

A Study On Bonds Market in Malaysia

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DOI: <https://doi.org/10.30880/ekst.2022.02.01.053>

Received 02 January 2022; Accepted 02 March 2022; Available online 1 August 2022

Abstract: The primary aim of this study is to figure out the most influential variable in Malaysia's conventional bonds and Sukuk pricing and determine the factors affecting the most influential variable. The variables tested are yield to maturity, period to maturity, and coupon rate. The data used are collected from Bond Info Hub and divided into four groups, which are government conventional bonds, corporates conventional bonds, government Sukuk, and corporates Sukuk. The most influential variable is determined by multiple linear regression analysis while the factors affecting the most influential variable is determined by using the secondary research method. According to the findings of this study, the most influential variable in the pricing of conventional bonds issued by the government, Sukuk issued by both government and corporates is coupon rate whereas the most influential variable in conventional corporates bonds pricing is yield to maturity. Besides, the factors affecting coupon rate are prevailing interest rate and the issuer's creditworthiness while the yield to maturity may be affected by the prevailing interest rate, coupon rate, and inflation rate.

Keywords: Bond Price, Determinants, Coupon Rate, Yield To Maturity, Period To Maturity, Multiple Linear Regression

1. Introduction

A bond is a loan issued by an issuer with a promise to pay the investors a fixed rate of the amount in a specific period, where the issuer acts as a borrower and the investors as the lenders. The types of issuers can be the government, special projects, or corporations. An issuer can be any party who raises funds for various reasons whereas an investor lends the money by purchasing the bonds in return for interest. The amount borrowed stated on the bond is defined as face value, while the return of the bonds and interest paid to the investors are named as yield and coupon rate respectively.

The bonds in Malaysia are mainly classified into two types, which are conventional bonds and Islamic bonds (Sukuk). Both types of bonds have their individual face values, fixed tenures, and the investors are entitled to a regular stream of income over the tenure of the bonds. However, these two bonds pose some different characteristics. Conventional bonds defined the relationship between issuer

and investor as a borrower-lender relationship. The yields and coupon rate of the conventional bonds that the investor obtains once the bonds mature are pre-determined. For example, Malaysian Government Securities (MGS) is a conventional bond issued by the government. However, Sukuk is the bond issued in compliance with Shariah principles. The relationship between the Sukuk issuer and investor is defined as a seller-buyer relationship. Sukuk issuers act as sellers of assets whereas investors are the owners who share the ownership of the assets. There is no interest paid in Sukuk bonds. However, the investors share the profit earned and loss of the assets as their yields. Hence, the yields paid to the investor are expected and the return of investors' capital cannot be guaranteed. For instance, Government Investment Issue is an example of an Islamic bond issued by the government [1].

There are four variables required in the formula used in calculating bonds price, which included coupon rate, face value, yield to maturity, and period to maturity [2]. However, these variables affect the bond price differently. Furthermore, they also have different significances in Sukuk and conventional bonds pricing. Therefore, the primary aim of this study would determine and compare the degree of significance of yield to maturity, period to maturity, and coupon rate in conventional bond and Sukuk pricing by using multiple linear regression analysis.

The main concept applied in calculating bond price is named as time value of money. Time value of money is a concept describing that the value of money is being influenced as time goes [2]. Hence, the value of money varies under distinct spots of time. This explains the reason for bond price changes over the periods. Besides, time value of money concept is highly utilized by the management of the financial sector for the purposes of analysing the return of investment opportunities [3].

Since the risks faced by both conventional bonds and Sukuk are different due to their characteristics, the demands of both types of bonds are independent. Based on the statistics obtained from the report of the Asian Development Bank, Sukuk plays the main role in the Malaysia bonds market, which is a recorded market size of RM 1016.3 billion out of the overall Malaysia bonds market size of RM 1604.5 billion. This figure indicates that the bonds market in Malaysia is made up of approximately 60% of Sukuk and 40% of conventional bonds.

Moreover, there is a relationship between the bonds market and economic growth. The estimated model applied in the study supported the statement of the real economics of a country is significantly influenced by the development of the bonds market of the country. [4]. Based on statistics obtained from the Department of Statistics Malaysia official website, the GDP of Malaysia in 2020 is USD 336.33 billion. Furthermore, based on the report from Asian Development Bank, Malaysia's bonds market size in the fourth quarter of 2020 recorded USD 399.1 billion, which is equivalent to RM 1604.5 billion. This figure illustrates that the size of the bond market is about 119.5% compared to GDP Malaysia in 2020. The statistics indicate the bonds market contributed to the majority incomes of our country. Besides, according to the Asian Bonds Online website, Malaysia ranked third largest size of local currency bond market in the percentage of GDP in Asia, which is behind Japan and the Republic of Korea.

Due to the large bond market size in Malaysia, the differences in the roles of variables in the pricing model of bonds should be really inflecting to statistics in real life to enable particular parties and citizens to develop this sector with better performance. The significance of this study is to compare the degree of significance of the roles of yield to maturity, period to maturity, and coupon rate in conventional bonds and Sukuk pricing.

2. Methodology

The data used in this research are realistic data obtained from Bond Info Hub. The data collected included the yield to maturity, period to maturity, and coupon rate of conventional bonds and Sukuk issued by government and corporates in Malaysia starting from January 2020 to December 2020. All data collected are according to four subgroups, which are government bonds, corporates bonds,

government Sukuk, and corporates Sukuk. Conventional bonds collected included Malaysian Government Securities (MGS), Medium Term Notes (MTN), and corporate conventional bonds while data of Sukuk collected and used in this research included Government Investment Issue (GII), Sukuk Perumahan Kerajaan (SPK), Islamic Medium Term Notes (iMTN), and corporate Islamic bonds.

Moreover, the data in this study are processed and analysed by using a combination of multiple mathematical software, which are Microsoft Excel 2016, Maplesoft Maple 2015, and IBM SPSS Statistics Version 23.0. Since the data collected are large, the data are saved in Excel worksheets. The data collected are selected randomly by using the formula function in Microsoft Excel 2016. After that, the data are analysed by using Maplesoft Maple 2015. Since Kruskal-Wallis Test and multiple linear regression analysis are not available in Maplesoft Maple 2015, SPSS Statistics Version 23.0 is used in carrying out these two tests.

2.1 Data description

From Bond Info Hub, there is a total of 76,845 bonds transactions that occurred from 1 January 2020 to 31 December 2020, which included 39,458 conventional bonds issued by the government, 2,645 conventional bonds issued by corporations, 21,441 Sukuk issued by the government, and 13,301 Sukuk issued by corporations. 2,000 data are selected randomly from each group. The data collected are filtered by using box and whisker plots and data descriptions for each group are tabulated.

2.2 Multiple linear regression analysis

Before carrying out multiple linear regression analysis, the independence and multicollinearity assumptions are tested. For independence assumption, the normality of data is tested by observing data distribution in histogram and skewness value. If the data is normally distributed, one-way analysis of variance (ANOVA) is carried out as independent test. Otherwise, Kruskal-Wallis test is more suitable as the independent test for not normally distributed data.

Kruskal-Wallis test is a non-parametric test for ANOVA to determine if there are statistically significant differences between two or more groups of independent variables when the data used is not normally distributed. In order to carry out the test, two assumptions are set at the beginning of the analysis, which are the null hypothesis and alternative hypothesis. The null hypothesis stated that the medians from all groups are the same whereas the alternative hypothesis stated that there is at least a group having a different median from other groups. Then H statistic is obtained by using the equation below.

$$H = \left[\frac{12}{c(c+1)} \sum_{j=1}^N \frac{T_j^2}{N_j} \right] - 3(n+1) \quad Eq. 1$$

From Eq.1, c is the sum of sample sizes for all groups, N is the number of groups, T_j is the sum of ranks in the j^{th} groups while N_j is the size of the j^{th} groups. The absolute value of H statistic obtained is compared with the critical chi-square value corresponding with the same number of degrees of freedom and selected significant level. If the statistic obtained by the formula is smaller than the corresponding value from the table, there is sufficient evidence to reject h_0 and the conclusion drawn is there is at least a group having a different median from other groups. The data are independent. Otherwise, if the statistics obtained by the formula is larger than the corresponding value from the table, there is no sufficient evidence to reject h_0 and the conclusion drawn is the median from all groups are the same. The data are not independent [5].

After that, the multicollinearity assumption is tested. The correlation of data is tested by using Pearson product moment correlation (PPMC) and the correlation coefficients obtained are further used in variance inflation factor (VIF) to test multicollinearity.

The model of linear regression model used is as follow:

$$Y = \beta_0 - \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \quad Eq. 2$$

In Eq. 2, Y is denoted as the dependent variable while X_1 , X_2 , and X_3 are independent variables. β_0 is the value of Y when all parameters are set to zero while β_1 , β_2 , and β_3 are the regression coefficient for the corresponding independent variable. In the multiple linear regression analysis in this study, the dependent variable and independent variables are defined in Table 1.

Table 1: Description of variables used in multiple linear regression analysis

Variables	Description
Y	Bond price
X_1	Yield to maturity
X_2	Period to maturity
X_3	Coupon rate

The model generated will predict the bond price by using yield to maturity, period to maturity, and coupon rate as useful predictors. The regression coefficients for each variable represent the degree of significance of the corresponding variables. The degree of significance of variables is compared to determine the most influential variable in bond pricing.

2.3 Secondary research

After determining the most influential variable in affecting the pricing of conventional bonds and Sukuk, additional analysis is required in order to determine the factors affecting the most influential variable. The factors are important to enable readers to have a more detailed understanding on the determinants of the bond price in real environment. Hence, the secondary research method is used. The reasons that may affect the most influential variable obtained from multiple linear regression analysis are collected from the internet public access sources, public libraries, or reviewing existing literature.

3. Results and Discussion

The results and discussion on the most influential variables in bond pricing are discussed based on four groups of data, which are government bonds, corporates bonds, government Sukuk, and corporates Sukuk. Besides, the factors that affecting the most influential variable are also discussed.

3.1 Data description

After outliers are removed, the data description for the conventional bonds issued by the government is shown in Table 2.

Table 2: Data description for conventional bonds issued by government

Data Description	Conventional Bonds issued by Government			
	Price	Yield to Maturity	Period to Maturity	Coupon Rate
Minimum	95.3500	1.4600	3.0000	3.4180
Maximum	116.7000	4.3100	30.0000	4.4980
Mean	105.5662	2.6366	11.4323	3.8354
Median	105.4000	2.6700	10.0000	3.8820
Standard deviation	3.4000	0.5496	6.5751	0.2358
Skewness	0.2884	0.0063	0.9145	0.2937
Kurtosis	2.5190	2.5042	3.3244	3.2304

From Table 2, the skewness value for the bond price, yield to maturity, period to maturity, and coupon rate are 0.2884, 0.0063, 0.9145, and 0.2937 respectively. This showed that the data are not

normally distributed. The data description for the conventional bonds issued by corporates after removing outliers is illustrated in Table 3.

Table 3: Data description for conventional bonds issued by corporation

Data Description	Conventional Bonds issued by Corporation			
	Price	Yield to Maturity	Period to Maturity	Coupon Rate
Minimum	97.5000	1.7600	1.0000	3.0000
Maximum	101.8500	6.6400	100.0000	7.6000
Mean	102.5895	3.8331	35.6002	5.0481
Median	102.3200	3.5100	10.0000	4.9800
Standard deviation	1.9060	1.1323	41.7214	0.9969
Skewness	0.6328	0.9907	0.8445	0.0636
Kurtosis	3.1631	3.1579	1.7347	2.7294

Based on the skewness value obtained in Table 3, the data distribution for the bond price, yield to maturity, and period to maturity are not normally distributed except for coupon rate. Table 4 shows the data description for the Sukuk issued by the government after removing outliers.

Table 4: Data description for Sukuk issued by government

Data Description	Sukuk issued by Government			
	Price	Yield to Maturity	Period to Maturity	Coupon Rate
Minimum	99.3000	1.6500	3.0000	3.1510
Maximum	120.9900	3.9300	20.0000	4.9430
Mean	108.2059	2.8312	10.3991	4.0326
Median	107.6000	2.8700	10.0000	4.1190
Standard deviation	4.4347	0.4751	4.9482	0.4121
Skewness	0.3848	-0.3460	0.6288	-0.3069
Kurtosis	2.5019	2.5204	2.4911	2.5827

In Table 4, the data distribution of the data for yield to maturity, period to maturity, and coupon rate can be considered as not normally distributed based on their skewness value. The data description for the Sukuk issued by corporations after removing outliers is tabulated in Table 5.

Table 5: Data description for Sukuk issued by corporation

Data Description	Sukuk issued by Corporate			
	Price	Yield to Maturity	Period to Maturity	Coupon Rate
Minimum	95.5400	1.8700	1.0000	2.8600
Maximum	123.6400	5.3600	26.0000	6.6500
Mean	107.3343	3.4317	10.6686	4.7571
Median	105.9100	3.4000	10.0000	4.7850
Standard deviation	5.6584	0.6479	4.7994	0.7279
Skewness	0.7388	0.5145	0.5905	0.0533
Kurtosis	2.7297	3.4367	3.0779	3.0137

The skewness value in Table 5 shows that the data distribution for yield to maturity, period to maturity, and coupon rate for Sukuk issued by corporations are not normally distributed.

3.2 Independent assumption

Since most of the data are not normally distributed, Kruskal-Wallis test is used in determining the independence of the data. For conventional bonds issued by the government, the statistical significance of the test obtained is approximately equal to zero, there is sufficient evidence to conclude that a statistically significant difference between bond price and yield to maturity, period to maturity, and coupon rate. For conventional bonds issued by corporations, the data are concluded as independent as there is at least a group having a different median from other groups. Moreover, the statistical significance of the test obtained for the data of Sukuk issued by the government is approximately equal to zero, this means that the statistically significant difference between bond price and yield to maturity, period to maturity, and coupon rate exist. The independent test for Sukuk issued by corporations showed there is at least a group having a different median from other groups. In short, all data used followed independent assumption.

3.3 Multicollinearity assumption

For the data of conventional bonds issued by the government, the Pearson correlation coefficient between bond price with yield to maturity, period to maturity, and coupon rate are -0.0971, 0.3661, and 0.4497 respectively. This proved that the associations between bond price with these variables are small or medium. While VIF values for yield to maturity, period to maturity, and coupon rate are 1.0095, 1.1548, and 1.2535 respectively, which are fall in the range of one to five, hence all independent variables are moderately correlated.

While the Pearson correlation coefficient between bond price with yield to maturity, period to maturity, and coupon rate for the data of conventional bonds issued by corporations are -0.2840, 0.3685, and 0.0333 respectively. The results showed small or medium associations between bond price with these variables. Then, the VIF values for yield to maturity, period to maturity, and coupon rate are 1.0877, 1.0014, and 1.0011 respectively. Since the results obtained fall in the range of one to five, all independent variables can be concluded as moderately correlated.

Moreover, the data of Sukuk issued by the government is also being tested. The Pearson correlation coefficient obtained shows the associations between bond price with yield to maturity, period to maturity, and coupon rate are medium or large and the data obtained are -0.4618, 0.8159, and 0.7448 respectively. The VIF values for these variables fall in the range of one to five, which are 1.2711, 2.9912, and 2.2461 respectively. This proves that all independent variables are moderately correlated.

Furthermore, for Sukuk issued by corporations, the Pearson correlation coefficient between bond price with yield to maturity, period to maturity, and coupon rate are -0.0643, 0.6558, and 0.4743 respectively. Hence, the association between bond price with these variables are small, large, and medium respectively. Besides, the VIF values for yield to maturity, period to maturity, and coupon rate are 1.0041, 1.7588, and 1.2903 respectively, which are fall in the range of one to five. Hence, all independent variables in Sukuk issued by corporations are moderately correlated. In brief, all data followed multicollinearity assumption.

3.4 Multiple linear regression analysis

In multiple linear regression analysis, the general form of the equation obtained to predict the price of conventional bonds issued by the government from yield to maturity, period to maturity, and coupon rate as shown in Eq. 3.

$$Y = 83.048 - 1.103X_1 + 0.240X_2 + 5.912X_3 \quad Eq. 3$$

From Eq. 3, for each decrease of 1.103% yield to maturity, increase of 0.240year period to maturity and increase of 5.912% coupon rate resulted in an increase of RM1.00 in bond price. Yield to maturity, period to maturity, and coupon rate can have an effect on the bond price of 31.0% while the remaining

69.0% is influenced by other variables. The most influential variable in the pricing of conventional bonds issued by the government is coupon rate. For the data of conventional bonds issued by corporations, the general form of the equation obtained to predict bond price from yield to maturity, period to maturity, and coupon rate as shown in Eq. 4.

$$Y = 102.221 - 1.050X_1 + 0.002X_2 + 0.854X_3 \quad \text{Eq. 4}$$

Based on general form in Eq. 4, the increase of per RM1.00 in bond price are due to decrease of 1.050% yield to maturity, increase of 0.002year period to maturity and increase of 0.854% coupon rate. There are a total of 19.4% of bond price affected by these three variables The most influential variables in pricing of conventional bonds issued by corporations is yield to maturity. Besides, Eq. 5 showed the general form of the equation obtained to predict Sukuk price issued by the government from yield to maturity, period to maturity, and coupon rate.

$$Y = 92.641 - 2.599X_1 + 0.660X_2 + 3.981X_3 \quad \text{Eq. 5}$$

For each increase of RM1.00 in bond price from the general form in Eq. 5, the increase resulted from a decrease of 2.599% yield to maturity, increase of 0.660year period to maturity, and increase of 3.981% coupon rate. These three variables have an effect on the bond price of 74.8% The most influential variable in pricing of Sukuk issued by the government is coupon rate. The general form of the equation obtained to predict the price of Sukuk issued by corporations from yield to maturity, period to maturity, and coupon rate as shown in Eq. 6.

$$Y = 89.064 - 3.307X_1 + 0.748X_2 + 4.547X_3 \quad \text{Eq. 6}$$

In Eq. 6, for each decrease of 3.307% yield to maturity, increase of 0.748year period to maturity and increase of 4.547% coupon rate with resulted in an increase of RM1.00 in bond price. There are 67.0% of bond price effected by yield to maturity, period to maturity, and coupon rate while the remaining 33.0% is influenced by other variables. The most influential variables in pricing of Sukuk issued by corporations is coupon rate.

3.5 Factors affecting the most influential variable

The most influential variable for conventional bonds issued by government, Sukuk issued by both government and corporation is coupon rate. The coupon rate is affected by prevailing interest rate and issuer's creditworthiness. In Malaysia, the prevailing interest rate refers to the Overnight Policy Rate (OPR) which is determined by the Monetary Policy Committee (MPC) of Bank Negara Malaysia. OPR is the minimum interest rate charged amongst banks in the interbank market. When the economy of the country is growing at a slower rate, OPR will be revised downward and result in a decrease in interest rates. When the interest rate decreases, the coupon rate and bond price decrease. Since the coupon rate is fixed at the starting of bonds being issued, the coupon rate will only be affected by the prevailing interest rate and changes in interest rate will not affect the coupon rate of existing bonds [6].

Besides, the coupon rate is also affected by the issuer's creditworthiness. An issuer with a lower rating has to offer a higher coupon rate to attract investors. This is because the investors have to take a higher risk when investing a lower rating bond. Therefore, the issuer has to rise up the coupon rate as compensation for the additional risk taken by the investors [7].

The most influential variable for conventional corporate bonds is yield to maturity. Similar to the coupon rate, yield to maturity is also affected by the prevailing interest rate. However, the impact of the prevailing interest rate towards yield to maturity is larger compared with the coupon rate as yield to maturity is calculated at the particular time while the coupon rate is fixed along with the tenure of the bond [8].

Moreover, yield to maturity is also affected by the coupon rate as the coupon rate is closely related to the interest rate. The most influential variable for conventional corporate bonds is different from others groups of bonds is because most than half of the conventional corporate bonds issued in the Malaysian market are zero-coupon bonds [9].

Furthermore, another determinant of yield to maturity is the inflation rate. An increase in the inflation rate may decrease the purchasing power of investors or increase the demands of investors to earn passive income. Therefore, yield to maturity will changes based on the inflation rate [10].

4. Conclusion

Three objectives of this study are achieved. For the first objective, the degree of significance of yield to maturity, period to maturity, and coupon rate with conventional bond pricing and Sukuk is being compared. From the result obtained, the degree of significance of coupon rate, face value, yield to maturity, and period to maturity in the pricing of government conventional bonds, government Sukuk, and corporate Sukuk in decreasing order is coupon rate, yield to maturity, and period to maturity whereas for corporate conventional bonds, the degree of significance in decreasing order is yield to maturity, coupon rate, and period to maturity.

After obtaining results from the first objective, the most influential variable in conventional bond and Sukuk pricing is able to determine. Coupon rate played the most significant role in government conventional bonds, government Sukuk, and corporate Sukuk pricing while yield to maturity is the most influential variable in conventional corporate bonds. The difference in results for conventional corporate bonds is due to most of the bonds in this group of bonds being zero-coupon bonds.

The third objective of this study is to determine the factors that affect the most influential variable in conventional bond and Sukuk pricing. The coupon rate is mainly affected by the prevailing interest rate and the issuer's creditworthiness. While yield to maturity may be affected by the prevailing interest rate, coupon rate, and inflation rate.

By observing the coefficients of determination obtained in multiple linear regression in this study, the impact of variables tested towards conventional bond prices issued by both government and corporation are less than 50%. This means that should be more variables being considered in further study to figure out the variables that contribute more to conventional bonds pricing.

Moreover, face value is one of the main components in calculating the bond price. However, the face value of a bond is depending on the amounts invested by the investor and varies by case. Hence, there is no official data that can be obtained by the researcher and face value is excluded as the variable being investigated in influencing the bond price in this study.

Acknowledgement

The authors would also like to thank the Faculty of Applied Sciences and Technology, Universiti Tun Hussein Onn Malaysia for its support.

References

- [1] A. A. Tahmoures, "Compare and Contrast Sukuk (Islamic Bonds) with Conventional Bonds, are They Compatible?." *The Journal of Global Business Management*, vol 9, no. 1, pp. 41-52, 2013.
- [2] M. Thakur, "Bond Pricing Formula," EDUCUBA. [Online]. Available: <https://www.educba.com/bond-pricing-formula/>. [Accessed Mar 24, 2021]
- [3] V. Shrotriya, "Time Value of Money -the Concept and its Utility," *International Journal of Research and Analytical Reviews (IJRAR)*, vol 6, no. 1, pp. 85-92, 2019.
- [4] Fink et al., "Bond Markets and Economic Growth," *SSRN Electronical Journal*, vol 49, 2003, doi: 10.2139/ssrn.1003763.
- [5] A.O. Samuel et al., " Empirical Comparison of the Kruskal Wallis Statistics and its Parametric Counterpart," *Journal of Modern Mathematics and Statistics*, vol 3, no. 2, pp. 38-42, 2009.
- [6] Bix, "What is Overnight Policy Rate (OPR) in Malaysia?," *Bond and Sukuk Information Centre*. [Online]. Available: [https://www.bixmalaysia.com/Learning-Center/Articles-Tutorials/What-is-Overnight-Policy-Rate-\(OPR\)-in-Malaysia](https://www.bixmalaysia.com/Learning-Center/Articles-Tutorials/What-is-Overnight-Policy-Rate-(OPR)-in-Malaysia). [Accessed Dec 24, 2021].
- [7] Corporate Finance Institute, "Coupon Rate," [Online]. Available: <https://corporatefinanceinstitute.com/resources/knowledge/finance/coupon-rate/>. [Accessed Dec 24, 2021]
- [8] A. Kurniasih et al., "The Influence of Macroeconomic Indicators and Foreign Ownership on Government Bonds Yields: A Case of Indonesia," *Mediterranean Journal of Social Sciences*, 2015, doi: 10.5901/miss.2015.y6n5s5p34
- [9] N. Che-Yahya et al., "Determinants of Corporate Bond Yield: The Case of Malaysian Bond Market. *International Journal of Business and Society*, vol. 17, no. 2, 2017, doi: 10.33736/ijbs.523.2016
- [10] D. Megananda et al., "Determinants of Corporate Bond Yield: Empirical Evidence from Indonesia," *The Journal of Asian Finance: Economics and Business*, vol. 8, no. 3, pp. 1135-1142, 2021, doi: 10.13106/jafeb.2021.80.3.1135