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The Relationship between Bond and Composite Index in Malaysia

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Abstract

The purpose of this research is to investigate the correlation between bond yields and the composite index from 2007 to 2019. The Multivariate-GARCH Dynamic Conditional Correlation (DCC) model and wavelet coherence are applied to the daily data indices of five bond markets, namely conventional bond, corporate bond, corporate sukuk, government bond, and government sukuk, as well as the daily index of the composite market, which is represented by FTSE Bursa Malaysia KLCI. The empirical evidence of MGARCH-DCC reveals that the Malaysian sukuk denoted negative and unconditional relationships with the composite market indices as a positive indicator of diversification advantages. From the wavelet analysis, the bond also indicated weak links for most frequency scales, recommending favourable diversification for fixed-income Malaysian investors through bonds investments.

Keywords: Bond, Stock, Multivariate-GARCH, Wavelet, Investment

Introduction

The capital market in the emerging market, particularly in Malaysia, has high global and international growth since the development of financial assets. Usually, retails and institutional investors will invest in various financial assets, namely equities, bonds, and real estate investment, to generate capital to accumulate wealth (Che & Liebenberg, 2017). There has been remarkable research development on diversification and performance, and risk and diversification during the last decade.

Over the last five years, the allocation from international investment in equity portfolio and investment fund shares showed a gradual increase except in the first quarter of 2016, where the total value of such portfolio dropped to RM186,226 million from RM204,705 million in the previous quarter (Bank Negara Malaysia, 2017). This pattern was due to the stock market downturn that led to the equities' poor performance. This problem caused investors to lose their confidence to invest in the equity market. Investors would not benefit from the investment in the equity market unless the equity market could promise a stable risk and diversification benefit for a long-term investment.

Prior research concentrated mostly on conventional or traditional assets, such as stocks and bonds (Mehmet Balcilar Gozde Cerci Riza Demirer, 2016).Their primary field of research focuses on the implications of portfolio diversification views. They also discover a negative association between sukuk and equities during periods of more volatility (Mehmet Balcilar Gozde Cerci Riza Demirer, 2016), Hammoudeh, Mensi, Reboredo, & Nguyen (2014) demonstrate a strong relationship between Islamic stocks and the global equity market. It shows that the equity market investment could not provide better diversification and stable risk to investors. Otherwise, the investors could not shift their investment strategies toward the bond market. In addition, research on the co-movement of financial assets within a single framework is lacking. In order for investors to diversify their financial assets, a significant gap must be filled, according to recent Islamic finance research. Therefore, this study would like to investigate the correlation between Shariah stock return and bond indices.

Literature Review

Raza et al. (2019) investigated the cross-asset portfolio diversification benefits to investors from Barclay's US bonds index, crude oil, gold, and implied volatility index futures with Islamic and conventional stock market indices. Using MGARCH-DCC, ADCC, cDCC, and GO-GARCH approach on US sample alternative assets for 1996-2015, they found that diversification across Islamic equity indices was preferable to the diversification of the portfolios across conventional equity indices of all major alternative asset classes regionally and globally. Interestingly, both Islamic and conventional stock market provides the highest hedging effectiveness.

The co-movement of bond markets is analyzed in other studies. Benlagha (2014) studied the relationship between four nominal and index-linked bonds in the French market. He applied the copula and MGARCG-DCC approach. The findings showed that there was a presence of asymmetries dependence in conditional correlations between conventional and index-linked bonds. He also showed that there were significant co-movement dynamics in French bond markets. Using the MGARCH-DCC model to investigate the volatilities and correlation between Islamic bond and conventional bond indices, Hassan et al. (2018) found that that sukuk and conventional investment-grade bonds in Europe, the United States, and emerging markets were less affected by the speculative shocks to the global financial system, showing them good investment alternatives. They also found that sukuk return and its conventional benchmark indices were positively and highly correlated with each other. Nevertheless, the sukuk index showed a less volatile pattern as compared to US and EU investment-grade bonds.

Gok and Çaankal (2020) analyzed the causal relationship between weekly stock index and bond rates using the wavelet coherence approach in Turkey over the sample period between 2005 and 2016. Their finding indicated a significant cointegration and unidirectional causality between the bond yields and the equity price in Turkey. They also found a one-way causal relationship between stock price and bond yield, implying a weak co-movement between the stabilities of the equity market and bond market.

Based on the previous literature, Aloui et al. (2018) noted that strong positive co-movement between the sharia stock index and three Islamic bond indices reduced the potential of diversification benefits. It accounts for the differences in time scales, such as the short horizon and long-term horizon (Gok & Çaankal, 2020). Besides, strong co-movement lower the potential of portfolio diversification benefits in the short run, and investors that maintain the tactical allocation strategy are less likely to co-move in the same direction in the long term period (Gok & Çaankal, 2020). Furthermore, adding bond indexes emphasizes the importance of the relationship between bond and equity indices (Tuysuz, 2020). Accordingly, we seek to test the following hypotheses.

Hypothesis 1a: There is a significant co-movement between the conventional bond returns and the Composite index
Hypothesis 1b: There is a significant co-movement between the corporate bond returns and the Composite index
Hypothesis 1c: There is a significant co-movement between the corporate sukuk returns and the Composite index
Hypothesis 1d: There is a significant co-movement between the government bond returns and the Composite index
Hypothesis 1e: There is a significant co-movement between the government sukuk returns and the Composite index

Research Methodology

Wavelet Coherence

To identify the dependence between two time series in the time and frequency domains, there are three approaches that can be applied. These include cross- wavelet power, wavelet power spectrum and cross- wavelet transform (Graham and Nikkinen ,2011). The wavelet power spectrum (WPS) measures the variance of single wavelet that detects and measures the relations between two time series, the cross-wavelet power assesses the covariance of the time series while the cross- wavelet transform can control the dependences of frequency and time between two time series. According Aguiar-conraria et al. (2008) defined wavelet coherence (WTC) as "the ratio of the cross-spectrum to the product of the spectrum of each series, and can be thought of as the local correlation (both in frequency and time), between two time series". The wavelet coherence is expressed in terms coefficient of correlation of time-frequency space. We define the wavelet coherence as follows:

$$R_n^2(s) = \frac{\left|S(s^{-1}W_n^{XY}(s)\right|^2}{S(s^{-1}\left|W_n^X(s)\right| \bullet S(s^{-1}\left|W_n^Y(s)\right|^2)} \quad (1)$$

Where R2 represents for wavelet coherency and S is for a smoothing operator. Interestingly, the value of wavelet coherence ranges from 0 to 1. It is a localized correlation coefficient in time-frequency space and also is useful technique for analysis of co-movements across two time series. The wavelet coherency can be interpreted similarly to the correlation coefficient suggesting strong dependence when the value is close to 1 and weak dependence when the value is close to 0. Likewise, the wavelet power spectrum explains the variance of a time series and covariance which capture cross wavelet power between two-time series at each scale or frequency. If the variance of a time series becomes large, the wavelet suggests that the existence of sizeable power spectrum. The statistical significance of wavelet coherence coefficient is estimated using Monte Carlo simulation, though little is known its theoretical contribution (Torrence and Compo, 1998).

Mgarch-Dcc

The study utilised daily frequency data for the following reasons: first, more full information on dynamic conditional correlation than monthly data. Specifically, employing daily frequency data is more advantageous for investors seeking to construct optimal portfolios and make economic profits. On the other side, Mensi, Hammoudeh, and Kang (2017) demonstrate that a daily data model is a stronger predictor of returns than a monthly data model. The equities sector return was calculated by multiplying the initial difference of the daily logarithmic indexes by 100. In other terms, the equity sector return formula can be expressed as follows:

$R_t = 100 \times \log (P_t/P_{t-1})$ (2)

Where R_t indicates the stock returns and P represents stock index levels at the time (t) and (t−1).

The empirical analysis began with an examination of the co-movement patterns between stock sectors and the composite index, as well as their evolution through time. GARCH analysis can be utilised to detect stylised facts of financial time series, like volatility clustering and fat tails. It has been implemented in the modelling of volatility. Moreover, the Multivariate Generalized Autoregressive Conditional Heteroskedasticity (MGARCH) model is widely utilised for portfolio optimization, pricing of assets and derivatives, computation of the value at risk (VaR), futures hedging, volatility transmitting, and asset allocation (Minovi & Simeunovi, 2002).

Engle (2002) develops the dynamic conditional correlation (DCC)-GARCH model, which provides the flexibility to describe the multivariate conditional volatility of stock returns and their time-varying correlations simultaneously. The DCC is a multivariate GARCH model with an autoregressive specification for time-varying correlations. Engle (2002) establishes a two-step procedure, namely estimate of univariate GARCH models for each series and dynamic conditional correlations derived from standard residuals.

$H_t = D_t R_t D_t$ (3)

In equation 2, H_t is the n×n conditional covariance matrix, R_t is the dynamic correlation matrix and D_t is a diagonal matrix with time- varying standard deviations.

D_t =diag (h111/2, … hkkt1/2)

Rt = diag (q11t -1/2 …….qkkt -1/2)Qt diag (q11t -1/2 …….qkkt -1/2)

where Q_t is a symmetric positive definite matrix:

$Q_t = (1 - \theta_1 - \theta_2)\, \bar{Q} + \theta_1 \varepsilon_{t-1} \acute{\varepsilon}_{t-1} + \theta_2 \theta_{t-1}$ (4)

$\bar{Q}$ is the n×n unconditional correlation matrix of the standardized residuals ε_{it} . The parameters θ_1 and θ_2 are non-negative with a sum of less than unity. The study calculate the conditional correlation at time t as:

$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t} q_{jj,t}}}$, ∀ i,j = 1, ………,n, i ≠ j
(5)

To estimate the model, the Quasi-Maximum Likelihood Estimation (QMLE) is utilised. This rich conditional correlation parameterization permits the examination of the co-movement of two markets and the inference of the dependence's evolution over time. Consequently, the least connected stock indices would provide investors with more diversification benefits.

Results and Discussion of Findings

The descriptive statistics between bond indexes and the Composite index are presented in Table 1. The corporate sukuk market was highest among the five bond market segments. As can be observed, the corporate sukuk index has better average returns than other bond indices.

Table 1
Summary of descriptive analysis

Variable	Observation	Minimum	Maximum	Mean	Std. Deviation
Conventional	3158	-189.127	189.161	0.006	4.761
Corporate bond	3158	-16.078	14.387	0.007	0.385
Corporate Sukuk	3158	-5.956	5.979	0.008	0.154
Government bond	3158	-189.694	189.729	0.006	7.397
Government Sukuk	3158	-250.263	250.319	0.006	6.306

The correlation coefficient between bond returns and KLCI indices shows a negative correlation and is statistically significant as shown in Table 2. The two exceptions are corporate bonds (0.043) and corporate sukuk (0.125). This outcome is in concordance with the study's expectation, except for corporate bond and corporate sukuk, which show a positive correlation. In other words, the findings confirm H1a-H1e, which stated bond returns negatively correlated with composite indices. Composite index returns coefficients were negative, implying a negative correlation among the Composite index returns on the one hand, and conventional bond, government bond, and government sukuk returns, on the other. It clearly shows that the correlation between conventional bonds and Composite index return was tiny and negligible over the sample period. This finding implies that conventional bonds may potentially diversify and improve the trade-off of risk and returns in a global bond portfolio. Similarly, the table shows that conventional bonds appeared to be weakly correlated with the Composite index. Its correlation was similar to government sukuk, which was relatively small and less than 0.1. The weak correlation with the composite indices makes a conventional and government sukuk a good candidate for diversifying a global bond portfolio.

Table 2
Correlation matrix

Variable	Conventional	Corporate bond	Corporate Sukuk	Government bond	Government Sukuk	Composite Index
Conventional	1					
Corporate bond	0.229*	1				
Corporate Sukuk	0.361***	0.334***	1			
Government bond	0.991***	0.201**	0.330***	1		
Government Sukuk	0.888***	0.219*	0.320*	0.896	1	
Composite	-0.070	0.043	0.125	-0.089	-0.162	1

This section addresses the empirical outcomes of the Multivariate GRACH models and the behaviour of the conditional correlation dynamics over time. The study begins with a discussion of the DCC-GARCH model's outcomes. The paper then addresses the conditional correlation patterns of equity based on the dynamics of the estimated correlations shown in Figures 1 and 2. The purpose of the study was to examine the co-movement of hazardous and non-risky assets on the stock market, on the one hand, and on conventional markets, on the other.

Figures 1 and 2 show empirical findings based on the conditional volatilities and correlations of bonds with the KLCI index. I the numerical approach failed to converge for multivariate normal distribution and multivariate Student t-distribution. Consequently, Multivariate GARCH applied to OLS residuals yielded the best results, indicating that the model employs two-step estimating techniques. In the initial estimation stage, independent OLS regressions were conducted for each variable. The second estimating stage included the DCC model (Pesaran & Pesaran, 2010). Complete models such as the GARCH model and time-varying correlation model are described in the study. The reporting of this estimations model is essential, as it might reveal the maximum likelihood test estimations. Notably, the study is consistent with Nagayev et al. (2016). According to Mimouni et al. (2016), a multivariate Gaussian distribution might also be used in this investigation, as the data points to the same conclusions.

Table 3 reports the parameter estimates of bond price returns and KLCI and the values of multivariate Student's t-distribution on OLS residuals. The results of maximum likelihood estimated values are shown in the second last row of the above table. The maximum likelihood estimates for OLS residuals had the mean value of 15226, and the degree of freedom for the OLS residuals model is 3.3296, which was less than 30, indicating that the model managed to take the fat-tailed nature of the distribution of prices index. The significant coefficient of volatility and correlations suggest that the bond prices parameter is remarkably close to zero.

Table 3
Estimates λi1 and δ1 for bond variables under review with KLCI index

Parameter		Estimate	SE	T-Ratio	[Prob]
Lamda 1 (λ_i)	KLCI	0.9714	0.0049	196.3750	[0.000]
	Conventional bond	0.6240	0.0072	86.8108	[0.000]
	Corporate bond	0.7468	0.0110	67.7494	[0.000]
	Corporate sukuk	0.7213	0.0103	70.0768	[0.000]
	Government bond	0.6123	0.0076	80.6057	[0.000]
	Government sukuk	0.6268	0.0095	66.0776	[0.000]
Delta 1 (δ_1)		0.9483	0.00245	384.5706	[0.000]
Maximized log-likelihood		15226.0000			
Degree of freedom (df)		3.3296			

Note: λi1 are decay factors for variance and covariance, respectively

Table 4 reports the empirical results of the unconditional volatilities of all sample bonds with the KLCI index. The analysis showed that the government bond and government sukuk had the highest volatility. The findings indicate that the Corporate sukuk price index shows the lowest volatility, reflecting Islamic fixed income securities provides a steady market for portfolio diversification advantages.

Table 4 also reports the correlation matrix between variables of interest. For instance, the corporate sukuk correlation was the highest and positively correlated with the KLCI of 0.0253. As for other variables, the conventional bond was negatively correlated with KLCI. These findings show that the estimated correlations varied with time, indicating the study should investigate the dynamic conditional correlation.

Table 4
Estimated unconditional volatility matrix for the bond prices return and KLCI index return

Variable	**KLCI Index**	**Conventional bond**	**Corporate bond**	**Corporate sukuk**	**Government bond**	**Government sukuk**
KLCI	**0.3245**					
Conventional bond	-0.0077	4.3098				
Corporate bond	0.0190	0.0044	0.4437			
Corporate sukuk	0.0253	0.6137	0.0156	0.2219		
Government bond	0.0030	0.6456	-0.0039	0.3640	6.6930	
Government sukuk	-0.0083	0.9976	-0.0021	0.6098	0.6671	5.7059

The findings of the DCC-GARCH model of bond indexes and the Composite index are displayed in Figure 1. As shown in the figure, most variables moved together. When the bond market set a constant in 2007, the bond indices and KLCI showed steady volatility. Then the volatilities had risen by the middle of 2014. After reaching the highest level, the bond-KLCI estimated volatilities upward and downward trend over the sample period.

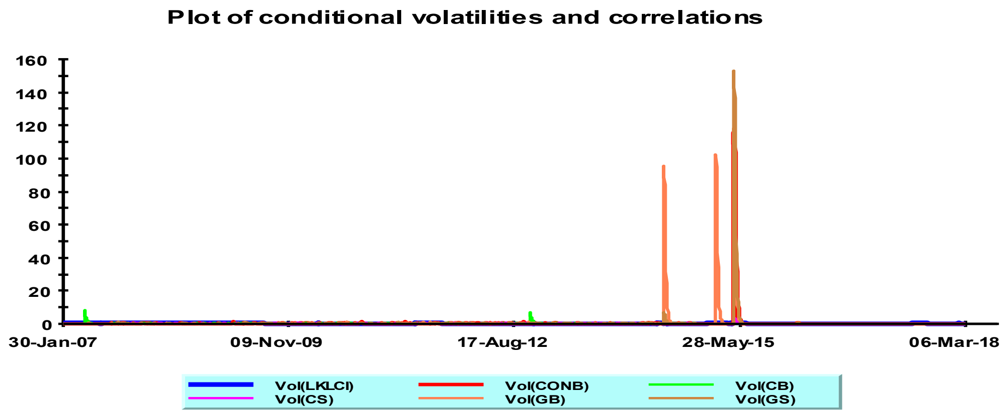

Figure 1: Conditional Volatilities of Bond Index Return with KLCI Index Return

Figure 2 shows the pattern of the estimated correlations of bond indices and KLCI index returns. When the bond market set a constant in 2007, the bond indices and KLCI showed a steady correlation. Then the correlation had risen by the middle of 2014. After reaching the highest level, the bond-KLCI estimated correlation upward and downward trend over the sample period. From the correlation, all types of bond indices recorded a stable correlation. Several studies find similar results across bond markets (Benlagha, 2014; Hassan et al., 2018). In addition, Hassan et al. (2018) suggest that diversification advantages can be gained for investors with Islamic and conventional types of bond indices for their bond investments, which is similar to the findings of this study. In other words, the findings confirm H1a-H1e. These results demonstrate that the correlations among the bond market positively and negatively related during 2007-2019.

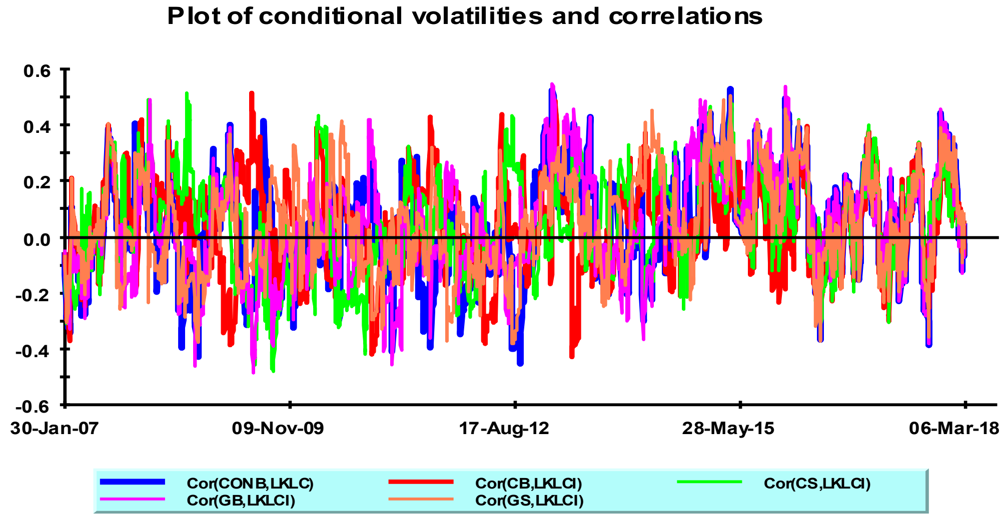

Figure 2: Conditional Correlation of Bond Index Return with KLCI Index

Conclusion

Additionally, the MGARCH-DCC results obtained indicate that all bond indices positively correlate with the Composite index except for government sukuk and conventional bonds. The analysis reveals that the bonds and the Composite index's conditional correlation appear the smallest compared to the bond-KLCI index pair. The results suggest that the bonds provide diversification benefits to investors. Interestingly, the government sukuk is likely to induce more diversification advantages; results concerning the government sukuk further show the weakest correlation with Composite index.

The wavelet coherence study summarizes the results of the relations between bonds and composite index as follows, there is a low correlation of bond with KLCI market at from short-term holding period to medium holding period, 16-64 and 64-256 days holding. The results imply a higher correlation during the long-term holding period; the finding confirms the hypotheses stating that a strong co-movement is negatively associated with a diversification advantage. The results are consistent with the existing literature that documented a strong positive co-movement offers lesser potential for diversification advantages depending on the investment holding period (Aloui et al., 2018). Given the results, the co-movements vary over time and frequency.

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