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LIQUIDITY CHARACTERISTICS OF GOVERNMENT BOND MARKETS: A COMPARATIVE STUDY WITH GENERALIZED AUTOREGRESSIVE CONDITIONAL HETEROSKEDASTICITY (GARCH) MODEL

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ABSTRACT

This study explored the potential information on the government bond market in several countries, i.e. China, South Korea, Singapore, Malaysia, Japan, India, Canada, Germany, South Africa, and the United States. Countries experiences of this study differ with respect to the success achieved in enhancing trading of government bonds.

The liquidity has several dimensions with some important characteristics, carries an important information for the investor and government macro policies that have implications on liquidity in their government bond market. The liquid government bond market will facilitate pricing of other and riskier financial assets and the yield curve in a liquid bond market carries important information for the investor. In addition, this study discusses the dimensions of market liquidity and examines whether the size of a country influences its choice.

This paper applied Conditional Heteroscedasticity models (GARCH) analyzing techniques to analyse the impact of government bond volatility toward govenment bond yield. The study resulted in government bond volatility has a positive and significant effect on government bond yield.

Key words: Bond Yield. GARCH, Government Bonds, Liquidity, Volatility

JEL Classification: G12, G18.

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1. INTRODUCTION

The experience of the countries reviewed in this study revealed lack of liquidity remains a major obstacle to their development in practically all countries. The liquid government bond market will facilitate pricing of other and riskier financial assets and the yield curve in a liquid bond market carries important information for the investor (Laksana et al, 2017). This study examined what governments did to promote liquidity in government bond markets. This research report is divided into three Sections. First Section discusses dimensions of market liquidity and examines whether the size of a country influences its choice. The second section deals with some of the macro policies that have implications for liquidity in the government bond market. While the third Section addresses some countries in enhancing best performances liquidity and policy on government bond which can be adopted in Indonesia.

2. DIMENSIONS OF GOVERNMENT BONDS MARKET LIQUIDITY

2.1. Market Liquidity of Government Bond Market

Market liquidity has several dimensions with some important characteristics by which a market can be considered liquid are its relative tightness, depth and resilience. It provides an idea about the costs incurred by market participants in executing transactions; the lower the spread, the higher is the market liquidity. The following table describes the indicators of liquidity in government bond markets.

Table 1 Indicators of liquidity in Government Bond Markets

Countries	Gov bonds 2016	Typical bid-ask spread		Most Active Maturity	Ratio of turnover to average outstanding Gov bond in 2016
		"On the run" bonds	"Off the run" bonds		
Malaysia	86	3	5	3, 5 years	0.52
Singapore	21	5	10	1, 2, 5, 15 years	0.5
Republic Korea	46	1	1	3 years	0.89
Japan	369	7	7	2, 4, 5, 6, 10, 20 years	1.31
India	83	1	1	10 years	1.23
China	225	5	10	1,3, 5,7,10 years	0.33
Germany	278	4	5	1, 2, 5, 10, 30 years	0.72
Canada	69	2	5	1, 3, 5, 10 years	1.08
South Africa	28	2	3	1, 5, 10 years	2
USA	446	3	7	1, 2, 5,10, 30 years	1.01

[2] In basis points, [4] In percentages & currently matures in may 2016

From the Table 1. American and Japanese government bonds had the highest in 2016; (446), Japan (369), China (225) and German (278). The spreads for "on-the-run" bonds varied from a low of 1-2 basis points in India, Korea, Canada, for "off the run" the highest bonds were experienced by Singapore, China and US. Very low spreads in some countries may not provide an accurate picture of liquidity if the volume traded is also low. In a majority of economies, however, spreads seemed to be much higher than those observed in mature markets. Second, for a few economies (notably, ASEAN) the depth of secondary market as measured by the ratio turnover to average outstanding government bonds appeared to be low. The typical EMES was between 1% and 2% compared to that of in USA, India and Japan.

2.2. Volatility of Short Term Rate

The broader policy framework to improve liquidity in the government bond market leaves the specific role of central banks and governments in boosting primary and secondary market liquidity to later sections. The role of policy could be critical in several directions such as the extent to which the bond market is allowed to function according to market-clearing principles and the nature of policy coordination between the government and the central bank. The overall financial sector policy affecting the investor base and the conduct of monetary policy also has significant implications for the depth and maturity of the government bond market

A well developed money market reduces liquidity risks for bondholders by providing access to the immediate cash market. It also facilitates the emergence of a sovereign yield curve, as money market benchmarks lead to the development of long-term yield curves. When the money market is not well developed and the overnight rate is volatile, investors face heightened liquidity risks that limit their ability to undertake maturity transformation. A simple indicator of the development of money markets is given by the volatility of the daily interbank rate, since illiquid markets often witness high volatility of interest rates. As Table 2. shows, the standard deviation of overnight rates in EMEs declined substantially in 2015 compared to the levels in 2005. In many countries, however, the volatility of short-term rates is still high.

Table 2 Volatility of Short-Term Interest Rate[1]

Countries	Mean		Standard deviation	
	2005	2015	2005	2015
Malaysia	2.7	3.2	0.14	0.21
Singapore	2	0.44	1.15	0.04
South Korea	3.2	1.25	1.99	0.62
Japan	1	-0.1	0.64	0.14
India	6.3	6.75	0.14	0.18
China	5.6	4.6	0.07	0.64
Germany	2	0	0.71	0.71
Canada	2.7	0.5	1.38	0.18
South Africa	7.5	7	1.41	1.06
USA	0.25	0.5	0.00	0.18

[1]Based on daily interbank or call money rates

The volatility of short-term rates was still high in several countries such as south Africa, India, and China. The lowest volatility interest rate country was Japan (-0.1) in 2015 and Germany in 2015. They were important in many financial economic models, such as models on the term structure of interest rates, and bond pricing models models. They were also important in the development of tools for effective risk management and in many empirical studies analyzing term premiums and yield curves where risk free short-term rates are taken as reference rate for other interest rates. In addition, they were also a crucial feature of the monetary transmission mechanism. Duguay (1994) describes the monetary transmission mechanism as starting with a monetary authority's actions influencing short-term rates and the exchange rate, which then go on to ultimately affect aggregate demand of inflation.

The term structure of interest rates concerns the relationship among the yields of default free zero coupon bonds that differ only with respect to maturity. These are expectation, liquidity preference, hedging pressure of preferred habitat and segmentation theories of the term structure of interest. According to the expectation theory, the shape of the yield can be explained by investors' expectations about future interest rates. The liquidity preference theory argues that short term bonds are more desirable than long term bonds because former are more liquid. Market segmentation theory assumes that there are two distinct markets for the short and long term bonds. The demand and supply in the long term bond market determines the long term yield and the demand and supply in the short term bond Market determines the short rate. This means that the expected future rates have little to do with the shape of the yield curve. In general, a central bank's purchases of government bonds are considered to lower long-term interest rates through three channels: the signaling channel, the scarcity channel, and the duration channel.

2.3. Average Remaining Maturity of Outstanding Government Bonds

Developing certain benchmark securities with high liquidity characteristics has been considered important in improving liquidity in bond markets. Benchmarks are important not only for developing a risk-free yield curve but also for reducing the servicing costs to government. Savings to government from selling benchmark issues are estimated to be in the order of 5-15 basis points in developed countries (Folkerts-Landau, 2009). Moreover, the availability of benchmark securities with different maturities (regarded as "on-the-run" issues) helps develop hedging markets and improve trading since the prices of these securities trade close to par and are thus better able to capture the market interest rate. Despite recent progress in issuing longer-

maturity papers, The average maturity has on Table 3 where most investor "buy" and "hold", the scope for developing benchmark issues could be limited. The large stock of non-marketable debts, mainly saving bonds and special purpose government bonds, also reduces the availability of benchmark instruments. Japan and German has the lowest average maturity outstanding of government bonds.

Table 3 Average Maturity of Outstanding Government Bonds (years)

Country	2000	2005	2010	2015
Malaysia	4.7	5.2	6	7
Singapore	4.1	3.4	4.1	5
South Korea	5.2	6	5.2	5
Japan	0.7	1	1.5	2
India	7.1	5.2	4.8	5
China	2	2	2.4	2.6
Germany	0.5	1	1	1
Canada	10	5	5	5
South Africa	2	2	5	5
USA	5	5	10	10

[1]Distribution by original maturity, Sources: Central bank & IMF database

2.4. Average Yield of Government Bonds

Anecdotal and empirical evidence has motivated the hypothesis that non-resident demand reduces yields while inducing volatility in response to changes in fundamentals and market sentiment (Beltran et al., 2012;). In contrast, the presence of a stable domestic investor base that includes institutional investors is thought to contain yields and foster stability in bond prices and yields. Institutional investors could be induced to increase their holdings by tightening prudential regulations. These mandated purchases, comparable to statutory purchases by central banks as part of quantitative easing programs, could have a similar effect on yields (Joyce et al., 2011). In Japan, a large domestic investor base has been associated with the low and stable yields despite very high debt (Tukuoka, 2010). This large domestic investor base is mostly a result of the accumulation of pension savings through deposits and investment funds, coupled with a strong home bias. In the euro area, equal regulatory treatment and the perception of homogenous credit risk has fostered investors' desire to diversify, thereby increasing the share of cross-holdings by non-residents (De Santis and Gerard, 2006). Japan average yield is lowest for since 2000 to 2015.

Table 4 Average Yield of Government Bonds (10 years tenor)

Country	2000	2005	2010	2015
Malaysia	3.59	4.24	3.62	3.66
Singapore	4.33	2.89	1.35	1.77
South Korea	7.47	4.40	4.98	2.37
Japan	1.69	1.46	0.44	0.03
India	11.07	6.84	7.55	7.85
China	3.11	3.79	3.29	3.12
Germany	5.16	3.47	2.13	-0.02
Canada	5.87	4.14	2.59	1.03
South Africa	13.20	7.80	7.92	8.41
USA	69.65	83.71	215.87	141.27

Sources: Bloomberg data stream

3. EMPIRICAL MODEL

GARCH (1,1) used in data analysis. Bollerslev (1986) developed GARCH model based on ARCH model. GARCH model developed in order to avoid high order possibility in ARCH model based on parsimony principle or simplest model selection, so its will assure that variance always positive. GARCH equation used in this study as follow :

$$Yield = \alpha + \beta_1 Volatiliy + \varepsilon_t \quad (1)$$

With

$$\varepsilon_t = \Phi_t \varepsilon_{t-1} + ... + \Phi_t \varepsilon_{t-p} + \eta_t \quad (2)$$

$$\eta_t = \sigma_t \epsilon_t \quad (3)$$

$$\sigma^2_t = \alpha_0 + \alpha_1 \eta^2_{t-1} + \ldots + \alpha_p \eta^2_{t-p} + \beta_1 \sigma^2_{t-1} + ... + \beta_q \sigma^2_{t-q} \quad (4)$$

ϵ_t were independent and identical distributed N(0,1) and independent from previous condition of η_{t-p}.

Where,

Yield = Government Bond Yield

Volatility = Government Bond Volatility

Before do GARCH analysis, data stationarity test conducted by using Augmented Dickey Fuller (ADF) statistic as suggested by Greene (2003) dan Enders (2009).

3.1. Unit Toot Test

Data stationarity test results by Augmented Dickey Fuller (ADF) shown in Table 5 as follow.

Table 5 Data Stationarity Test Results

No.	Variables	ADF Statistic (Level)
1.	YIELD	-3.481373*
2.	VOLATILITY	-6.349410*

*level of significance at the 1%

Table 5 shows that all data variables used in this study have ADF test statistics in level which significant at 1% level of significance. Based on that so we can say that all data used in this study were fulfill stationarity requirements and doesn't indicate unit root. This data do not need special treatment and can analyzed directly by using GARCH. Posedel (2005) suggest that GARCH (1,1) is appropriate for data which do not need special treatment. Based on that, so GARCH (1,1) used in this study.

3.2. GARCH Result

Volatility Estimation Understanding the way and the reasons why fixed income returns change, is crucial to comprehend movements of yield curve and somehow investors' strategies as well. During decades, this have been one of the main proposes of asset prices and risk management literature. In fact, during nineties, financial researches have dealt with uncertainty in asset returns analysis through time-varying variance models its generalized extension (GARCH) by Bollerslev (2006). These models were developed to satisfy the uncertainty regarding fluctuations of asset returns. In consequence, literature has extended original GARCH models in order to consider an asymmetric representation. By using GARCH (1,1), we find that government bond volatility has a significant positive effect toward government bond yield at 1% level of significance. While government bond volatility from previous period (t-1) also have a positive and significant impact toward government bond yield at 5% level of significance.

Table 6 GARCH (1, 1) Result

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.005415	0.003671	-1.475133	0.1402
VOLATILITY	0.008501	0.000826	10.28927	0.0000
Variance Equation				
C	0.000130	5.21E-05	2.501074	0.0124
RESID(-1)^2	0.772155	0.310771	2.484644	0.0130
GARCH(-1)	-0.049768	0.216352	-0.230030	0.8181

4. YIELD VOLATILITY RESULT

This chapter is presented in a matrix: matrix volatility base on Yield. This matrix consists of four groups, which were classified based on the combination of volatility and Government Bond Yield. This matrix was based on two main assumptions, i.e. the higher the volatility owned by a State Government bond, the yield will be obtained even greater. The countries with higher-yielding bonds indicated that investors had high liquidity risk.

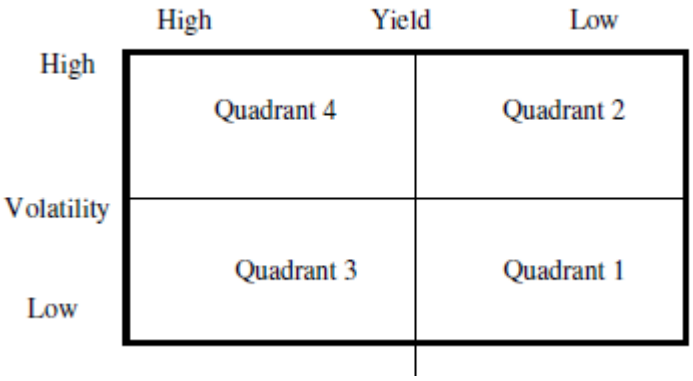

Figure Yield Volatility Matrix

This matrix used a score interpretation that the Volatility base on Yield <0.1 illustrated that the country had Government bond with low volatility and low base yield; investors would tend to avoid it because it was considered to have a low level of liquidity as well. Meanwhile, if the matrix volatility based on Yield, if the volatility > 0.5, the countries with high volatility and had a tendency to have a high yield value would attract investors to invest in government bonds asset.

The following explanations were based on Yield Volatility Matrix in 10 countries. The matrix quadrant 2 consisted of South Africa, India, China and South Korea. The matrix quadrant 2 was occupied by United States, Malaysia and Singapore. The matrix quadrant 3 featured Germany and Canada. For the first quadrant japan state is the only in the quadrant. Based on figure 8 the STRIPS benchmark for Indonesia Government bond on next research would be based on matrix quadrant 4 matrix featuring South Africa, India, China and South Korea for benchmarking countries. The matrix quadrant 4 describe high volatility and high yield which by the measure will attract investors to invest in government bonds asset.

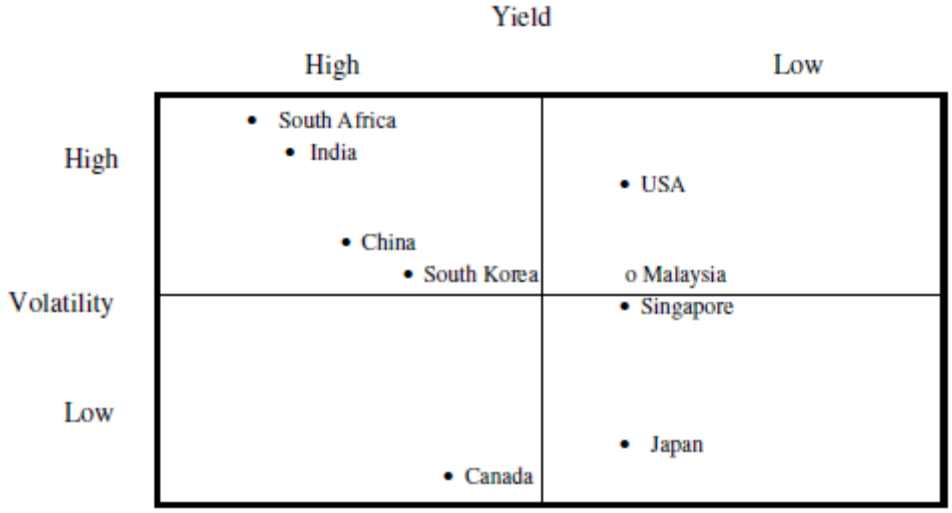

Figure 8 Yield Volatility Matrix

5. CONCLUSION

Developing certain benchmark securities with high liquidity characteristics has been considered important in improving liquidity in bond markets. Benchmarks were important not only for developing a risk-free yield curve but also for reducing the servicing costs to government. In most Asian countries, trading in government bonds is through dealer-based OTC markets. There are, however important exceptions. In China all trading in government bonds take place through stock exchanges. This study applied Conditional Heteroscedasticity models (GARCH) analyzing techniques to analysis effect volatility to Yield. Volatility had a positive and significant effect on Yield. Volatility Estimation Understanding the way and the reasons why fixed income returns change, is crucial to comprehend movements of yield curve and somehow investors' strategies as well Country experiences differ with respect to the success achieved in enhancing trading of government bonds in organised stock exchanges. For example, while the national stock exchange in India provides facilities for wholesale trading of government bonds under transparent market conditions, the volume traded is significantly lower than that in the OTC market. One of the reasons why electronic trading in Korean stock exchanges has not picked up is the prevalence of broking through personal networks between dealers and institutional investors. In many countries, trading had been relatively low although government bonds are listed on the stock exchange. Possible reasons for such phenomenon included high transaction costs due to thinness of markets, low degree of market transparency and high settlement risks.

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