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Modeling the yields curve of Sukuk Ijarah

Dedi Rosadi
Department of Mathematics, Universitas Gadjah Mada, Indonesia, email : dedirosadi@ugm.ac.id

Heni Wahyuni
Department of Economics, Universitas Gadjah Mada, Indonesia,email : hwahyuni@ugm.ac.id

Sri Redjeki
STMIK AKAKOM, Indonesia, email : dzeky@akakom.ac.id

Muslim
Departmenf of Mathematics Universitas Jambi, Indonesia, email : Aliem_h@yahoo.co.id

Abstract

Shariah financial products are currently developing in sharia financial market, including in Indonesia bond market. One of the most important products is called as Sukuk which is commonly referred to as "sharia compliant" bonds. The types of Sukuk that have been widely traded in Indonesia until now are Sukuk Ijarah and Sukuk Mudharabah. To compare yields for bonds with different maturity time (including sukuk), we may use the yield curve (see also Ariff and Safari, 2012). To the best of our knowledge, there is no previous study has been considered in the literature to model the yields curve of sukuk. In this paper, we discuss two approaches for modeling the term structure of the fixed-non-callable Sukuk Ijarah and provide the empirical studies using data from Indonesia Bonds market.

Keywords: first keyword; Sukuk Ijarah; fixed-non-callable; yield curve

1. Introduction

Shariah financial products are currently developing in sharia financial market, including in Indonesia bond market. One of the most important products is called as Sukuk which is commonly referred to as "sharia compliant" bonds. The types of Sukuk that have been widely traded in Indonesia until now are Sukuk Ijarah and Sukuk Mudharabah (OJK, 2017). Sukuk *Ijarah* is an Islamic bond using *Ijarah* contract. *Ijarah* is "essentially" a rental or lease contract to use the benefits of a good or service with a reward. This means that the lessor would entitle the other party to use the objects, but the tenant has the obligation to provide compensation in accordance with the agreement. In *Ijarah* contract basically there is a transfer of temporary benefits, but without any transfer of ownership. Ijarah object used as the underlying in the issuance of sukuk is fixed assets (e.g. ships, electrical networks, land, machinery, buildings, circuits, vehicles, business spaces, engine power plants,) or services (contract/ purchase agreement, transport services). The differences between sukuk ijarah and the conventional bonds and also sukuk mudharabah are described in the Table 1. To compare yields for bonds with different maturity time (including sukuk), we may use the yield curve (see also Ariff and Safari, 2012). To the best of our knowledge, there is no previous study has been considered in the literature to model the yields curve of sukuk.

The rest of this paper is organized as follows. In Section 2 of this paper we consider two approaches for modeling the yields of the sukuk ijarah, one method by modeling the price of the sukuk using a structural method as described in Rohmatunnisa (2008). The second approach is modeled via calculating the credit spread of the asset using reduced-form model as described in Nakasihma dan Saito (2009). When we already obtained the yields of sukuk ijarah, in Section 3, we propose to model the yield curve using extended nelson-siegel model. In Section 4 we provide empirical study using data from Indonesia market. In Section 5 we conclude our presentation.

Table 1. Comparison between sukuk Ijarah, sukuk mudharabah and the conventional bonds

Distinguishing variable	Sukuk Mudharabah	Sukuk Ijarah	Conventional Bonds
Contract (transaction)	Mudharabah / Profit sharing	Ijarah / lease	No
Type of Transaction	Uncertainty Contract	Certainty Contract	-
Nature of Instrument	Ownershipcertificate of an asset	Ownership certificate of an asset	Acknowledgement of Debt Instruments
Publisher	Governments, corporations	Governments, corporations	Governments, corporations
Offer Price	100%	100%	100%
Coupons / income	Revenue/ Profit sharing	Remuneration / fee	Interest / usury
Period of time	Short-Medium	Short-Medium	Medium-length
Returns	Indicative based on revenue / income	Predetermined	Float / fixed
Underlying asset object agreement	Important	Important	No need to
Type of investors	Shariah / conventional	Shariah / conventional	Shariah / conventional
Outcome	Halal	Halal	Haram
Law	Maslahat world and the hereafter	Maslahat world and the hereafter	Madharat
Price	Market Price	Market Price	Market Price
Use of Results Publishing	According to the Shariah	Accordingto the Shariah	Free

2. Modeling the yield of sukuk ijarah

2.1. Modeling the price of sukuk ijarah using structural model

Rohmatunnisa (2008) described the structural method for modeling the price of sukuk ijarah. From Rohmatunnisa (2008), we can see the cashflow of sukuk ijarah as follows

- At time zero, the sukuk holders give the proceeds (Qo) of Ijarah sukuk to the issuing "special purpose vehicle" (SPV), an independent board of management between issuer and sukuk holder.
- During the contract the sukuk holders receive periodic distribution amounts (L) from the SPV which are equal to the leasing payment received from the borrower.
- Finally, at the end of the contract, the SPV sell back the asset to borrower and borrower pays the repurchase price of the asset (Pt) to the SPV. The SPV distributes the dissolution distribution amount to sukuk holders.

From the cash flows above, we can see that the Ijarah sukuk cash flows are similar to conventional bond cash flows. The periodic distribution amounts in Ijarah sukuk replace the coupon payments in conventional bonds, and the repurchase price or the dissolution distribution amount substitutes for the principal.

It is also known in the literature (see e.g. Rohmatunnisa, 2008) that the sale and lease transaction in Ijarah sukuk is not real, and the core of the Ijarah sukuk structure is a conventional bond. In other words, Ijarah sukuk is an expensive version of the conventional bond. It is said to be an expensive version because the transaction cost in this instrument is considered significant. The Ijarah

sukuk transaction costs are: the fees of the SPV or the investment bank, lawyers' and Shari'ah Boards' fees, maintenance expenses and insurance expenses in the leasing transaction.

The transaction involved in sukuk ijarah can be separated as the following parts:
Part 1. Periodic distribution amounts

- From time 1 to time T (maturity) the SPV makes regular payments or periodic distribution amounts (L) to sukuk holders which are equal to the lease payment received by the SPV from the borrower.
- Present value of the lease payments or the periodic distribution amounts are:

$$PV = \frac{L}{(1+r)^1} + \frac{L}{(1+r)^2} + \frac{L}{(1+r)^3} + \ldots + \frac{L}{(1+r)^T}$$

The discount rate used in this transaction cost is the cost of capital in a non-interest economy as discussed by Mirakhor (1996). Therefore, the discount rate is: $r = \rho = \frac{Y}{V}(1 - d + dq)$

where

Y = Expected value of firm's accounting earnings
V = Market value of firm
b= expected value from retention rate of the company
s= expected value of rate stock financing
d=b+s
C= cost of replacement (current asset, saving, security of the company, cost of property, ground and tools)
q=V/C

Part 2. Repurchase price

- If the asset follows geometric Brownian motion (gBm), the percentage in asset price is independent and identically distributed. The asset price changes independently from the movement of past price. Therefore the monthly expected asset price at time t is: $P_t = Po.e^{\mu t}$, where Po is the asset price at time 0.
  The repurchase price held at maturity is: $P_T = Po.e^{\mu T}$
- In some agreements, the repurchase price is predetermined, so the repurchase price is simply "PT", which is equal to the price agreed at the beginning of the contract transaction

We obtain the Present Value of repurchase price as

a. Asset repurchase with certainty:

If the asset will be repurchased with certainty at maturity, the present value of the repurchase price is:

- Geometric Brownian motion (gBm) $PV = \frac{Po.e^{\mu T}}{(1+r)^T}$

- Predetermined price $PV = \frac{P_T}{(1+r)^T}$

b. Asset repurchase with call option given to the borrower is not discussed here; we may use the Black Scholes formula

Part 3. Transaction cost

- Fee of the SPV or investment bank at the beginning of the contract (time 0). The SPV or investment bank's fee is based on the annual asset price given by the borrower (Po).

The SPV fee is: $Fee = Po.a$. a is the proportion of the annual asset price.

- Fee of the Legal and Shari'ah Board at the beginning of the contract (time 0)

This is the dollar amount fee charged by the Legal and Shari'ah Board for this transaction, expressed by "S".

- Operating expense, such as maintenance and insurance fee from time 1 to maturity (T):

$$PV = \frac{O_t}{(1+r)^1} + \frac{O_t}{(1+r)^2} + \frac{O_t}{(1+r)^3} + \ldots + \frac{O_t}{(1+r)^T}$$

The price of sukuk ijarah is the net present value from all cash flow of this instrument. Combining all of the transaction parts, after simplification, we obtain

1. Repurchase transaction with certainty and with predetermined price:

$$Qo = \frac{L+Ot}{r} + Po.a + S + \left(Pt - \frac{L+Ot}{r} \right) + (1+r)^{-T}$$

2. Repurchase transaction with certainty and the asset price follows geometric Brownian motion (gBm):

$$Qo = \frac{L+Ot}{r} + Po.a + S + \left(Po.e^{\mu T} - \frac{L+Ot}{r} \right) + (1+r)^{-T}$$

2.2. Pricing Sukuk Ijarah : Reduced Model

In order to make the risky bond more attractive than non-risky bond, we give the risky bond higher yield (or lower price) than the non-risky ones (for the same maturity date). The difference is called credit spread or yield spread

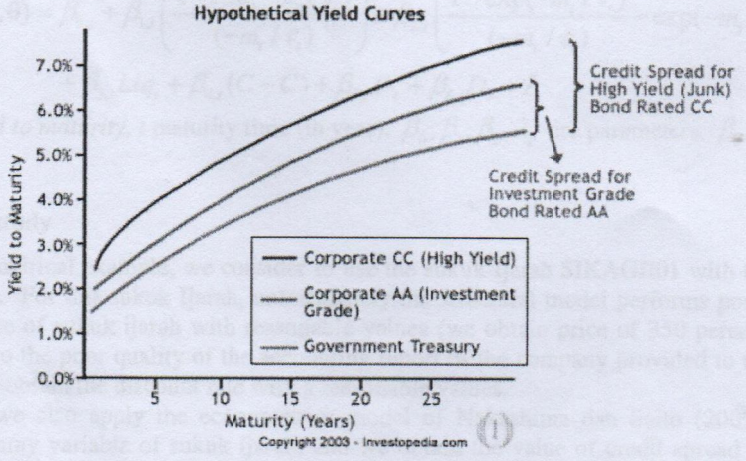

Figure 1. Hypothetical Yield Curve

Main goal in bond price modeling in practice is to model the credit/yield spread, which is difference of yield between conventional bond and government bond with the same time to maturity. Here Yield-To-Maturity (YTM) is the internal rate of return earned by bondholder who buys a bond certificate

today, at market price, and hold it until the maturity, entitling the bondholder to all coupon payments as well as maturity payment (Ariff and Safari, 2012).

For reduced form approach, in this paper we consider to apply the Nakasihma and Saito (2009) econometric model (which is applicable for modeling the credit spread and also therefore, the yields). Nakasihma and Saito (2009) derive the relationships between credit spreads and firm-level factors. The price of certain bond can be determined using standard formula of relation between yield and price. The credit spread is assumed to be affected by the internal factor of the company and by the external factors. The internal factors are the ratio between liability and equity (denote as $deratio_t^i$), the volatility of the returns of company asset values (σ_t^i), time to maturity (variable log T_t^i), where for the external factor (global market), they consider the use of risk free rate of corresponding maturity and quatterly time as the dummy variable. We obtain the following model

$$spread_t^i = \beta_0 + \beta_1(deratio_t^i) + \beta_2 \log(\sigma_t^i) + \beta_3 T_t^i + \beta_4 r_t + \sum_{t=1}^{4} \beta_{5i}(time_t) + \varepsilon_t^i, i = \text{bond-i}$$

Here we add one additional dummy variable to the model, which certainly explains that the bond traded is sukuk ijarah type (fixed rate). Some detail calculation of the variables is omitted.

3. The Term Structure of Sukuk Ijarah

To compare yields for bonds with different maturity time (including sukuk), we may use the Yield curve (see also Ariff and Safari, 2012). Elton et al. (2004) discussed that the standard Nelson Siegel (NS) model contain systematic error if it is applied for corporate bonds. To improve accuracy in modeling corporate bonds (in our opinion, including sukuk) yield curve, we consider the model NS with some additional variable, such as the liquidity risk (in the form of bid-ask spread), tax (difference between coupon minus average coupon, $C - \bar{C}$) and subrating classification (two dummy variables D+ and D-), which has been discussed in Elton et al. (2004) and Van Landschoot (2004). This model we called as Extended NS model, given by the formulas

$$i_t(m, \boldsymbol{\theta}) = \beta_{0,t} + \beta_{1,t}\left(\frac{1-\exp(-m_t/\tau_t)}{(-m_t/\tau_t)}\right) + \beta_{2,t}\left(\frac{1-\exp(-m_t/\tau_t)}{(-m_t/\tau_t)} - \exp(-m_t/\tau_t)\right)$$
$$+ \beta_{3,t} Liq_t + \beta_{4,t}(C - \bar{C}) + \beta_{5,t} D_+ + \beta_{6,t} D_- + \tilde{\varepsilon}_t$$

Here y_t is *yield to maturity*, t maturity time (in year), $\beta_0, \beta_1, \beta_2, \lambda_1$ are parameters. β_0, λ_1 are always positive.

4. Empirical study

For empirical example, we consider to use the sukuk Ijarah SIKAGII01 with transaction date June 14, 2010. For this sukuk Ijarah, unfortunately the structural model performs poorly, we cannot obtain the price of sukuk ijarah with reasonable values (we obtain price of 350 percent). This result probably due to the poor quality of the accounting report of the company provided to the public, such that we cannot obtain the discount rate with a reasonable values.

Here we also apply the econometrics model of Nakashima dan Saito (2009) model using additional dummy variable of sukuk ijarah, and we obtain the value of credit spread empirically for several sukuk on June 14, 2010. We can stop to calculate the credit spread, or based on this result, we may transform its value into yield and determined the price of sukuk with more suitable to the market price results. If the yields and time to maturity data are ready, we apply the extended NS for modeling yield curve of Sukuk Ijarah, see Figure 2.

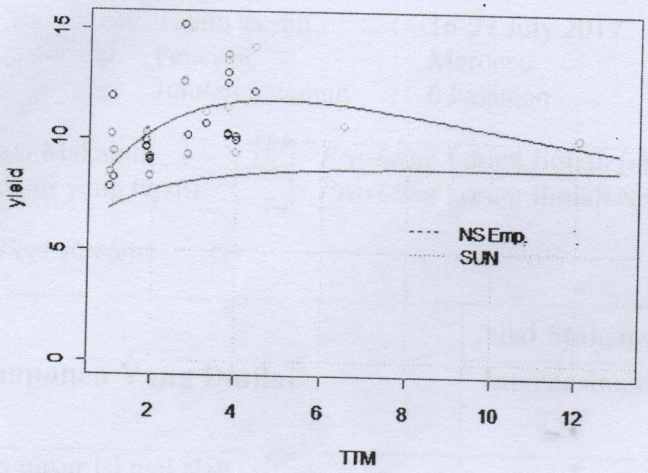

Figure 2. Yield Curve of sukuk ijarah based on reduced form model

5. Conclusions

In this paper we consider the structural and reduced form models for yields of sukuk ijarah, and further applying the NS Extended model for modeling its yields curve. In the empirical study, we obtain the reduced form together with NS Extended model performs quite well.

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