not only demanded by the Islamic financial institutions and funds but also by the non-Islamic institutions resulting in scarcity in demand. This has resulted in the yield compression as the demand may be higher than supply.

Finally, given these findings are solely focused on US Treasury representing the advanced market, a further and extended research of the impact on yield movement of other markets such as, European

market, Gulf Cooperation Countries and Asian market is believed to be of interest to many researchers as well as industry practitioners and regulators.

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