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LIQUIDITY PERFORMANCE MEASURES on BOND MARKETS

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Abstract. Financial markets are very important because of the facility provides in trade. Hence, performance of a financial market is important. Liquidity is a crucial indicator to evaluate a financial market's performance. In this paper, liquidity performance measures for bond markets are examined with real-life examples.

Keywords. Liquidity, Bond market, Liquidity measures

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TERM PROJECT

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0.1 Introduction

Financial Markets include any place or system that provides buyers and sellers the means to trade financial instruments, including bonds, equities, the various international currencies, and derivatives (OCC, 2019). Financial markets provide great convenience for purposes such as investing, growing, saving, and transferring money locally and internationally. Financial markets can be classified into 2 groups as primary markets and secondary markets. New securities such as government bonds, local bonds are issued in primary markets. On the other hand, the securities that have been already issued are issued in secondary markets.

There are many financial marketplaces in the world such as New York Stock Exchange, NASDAQ for stock markets; Chicago Mercantile Exchange, Intercontinental Exchange for commodities market; Over-the-Counter-Markets for bonds. Since there are many markets, the performances of them become critical. Liquidity is one of the key indicators to measure performance of a financial market. In this paper, liquidity measures of bond markets are examined.

There are 3 main definitions of liquidity as (1) the ease with which an asset can be turned into cash, (2) the ability to buy or sell an asset quickly and in large volume without substantially affecting the asset's price and (3) the ability of a market to accept large transactions (Choudhry, 2010).

Liquidity for financial markets is so important. Sarr and Lybek says that liquid markets provide many benefits with allowing central banks to use indirect monetary instruments, permitting financial institutions to accept larger asset-liability mismatches, rendering financial assets more attractive to investors who can transact in them more easily (Sarr and Lybek, 2002). The liquidity of the bond market is obviously of interest to all traders in the market (Ødegaard, 2017).

Liquid markets tend to exhibit five characteristics as tightness, immediacy, depth, breadth, and resiliency (Sarr and Lybek, 2002). Tightness means low transaction costs. Immediacy is related to speed. If the orders in the market can be fulfilled quickly, it can be said that the market has immediacy characteristics. Depth means ability to absorb large market orders. If depth is greater, the large level orders cannot affect the security's price deeply. Breadth means that orders are both numerous and large in volume with minimal impact on prices (Sarr and Lybek, 2002). Resiliency is an ability to balance the orders that causes any imbalances in the market. If a market is more resilient, the market is more liquid.

Liquidity measures which are mentioned in the next section are constructed around these features. These measures try to measure these characteristics.

0.2 Literature Review

Liquidity is a crucial gauge of market development, transmission of monetary policy, and price efficiency for financial markets. However, it is difficult to measure the level of liquidity in any market. There are some approaches to gauge the liquidity of financial markets. The

approaches for measuring the liquidity of bond markets are examined in this section. When looking the literature, different measures have been developed, but the general methodology is to make calculations on the basis of bonds and aggregate them to the market.
As mentioned, characteristics of liquid markets are tightness, immediacy, depth, breadth, and resiliency. The measures are shaped around these characteristics. In this context, Sarr and Lybek argue that liquidity measures can be grouped under 4 main headings as transaction cost measures, volume-based measures, equilibrium price-based and market-impact measures (Sarr and Lybek, 2002).

0.2.1 Transaction Cost Measures

All investors trading in the bond markets incur some transaction costs depending on the market conditions. Among the transaction costs to which investors are subject include those associated with order processing, asymmetric information, carrying inventory, and oligopolistic market structures. Since bid-ask spreads represent these costs, it is used as a liquidity measure. Bid-ask spread is mainly the difference between bid price and ask price. If bid-ask spread is higher, in other words the bond market has high transaction costs, it implies that market is illiquid. The bid-ask spread can be formulated in 2 ways as follows:

$$S = P_A - P_B \text{ or } (P_A - P_B)/[(P_A + P_B)/2] \tag{1}$$

where P_A= ask price, P_B=bid price
By aggregating the bid-ask spreads calculated per bond, a market-wide assessment can be achieved, but since the prices of the bonds in the market can be very different from each other, it would be more reasonable to calculate the differences as a percentage. Immediacy characteristic of liquidity is examined with this measure.

0.2.2 Volume-based Measures

With these types of measures volume of transactions are measured with respect to price variability. Breadth and depth characteristics of liquidity are examined with this measure. Two main measures are used under this category: Turnover Rate and The Hui-Heubel Liquidity Ratio

- Turnover Rate

Turnover rate is basically the percentage of trading volume of a bond with respect to outstanding amount of the bond in the bond markets. It can be calculated as follows:

$$V = \sum_i P_i * Q_i \tag{2}$$

where P_i = price of bond i and Q_i=quantity of bond i at specified time

$$Tn = V/(S * P) \tag{3}$$

where S = outstanding bonds in the bond market and P = price
If turnover is higher, it can be said that the bond market is more liquid.

- The Hui-Heubel Liquidity Ratio

The Hui-Heubel Liquidity Ratio tries to quantify the other aspect of market breadth, which links transaction volume to price effect. Hence, the ratio also measures the resiliency of the market.
As Arbuzov and Frolova indicates, the Hui-Heubel Liquidity Ratio can be calculated as follows (Arbuzov and Frolova, 2012):

$$L_{HH} = [(P_{max} - P_{min})/P_{min}]/[V/(S * \overline{P})] \quad where, \tag{4}$$

P_{max} = highest daily price over last 5 days
P_{min} = lowest daily price over last 5 days
V = total dollar volume traded last 5 days
S = number of bonds outstanding in the market
$\overline{P}$ = average closing price of the instrument over a 5-day period

If L_{HH} is lower, it can be said that the bond, and also the bond market, has higher liquidity

0.2.3 Equilibrium Price-Based Measures

These measures try to capture the orderly price fluctuations while catching the price balance. Hence, resiliency characteristics of liquidity is examined here. Prices in a bond market are affected when a new information is available in the market. The information causes a volatility. This volatility can be observed at short and long term. If the bond market is resilient, it is expected low price volatility in the market at short and long term. Schwartz and Hasbrouck (1988) suggest the Market-Efficiency Coefficient(MEC) to measure this concept. The coefficient can be calculated as follows:

$$MEC = (Var(R_t)/(T * Var(r_t) \quad where, \tag{5}$$

$Var(R_t)$ = variance of the logarithm of long-period returns
$Var(r_t)$ = variance of the logarithm of short-period returns
T = number of short periods in each longer period
If market is more resilient, in other words more liquid, the ratio should be closer to 1 or slightly below 1. However, Bernstein (1987) argues that factors such as market maker intervention, and inaccurate price determination involving partial adjustment to news, cause prices to adjust in relatively small, and positively correlated increments. In such a case, long-term price variability would be higher than short-term price variability and MEC would be higher than 1.

0.2.4 Market-Impact Measures

These measures also examine the price movements due to the degree of liquidity, but they try to differentiate movements from factors like market conditions, released new information. Price discovery speed, and obviously resiliency characteristic, is tried to measure with these types of measures.
Hui and Heubel suggest a calculation by using systematic and unsystematic risk approach. Systematic risk is the type of risk caused by external factors that affect all investments and, systematic risk is the probability of a loss associated with the entire market or the segment and cannot be controlled whereas unsystematic risk is associated with a specific industry as well as it is controllable (Thilini and Anuradha, 2021). In other words, systematic risk is the risk which can't be inseparable at bond level; unsystematic risk is the bond-specific risk after systematic risk is removed from market. Hui and Heubel suggest Market-Adjusted Liquidity. To separate a bond's return from market return, Market-Adjusted Liquidity uses residuals of regression model. The calculations can be summarized as follows:

$$R_i = \alpha + \beta * R_m + u_i \quad where, \tag{6}$$

R_i = daily return on the ith stock
R_m = daily market return
β = regression coefficient (systematic risk)
u_i = regression residuals (unsystematic risk)

$$u_i^2 = \gamma_1 + \gamma_2 * V_i + e_i \quad where, \tag{7}$$

u_i^2 = dsquared residuals from previous equation
V_i = daily percentage change in dollar volume traded
e_i = residuals
If γ_2^2 is smaller, it means the bonds and the bond market can be said liquid because smaller γ_2^2 implies that volume's effect on variance of market is lower.
In addition to these measures, Hotchkiss and Jostova (2017) argue that issue size and age are by far the two most important determinants of liquidity for US corporate bonds. If a bond's size is larger, it can be said that the bond is more liquid since it is traded by more investors with lower inventory costs. Also, a bond is less liquid while getting old because of the less active portfolios.
There are also other proposals regarding liquidity measures. For example, Hameed, Helwege, and Packer suggest some liquidity measures in 2019. They categorize the measures into 2 categories as quantity-based measures and price -based measures.

0.2.5 Quantity-based Measures

These measures try to estimate the intensity of trading by investigating average trading activity. More activity means more liquid market. The quantity-based measures suggested can be listed as follows:

1. the number of trades in a bond per year
2. the number of days a bond traded during the year
3. turnover
4. the percentage of days with zero trading
5. average number of days since the last trade on the bond

0.2.6 Price-based Measures

These measures investigate price of bonds and transaction costs in the market. As mentioned above, the bond market is more liquid if the transaction costs are lower. The price-based measures suggested can be listed as follows:

1. absolute returns divided by trading volume, known as Amihud price impact explained in detail later.
2. price dispersion
3. the spread in the monthly high and low traded bond prices as a percentage of the average of the two prices
4. the one in previous measure with daily data
5. average realized bid-ask spread

Amihud (2002) suggests an illiquidity measure to calculate illiquidity level. It is the most widely-used such measure in empirical financial economics when citations records are investigated (Barardehi et al., 2021). The Amihud illiquidity measure formula can be seen as follows:

$$ILLIQ = (1/N) * \sum_{t=1}^{T} (|r_t|/V_t) \quad where, \tag{8}$$

T = number of days
V_t = dollar volume at day t
R_t = daily return
N = is the number of trading days (with nonzero volume)

0.3 Data and Sources

There are some indicators that is needed to calculate the liquidity measures. These are mainly listed as follows:

0.3.1 Bid-Ask Spreads

As mentioned, bid-ask spread is mainly the difference between bid price and ask price. To measure liquidity of a bond market, the spreads of the bonds with different times of maturity such as 3 months, 12 months, 5 years must be calculated.

0.3.2 Tick Size

It is mainly the minimum price movement of an instrument as a result of trading activity.

0.3.3 Turnover Indicators

As mentioned, turnover is one of the key liquidity measures. To measure liquidity of a bond market by using turnover measure, the data of turnover rate, yearly trading, amount of outstanding, yearly trading volume must be collected.

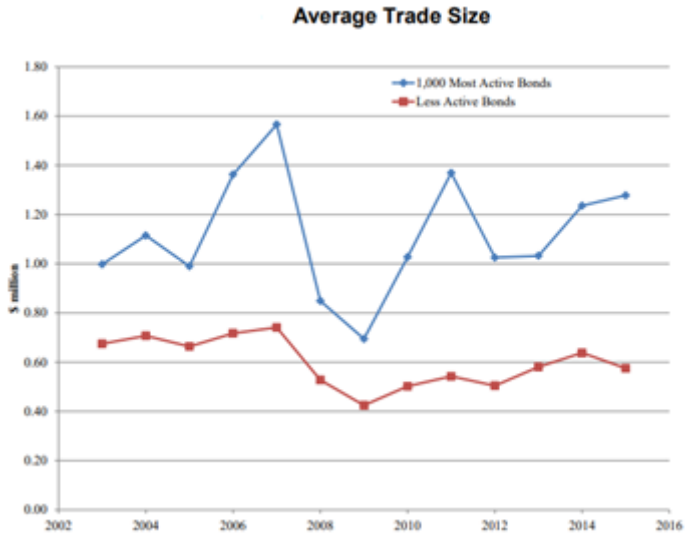
0.3.4 Other Indicators

These indicators are the ones that may affect the market structures. The indicators include the data of market structure as customer/interdealer, tick size, percent of holdings of non-residents. The data are very important since the results give a sign for characteristics of market.
There are many databases that the related data are available. Bloomberg, Nasdaq, New York Stock Exchange, Thomson-Reuters database. In addition, there are vehicles to provide over-the-counter bond market data. TRACE is one of the most popular vehicles to access information. The Trade Reporting and Compliance Engine (TRACE) is the vehicle that facilitates the mandatory reporting of over-the-counter transactions in eligible fixed income securities (TRACE, n.d.). The vehicle also provides reporting of bond markets. For example, average trade size and bid-ask spreads are very important indicators to measure liquidity. As illustrated below in Figure 1 and Figure 2, TRACE system provides reporting for them (retrieved from www.finra.org):
Electronic Trading Platform of Malaysia government is another example of database. Its features are similar to TRACE system. It serves as the primary and secondary bond markets' centralized price and trade repository and disseminator. In the case study which will be discussed in the next section, data are retrieved from this database.

0.4 Methodology

Literature review about liquidity measures for bond markets, the indicators and data, where the data are available issues have mentioned so far. In this section, the methodology of implementing the discussed issues in a real-life example is examined. Hameed, Helwege, and Packer conducted a paper in 2019 which is Measuring Corporate Bond Liquidity in Emerging Market Economies: Price- vs Quantity-based (Hameed, Helwege, and Packer,

Figure 1: Average Trade Size



2019).

The Malaysian corporate bond market's liquidity is investigated in the paper. Two sets of liquidity measures are selected, and these measures are calculated for each bond. The sets are quantity-based liquidity measures and price-based liquidity measures. After, the measurement values are aggregated to marketwise, as mentioned earlier. Also, some calculations are made to examine the reliability and efficacy of the two sets measures. Correlations of two sets of measures are calculated for the reliability of the quantity- and price-based liquidity measures; bond-level regression analyzes are issued for the efficacy of the quantity- and price-based liquidity measures. ETP data, which is introduced in previous section, from 1997 to 2017 is analyzed in this paper.

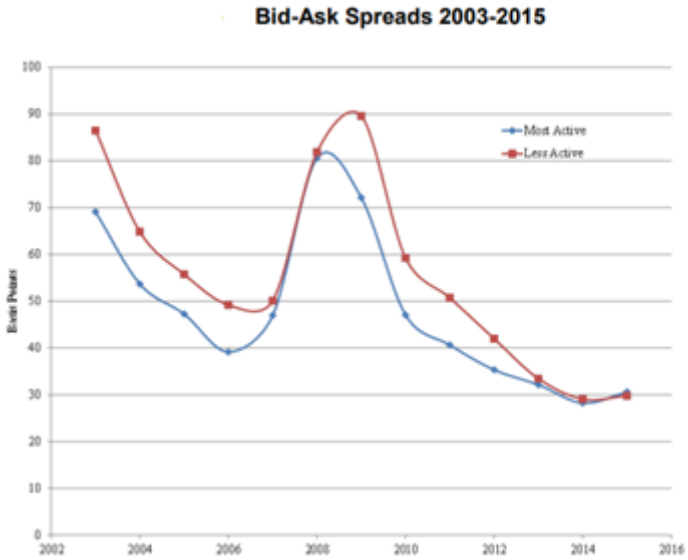
The selected liquidity measures for two sets as listed as follows:

0.4.1 Price-based Measures in the Paper

1. Amihud Price Impact = absolute returns / trading volume as *NegAmihud*
2. Price Dispersion = volume-weighted variance of traded bond price relative to the volume-weighted average price of the bond as *NegPriceDisp*
3. Spread between high and low monthly traded bond prices during the year as *NegSpdMth*
4. Spread between high and low daily traded bond prices during the month as *NegSpdDay*
5. Average realized bid-ask spread as *NegRSpd*

All measures are multiplied by -1 since it has negative effect on liquidity.

Figure 2: Bid-Ask Spreads



0.4.2 Quantity-based Measures in the Paper

1. The number of trades per year as *TradeNo*
2. The number of days bond I traded during the year as *TradeDay*
3. Percentage of days with zero returns of zero trading day for bond i during the year as *NegZTD*. It is multiplied by -1 since it has negative effect on liquidity
4. The average number of days since the last trade on the bond as *NegTradeInt*. It is also multiplied by -1
5. Average realized bid-ask spread as *NegRSpd*

In addition to these measures, there are 2 composite liquidity measure for two sets to construct an overall measure as PriceLiq for price-based measures and QtyLiq for quantity-based measures.
After analyzing the data, the statistics for all corporate bonds found are represented in the Table 1 and Table 2 as follows:

According to the quantity-based liquidity measure results, average turnover value in the market is 0.5 percent in a year. Median of the trading day of a bond is equal to 1.5. Also, the bonds are not traded during the 97.6 percent of a year. These and other result show that the market is extremely illiquid. Also, Hameed and his friends point that the variation in the prices of the highly illiquid Malaysian corporate bond market appears to be much lower than what they would expect (Hameed et al., 2019). This is a hint of that price-based liquidity measures are problematic according to them. Therefore, correlations among two sets of measures and bond-level regression analyses are made in the paper.

Table 1: Summary Statistics of Quantity-based Liquidity Measures

Statistics	number of bonds	Mean	Std Dev	p25	p50	p75
Turnover	3634	0.005	0.019	0.002	0.004	0.006
TradeNo	3636	0.070	0.353	0.020	0.035	0.067
NegZTD	3636	-0.976	0.034	-0.992	-0.986	-0.974
TradeDay	3636	2.571	3.630	0.815	1.489	2.846
NegTradeInt	3276	-95.430	146.140	-112.186	-54.638	-22.406
QtyLiq	3276	0.489	0.168	0.369	0.473	0.595

Table 2: Summary Statistics of Price-based Liquidity Measures

Statistics	number of bonds	Mean	Std Dev	p25	p50	p75
NegAmihud	3636	-8610.985	51280.266	-2840.015	858.862	-48.779
NegPriceDisp	3636	-2.956	7.458	1.500	-0.028	-0.003
NegSpdMth	3094	-0.527	4.314	-0.248	-0.076	-0.016
NegSpdDay	2768	-2.728	20.005	-0.103	0.035	-0.014
NegRSpd	3460	-18.193	371.392	-0.456	-0.042	0.000
PriceLiq	2755	0.450	0.144	0.353	0.448	0.546

Correlation results between quantity-based measures, price-based measures and two-sets of measures are represented in the figure 3. As seen, price-based and quantity-based liquidity measures are negatively correlated in general. It means that if bond market or bonds are more liquid with respect to the quantity-based measures, they are more illiquid with respect to the price-based measures.
Bond level regression in the paper is set on the bond characteristics as following formula:

$$Liq_{i,y} = \alpha + b1 * Size_{i,y} + b2 * Age_{i,y} + c * Remain\ maturity_{i,y} + \epsilon_{i,y} \quad where, \tag{9}$$

$Liq_{i,y}$ is one of the 12 measures. Size, measured by the value of the bond outstanding in million Malaysian ringgit, Age, the number of years since the bond was first issued and Remain maturity, the number of years remaining till the bond matures. Helwege and Wang figure out that larger bonds tend to be more liquid (2018). Hence, the hypothesis is bond liquidity increases if size increases; decreases if age increases. The results are illustrated in the figures 4, 5, and 6.
After results, the inference that quantity-based liquidity measures are more efficacy than the price-based ones, is done.
As illustrated in the above case example, liquidity measures are determined firstly. Secondly, analyses are made from the proper database. Thirdly, measurements are evaluated to determine whether the bond market is liquid or not. For the examined paper, different sets of measures are also evaluated between each other for which ones are better to measure liquidity.

Figure 3: Correlation Results

Panel A: Correlation of Quantity-Based Liquidity Measures

	Turnover	TradeNo	NegZTD	TradeDay	NegTradeInt	QtyLiq
Turnover	1.000	0.368	0.235	0.239	0.420	0.593
TradeNo		1.000	0.831	0.837	0.562	0.923
NegZTD			1.000	0.993	0.435	0.875
TradeDay				1.000	0.445	0.881
NegTradeInt					1.000	0.700
QtyLiq						1.000

Panel B: Correlation of price-based liquidity measures

	Neg Amihud	Neg PriceDisp	Neg SpdMth	Neg SpdDay	NegRSpd	PriceLiq
NegAmihud	1.000	0.407	0.179	0.069	0.121	0.357
NegPriceDisp		1.000	0.756	0.637	0.274	0.816
NegSpdMth			1.000	0.732	0.283	0.850
NegSpdDay				1.000	0.325	0.799
NegRSpd					1.000	0.522
PriceLiq						1.000

Panel C: Correlation of quantity- vs price-based liquidity measures

	Neg Amihud	Neg PriceDisp	Neg SpdMth	Neg SpdDay	NegRSpd	PriceLiq
Turnover	0.242	−0.130	−0.214	−0.226	0.024	−0.194
TradeNo	−0.119	−0.481	−0.570	−0.387	−0.191	−0.502
NegZTD	−0.282	−0.529	−0.576	−0.331	−0.230	−0.508
TradeDay	−0.280	−0.531	−0.569	−0.331	−0.227	−0.502
NegTradeInt	0.300	−0.283	−0.423	−0.340	−0.030	−0.410
QtyLiq	0.054	−0.462	−0.572	−0.396	−0.169	−0.455

Figure 4: Regression Results for All Bonds

Regression: All bonds

Panel A: Quantity-based liquidity measures

Variables	Turnover	TradeNo	NegZTD	TradeDay	NegTradeInt	QtyLiq
Size[1]	–1.35e-06***	0.000182***	6.07e-05***	0.00657***	0.0854***	0.000215***
	(3.05e-07)	(2.18e-05)	(5.08e-06)	(0.000537)	(0.00770)	(8.30e-06)
Age2	–0.000513***	–0.00782***	–0.00112***	–0.135***	–20.12***	–0.0265***
	(3.45e-05)	(0.00114)	(0.000311)	(0.0338)	(1.073)	(0.00159)
Remain maturity[2]	–3.16e-05*	0.000631	0.000269	0.0254	–0.272*	0.000196
	(1.82e-05)	(0.000544)	(0.000160)	(0.0161)	(0.154)	(0.000371)
Constant	0.00449***	0.0144***	–0.996***	0.390***	–35.87	0.445***
	(0.000742)	(0.00221)	(0.00116)	(0.118)	(22.01)	(0.0123)
Observations	8,772	8,774	8,774	8,774	8,128	8,128
R-squared	0.077	0.218	0.254	0.266	0.131	0.239

Panel B: Price-based liquidity measures

Variables	Neg Amihud	Neg PriceDisp	Neg SpdMth	Neg SpdDay	NegRSpd	PriceLiq
Size[1]	–18.90***	–0.00120***	–8.82e-06*	2.85e-06	–0.000487*	–0.000105***
	(3.454)	(0.000332)	(4.45e-06)	(2.31e-06)	(0.000279)	(9.20e-06)
Age[2]	–901.6	0.770***	0.000603*	0.00471***	0.0274	0.0101***
	(551.3)	(0.0876)	(0.000342)	(0.00135)	(0.0200)	(0.00181)
Remain maturity[2]	–1,193***	–0.0416*	–8.04e-05	0.000285**	0.00251	–0.00432***
	(208.0)	(0.0207)	(9.51e-05)	(0.000131)	(0.00631)	(0.000552)
Constant	1,848***	0.0151	–0.00499	–2.001***	–0.0827	0.594***
	(185.8)	(0.0602)	(0.00339)	(0.000407)	(0.0673)	(0.0284)
Observations	8,774	8,774	7,649	6,784	8,321	6,756
R-squared	0.044	0.066	0.007	0.035	0.005	0.149

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

[1] In millions

[2] In years.

Figure 5: Regression Results for Conventional Bonds

Regression: Conventional bonds

Panel A: Quantity-based liquidity measures

Variables	Turnover	TradeNo	NegZTD	TradeDay	NegTradeInt	QtyLiq
Size[1]	−3.64e-07	0.000215***	6.81e-05***	0.00740***	0.0655***	0.000186***
	(5.28e-07)	(3.75e-05)	(7.86e-06)	(0.000801)	(0.00547)	(1.03e-05)
Age2	−0.000564***	−0.0137***	−0.00167**	−0.202***	−19.14***	−0.0251***
	(5.82e-05)	(0.00277)	(0.000593)	(0.0644)	(1.329)	(0.00322)
Remain maturity[2]	−1.29e-05	0.00215*	0.000902**	0.0930**	0.501**	0.00177***
	(9.99e-06)	(0.00103)	(0.000350)	(0.0349)	(0.236)	(0.000594)
Constant	0.00277***	0.00521***	−0.998***	0.147***	−186.0**	0.283***
	(1.27e-05)	(0.00103)	(0.000328)	(0.0341)	(69.53)	(0.0204)
Observations	3,004	3,004	3,004	3,004	2,733	2,733
R-squared	0.099	0.198	0.248	0.262	0.145	0.233

Panel B: Price-based liquidity measures

Variables	Neg Amihud	Neg PriceDisp	Neg SpdMth	Neg SpdDay	NegRSpd	PriceLiq
Size[1]	0.000186***	−0.00212***	−1.63e-05**	7.75e-06	−0.000318*	−0.000109***
	(1.03e-05)	(0.000539)	(7.63e-06)	(4.63e-06)	(0.000177)	(1.19e-05)
Age[2]	−0.0251***	0.522***	0.00130	0.00595***	0.0319	0.00938***
	(0.00322)	(0.0803)	(0.000815)	(0.00158)	(0.0284)	(0.00305)
Remain maturity[2]	0.00177***	−0.115***	−5.26e-05	0.000251	0.00184	−0.00404***
	(0.000594)	(0.0230)	(0.000124)	(0.000307)	(0.00742)	(0.000923)
Constant	0.283***	0.162***	−0.00700	−0.0208**	0.000649	0.492***
	(0.0204)	(0.0187)	(0.00424)	(0.00759)	(0.0350)	(0.0172)
Observations	3,004	3,004	3,004	3,004	2,733	2,733
R-squared	0.099	0.198	0.248	0.262	0.145	0.233

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

[1] In millions.

[2] In years.

Figure 6: Regression Results for Islamic Bonds

Regression: Islamic bonds

Panel A: Quantity-based liquidity measures

Variables	Turnover	TradeNo	NegZTD	TradeDay	NegTradeInt	QtyLiq
Size[1]	−2.33e-06***	0.000145***	4.95e-05***	0.00538***	0.101***	0.000244***
	(1.82e-07)	(1.33e-05)	(4.62e-06)	(0.000510)	(0.0101)	(1.27e-05)
Age2	−0.000487***	−0.00605***	−0.00110***	−0.130***	−20.73***	−0.0280***
	(3.26e-05)	(0.000559)	(0.000233)	(0.0267)	(1.726)	(0.00198)
Remain maturity[2]	−2.36e-05	−0.000105	−0.000121	−0.0157	−1.063***	−0.00144**
	(2.86e-05)	(0.000354)	(0.000112)	(0.0121)	(0.281)	(0.000600)
Constant	0.00764***	0.0175***	−0.995***	0.498***	−35.69	0.446***
	(0.000663)	(0.00218)	(0.00134)	(0.137)	(22.30)	(0.0128)
Observations	5,768	5,770	5,770	5,770	5,395	5,395
R-squared	0.080	0.350	0.300	0.306	0.126	0.250

Panel B: Price-based liquidity measures

Variables	Neg Amihud	Neg PriceDisp	Neg SpdMth	Neg SpdDay	NegRSpd	PriceLiq
Size[1]	−6.944**	−0.000220	−1.78e-06*	9.90e-07	−0.000639	−0.000102***
	(3.167)	(0.000347)	(8.53e-07)	(5.41e-06)	(0.000496)	(1.12e-05)
Age[2]	−889.0**	0.926***	0.000226	0.00418**	0.0290	0.0104***
	(309.6)	(0.110)	(0.000165)	(0.00183)	(0.0213)	(0.00240)
Remain maturity[2]	−556.1***	0.0297	−0.000244**	0.000406	0.00216	−0.00425***
	(184.4)	(0.0234)	(0.000107)	(0.000260)	(0.0128)	(0.000690)
Constant	854.8***	−0.111	0.000633	−0.0137**	−0.0198	0.593***
	(289.7)	(0.0861)	(0.000940)	(0.00605)	(0.130)	(0.0288)
Observations	5,770	5,770	5,082	4,521	5,528	4,514
R-squared	0.066	0.078	0.007	0.008	0.007	0.150

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

[1] In millions.

[2] In years.

0.5 Conclusion

Liquidity is a very important metric for bond markets. The degree of liquidity affects the investors' choice whether to enter the market or not. Therefore, determining right bond market liquidity measures, accessing the right data are very crucial. In this paper, liquidity measures mentioned for bond markets in the literature are explained. Also, how the measurements should be done and how to evaluate that the selected liquidity measures are valid are explained via real-life example in this paper. Different issuers, maturities, bond types, bond privileges may make the market specific, but it seems that this study will be a good guide for those who want to make a liquidity assessment in any bond market.

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