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Drivers of Corporate Bond Market Liquidity: Evidence from Pakistan

Attiya Yasmin Javid* and Waseem Khan†

Abstract

This study examines the factors that contribute to corporate bond market liquidity using the data of Term Finance Certificates from March 2009 to March 2018. The results of summary statistics indicate that majority of trades are carried out in large issue and high credit rating corporate bonds. The regression results indicate that the most important derivers of bond trading volume are the issue size of bond, bond market rating, market interest rate, bond price volatility and equity market conditions. The results of this study lead to the implications that authorities should take steps to improve the bond market in general and promote the flow of trading of these bonds in a centralized way. This will help the policy makers as well as the market participant for making investment decisions.

Keywords: Corporate bonds, liquidity, issue size, credit rating, price volatility.

1. INTRODUCTION

The creation of a bond market from the macroeconomic view point provides an alternative and cost-efficient source of financing corporate sector for expansion, development and large scale projects. Corporate bonds market is important for determination of prices of other assets and bank interest rates. In the emerging markets, since the middle of 1990s, companies are also focusing on finance from bond market in addition to bank's finance. Therefore, awareness regarding importance of establishment of efficient bond market is also increasing in regulators and policy makers of these countries [Luengnaruemitchai and Ong (2005)]. The corporate bond market of Pakistan is relatively less developed and less transparent due to the fact that corporate bonds were traded over the counter earlier. However, the corporate bond market

* Attiya Yasmin Javid <attiyajavid@pide.org.pk> is Professor of Economics at Pakistan Institute of Development Economics, Islamabad.
† Waseem Khan is Additional Director, Securities and Exchange Commission of Pakistan.

plays an important role in the capital and financial markets of Pakistan's economy.

Despite the significance of corporate bond market, less attention is given by researchers in Pakistan to this area. There are very few descriptive studies carried out on Pakistan's bond market that are based on the existing condition of debt market and recommendations for future development. There is a wide gap in empirical work in this area. The main reason for this is non-availability of data for the corporate bonds. The motivation of this study comes from the fact that this neglected area needs to be explored for the development of capital market of Pakistan. The corporate bond market can play an important role in promoting the private sector investment. Development of this sector will therefore provide an alternative source of financing to corporate sector and will reduce the reliance of corporate sector on banks. The developed corporate bond market will ultimately diversify the risk of our economy which is currently banking centric.

Pakistan corporate bond market is illiquid and dealer driven [Nazir *et al.* (2010)]. The empirical analysis of liquidity in corporate bond market of Pakistan is important to develop this market and planning to increase the retail base of this market. Therefore, it is very relevant to review the present status of liquidity and derivers of liquidity in Pakistan's local environment. This empirical analysis of liquidity will help the policy makers as well as the market participant for making investment decisions.

This is a first attempt to investigate the corporate bond market liquidity in Pakistan on the basis of actual trade data because prior to 2009 in Pakistan centralized trading platform and central reporting system was not available. No specific work has been done on the corporate bond market liquidity or bid-ask spreads on the basis of primary or secondary trading due to non-availability data. However, now due to the data availability on Mutual Funds Association of Pakistan (MUFAP) website, it is possible to analyze the corporate bond trading and liquidity. This transaction based data allows undertaking the present study to examine the factors affecting the trading volume corporate bond market of Pakistan.

The present study examines the liquidity in the corporate bonds in the Pakistan and factors that derive the market liquidity. The study investigates the impact of bond issue size, credit rating of the issuer, market interest rates, the equity market condition and the bond price volatility on the bond market activity. These factors are significant contributors of corporate bond market liquidity [Hotchkiss and Jostova (2017)].

The remaining part of this study is organized as follows: Section 2 provides the overview of bond market in Pakistan. The literature review on corporate bonds is presented in section 3. Section 4 discusses the methodology and data used in the analysis. The empirical results are presented in Section 5 and Section 6 concludes the study.

2. OVERVIEW OF THE CORPORATE BOND MARKET

Pakistan's debt market is comprised of government securities market (including Treasury Bills, Pakistan Investment Bonds, Sukuk) and corporate debt market. The major instruments which trade in Pakistan corporate bond market are Term Finance Certificates (TFCs), Commercial Papers and Sukuks. TFC's are issued by the companies as instruments of redeemable capital as per the requirements of Companies Ordinance 1984.

The Pakistan corporate debt market is pre-dominated by TFCs and Sukuks and there are total 86 TFCs in issue with a total outstanding amount of Rs.153.917 billion, whereas the total number of Sukuk in issue are 55 with a total outstanding amount of Rs.224.474 billion on December 31st 2010. The investor base of both listed and unlisted TFCs/Sukuks primarily consist of commercial banks, DFIs, mutual funds, employee benefit funds, insurance companies and other institutions with a very low participation from the retail sector [SECP-BATS Review Committee (2010)].

Internationally the corporate bond markets are dealer driven and operate over the counter. The International Organization of Securities Commissions (IOSCO 2004) notes that "a majority of bond trading in most SC24 jurisdictions occurs bilaterally, dealer-to-client." FSA (2005)

reports that the predominant form of trading in UK bond markets is based around the bond dealer.[1]

In line with the international practice, in Pakistan trading of listed and unlisted TFCs have always been carried out at Over the Counter (OTC), market with direct negotiation between buyers and sellers and also through broker. Prior to 2009 there was no separate trading platform available at stock exchanges for trading of TFCs. Listed TFCs are listed on Karachi, Lahore and Islamabad stock exchange, however, general listing requirements are not applicable on them as these requirements are made as per the requirement of equity securities. Karachi Stock Exchange (KSE) in 2009 has launched the separate trading platform with the name of Bond Automated Trading System (BATS) for the trading of listed corporate bonds at Karachi Stock Exchange. The objective of this platform is to provide a trading inference as per the requirements of debt market participants with risk management and pricing mechanism [SECP-BATS Review Committee (2011)]. However, even after introduction of this platform majority of trades in listed and unlisted TFCs are carried over the counter.

As in Pakistan the corporate bonds are traded on non-centralized over the counter market until 2009, therefore, corporate debt market is not transparent as any pre-trade or post trade data is not available. Mutual Funds are the major investor in corporate bond market and in order to provide the fair price discovery for Net Asset Value (NAV) calculation of mutual funds, in January 2009 Securities and Exchange Commission of Pakistan (SECP) has instructed the mutual funds to report their transaction both in listed and unlisted debt securities to MUFAP. This was first time in Pakistan which provided a central source of post trade information regarding trading of corporate bonds in Pakistan. This information on trades of corporate bonds is the big and main source of corporate bond trading data. These transactions compose a significant portion of the market for corporate bonds as mutual funds are a major holder of TFCs/Sukuks. Moreover, introduction of BATS at

[1] https://www.fsa.usda.gov/Assets.

KSE also provided another source of information regarding trading of listed corporate bonds, however, trades at BATS are very low.

3. LITERATURE REVIEW

The bond market is well researched area in studies related to developed markets of US and Europe, however, very little work has been done on corporate bond market from emerging markets including Pakistan. This section provides the review of previous empirical research done in this area.

Regarding the theoretical literature on models of liquidity; market microstructure literature can take two strands broadly: the models of information cost and models of inventory cost. The seminal work of Copeland and Galai (1983) on information costs results in series of paper on this issue. These models depend on the costs of trading against informed traders to generate a bid-ask spread. Later, these models are extended to sequential trade models by Glosten and Milgrom (1985) and Easley and O'Hara (1987). Kyle (1985) has further extended this approach by bringing in the strategic behavior of an informed trader. This literature is further enriched by incorporating the strategic behavior of uninformed (or liquidity) traders. Admati and Pfeiderer (1988), Foster and Viswanathan (1990), Seppi (1990) and O'Hara (2004) provide an excellent review of literature of information models.

Garman (1976) has introduced the model on inventory costs. His work is extended by Amihud and Mendelson (1980) by incorporating inventory and time-variation of inventory and its link to price changes. Ho & Stoll (1981) have analyzed this issue from the dealers' perspective as they provide liquidity immediately and focus on the required compensation for this service. O'Hara and Oldfield (1986) have examined the role of inventory costs in transactions prices and it is recognized as a factor affecting liquidity and spreads.

The equity and bond market liquidity is extensively empirically investigated for the developed markets. For the role of liquidity in credit markets focus is mostly to explain the yield spread on corporate bonds or credit default swaps. This provides evidence of non-default component of these spreads and attributes at least part of it to illiquidity effects

[Huang and Huang, 2003 and Longstaff, Mithal and Neis (2005)]. The literature on liquidity in debt market has focused on the transactional issues of corporate debt for example bid-ask spreads and trading volume in corporate bonds for US market is examined by Chakravarty and Sarkar (1999), Hong and Warga (2000), Schultz (2001) and Hotchkiss and Jostova (2017). The liquidity and informational efficiency in the US corporate bond market is investigated by Hotchkiss and Ronen (2002) and Alexander *et al*. (2000).

Hotchkiss and Jostova (2017) have examined the determinants of US bond trading for 1700 corporate bonds for five years. The findings reveal that bond issue size and age of the bond are the most important determinants of corporate bond trading and the volume of trading declines as bond become aged it goes into less liquid portfolio. The results show that bonds of listed companies trade more actively than the bonds of unlisted companies. The liquidity in investment category corporate bonds and high-yield bonds is more influenced by the changes in interest rate. Hong and Warga (1995) have examined the US dealer market and exchange-based transaction and estimated the bid asked difference for bonds for retail investors and corporate investor in the market. The study finds no different in effective spreads between exchange based transactions and over the counter dealer transactions. Biais and Fany (2006) have analyzed the transactions costs and information in the European corporate bond market during 2003 to 2005. They have used the quotes and trades dataset provided by International Index Company and the International Capital Market Association. Their study concludes that the corporate bond spread increase with maturity and default risk and spread decrease with trade size.

Chacko and Stafford (2004) find that in the absence of direct measures of liquidity for most corporate bonds, the researchers are mostly forced to use proxies such as bid-ask spreads and trading volume even in case of most US corporate bonds and these proxies may be quite imperfect [Crabbe and Turner (1995)]. For a more direct measure of liquidity they construct a statistic known as latent liquidity, which measures the accessibility of a bond to dealers, based on the aggregate trading characteristics of investors holding bonds. They find that the

credit quality, the age of a bond, the size of a bond issue, the original maturity value of a bond at issue date, and provisions such as a call, put, or convertible options have a strong impact on liquidity and liquidity statistic appears to be a good proxy for liquidity.

As regards the emerging markets there is scarce work on corporate bond market. In case of Indian bond market issue size and credit rating are main sources of liquidity [Chaudhari *et al*. (2014)]. Chan *et al.* (2006) have found that the main derivers of liquidity of Malaysian bond market are issue size, new issues, maturity spread, credit ratings and change in inventory. Ahmad *et al.* (2009) document that macro-economic factors such as Kuala Lumpier Composite index, inflation, interest rate and bond yield are the factor effecting Malaysian bond market liquidity. Clabchitrichaidol and Panyanukul (2005) conclude that the key determinants of liquidity in Thai bond market (where bid ask spread is used to measure liquidity) are issue size, volatility, bond holding, actions and trading volume.

There are very few studies done for Pakistan bond market and they are mostly focused on descriptive analysis. A comprehensive study for bond market is done by Khalid (2007) comparing the early reformer of East Asia (Malaysia, Singapore and South Korea) with late reformers (China, India and Pakistan) and draws lessons for Pakistan to make meaningful development in the bond market. Pakistan does not meet most of the preconditions needed to develop an efficient bond market. The macroeconomic uncertainties and lack of complete information makes the decision making process difficult for market participants. The comparison based on some social indicators and institutional factors indicates Pakistan performed poorly in most of these rankings even within the South Asian region. This comparison shows that Pakistan needs to make a good effort to put necessary infrastructure to ensure market efficiency. The study recommends initiating policies for the development of a domestic bond market.

Nazir *et al.* (2010) provide an overview of future and prospects of bond market development in Pakistan. They find that liquidity of the bond market could be improved by strengthening useful corporate bond transaction information sharing, allowing repurchase order and short-

selling in corporate bonds. Choan (1999) in the World Bank report provides an overview and suggestions for development of mortgaged – backed securities market in Pakistan. The report has emphasized the need of necessary changes in laws, rules and regulations regarding securitization. Hameed (2006) presents challenges faced by bond market in Pakistan and compared it with world market. He suggests introduction of REPO and short selling in corporate bond market to improve liquidity in Pakistan corporate bond market.

From the above literature review, it is evident that one of the challenges faced by Pakistan corporate bond market is less liquidity. This study tries to fill this gap by investigating the factors that influence bond market liquidity in Pakistan.

4. METHODOLOGY AND DATA

The development of a bond market is very important for Pakistan as it provides an alternative and cost-efficient source of financing to corporate sector for expansions and development and large scale projects on the one hand. On the other hand, corporate bonds market is essential for determinations of prices of other assets and bank interest rates. Therefore, it is crucial to examine what factors contribute towards the bond market liquidity in Pakistan.

4.1 Theoretical Framework

The theoretical ground of the bond market liquidity and its determinants is based on market microstructure theory that identifies three main factors that may affect liquidity in financial markets [Upper (2001)]. These include order processing costs, inventory control considerations, and adverse selection problems. Theoretical arguments of this study are framed on inventory cost of the bonds.

Market liquidity is the ability to trade quickly at a low cost. Trading volume is an intuitive and widely cited measure of market liquidity [O'Hara (2004)]. The 'inventory paradigm' given by Demsetz (1968) supports using trading volume as a proxy for market liquidity. The argument is that inventory costs for low-trading bonds are likely to

be higher and are passed on to the investor in the form of higher bid-ask spreads. Review of previous literature supports the use of bond trading as an indicator for liquidity such as Stoll (1989) state that liquidity depends on the cost of financing dealer inventories. Hotchkiss and Jostova (2017) use the bond trading as a measure of liquidity for US bond market. Their argument is that liquidity depends on the cost of financing of brokers for holding inventory. This means that illiquid bonds have high cost of inventory which will be indicative in the form of high bid and ask spread. Low volumes and high spread is the indicator of illiquidity. In this study the liquidity in the TFCs is measured on the basis of trading activity in a particular month following O'Hara (2004).

In choosing the factors that influence the liquidity of corporate bond market motivation comes from the theory and previous empirical literature. Theory suggests there are number micro factors that affect bond market liquidity such as product design, market microstructure and behavior of market participants [Mares (2002)]. Macroeconomic factors also play their role in determining market liquidity such as size of the economy, economies of scale (Mohanty, 2002) and market conditions stress and boom [Borio (2000)]. This study selects those bond and stock variables that have the potential to impact the liquidity of corporate bond in Pakistan's business environment. In the present study issue size, credit rating, interest rate, bond price volatility and equity market conditions are considered as potential factors that have influence on liquidity of TFCs. For corporate bond liquidity the total trading volume (buy and sell) is used as a proxy for liquidity. The definition of these variables suggested by theory and supported by previous empirical literature is given below.

The bond issue size is used as determinates of bond liquidity in this study. It is expected that size should have a significant positive impact on bond liquidity, as dealers can more easily manage their inventory of larger issues following the inventory paradigm argument. Hotchkiss and Jostova (2017) have used the issue size as determinant of liquidity of corporate bond. They find the size of the issue and age of the bond as the most economically important determinants of bond trading volume. Hong and Warga (2000) show that larger issues have

significantly tighter bid-ask spreads. However, for the 55 Fixed Income Pricing System FIPS -traded bonds, Alexander, *et al*. (2000) also find that there are active trading volumes in issue of large size. The first hypothesis is formulated as:

H_1: Issue Size has a positive effect on bond liquidity.

The bond credit rating shows the level of credit risk of the bond. Hotchkiss and Jostova (2017) use the bond credit rating as determinant of liquidity of corporate bond. Alexander, *et al.* (2000) also support the view point that high yield bonds with lower credit rating trade more actively. Hotchkiss and Ronen (2002) find that lower grade bonds are more likely to reflect firm specific information. Following the argument that uncertainty regarding bond value is likely to be higher for lower credit quality issues and more trading is expected in high-yield bonds with higher credit risk. It is believed that the speculation about changes in the bond's credit quality, which are more likely for lower grade bonds, should induce more trading. This leads to develop the second hypothesis:

H_2: Credit risk has negative effect on bond liquidity

Theory postulates that speculative trading increase in longer duration bonds on the basis of investor forecast [Harris and Raviv (1993) and Kandel and Pearson (1995)]. Empirical literature also confirms this relationship; Hotchkiss and Jostova (2017) have used the changes in long term interest rate as determinants of liquidity of corporate bond. Following Alexander *et al.* (2000) this study tests whether change in interest rate impacts the bond trading. Therefore, the third hypothesis tested is framed as:

H_3: Change in market interest rate has a positive effect on bond liquidity

Equity market conditions have influence on the trading in securities market as investors change their portfolios in light market conditions and information. The empirical research on the relationship between equity market conditions and liquidity of the market has two contrast outcomes. Some researchers find the positive relationship

between market volatility and trading volume [Gallant, *et al*. (1992)]. On the opposite side, Engle and Lange (1997) find the negative relationship between market condition and liquidity. Theory also supports that financial market conditions influence bond market liquidity and this leads to test the hypothesis that:

H_4: Equity market conditions has a positive effect on bond liquidity

Trading volume is positively affected by returns shocks because price volatility reflects differences in investors' opinions in turn creating more speculative trading. Higher bond price volatility is associated with lower trading volume. Chabchitrchadol and Panyanukul (2005) on the contrary find the lower price volatility is an indicator of better marker liquidity (bid-ask spread) and market microfinance theory also supports this association [Upper (2001)]. The price volatility is estimated by moving average of standard deviation for 5 days (1 week) using daily data and converted into monthly. The following hypothesis is formulated.

H_5: Price volatility has a positive effect on bond liquidity.

4.2 Model Specification

The standard approach to study the derivers of liquidity is to estimate the liquidity equation using the bond market factors after controlling for risks and economy/market conditions. This study uses monthly trading as indicator of bond liquidity and its derivers include issue size, bond yield volatility, credit risk, interest rate risk and equity market conditions. The following model (1) specifies the factors affecting the trading volumes of corporate bonds.

$$LIQ_t = a_0 + a_1 LIQ_{t-1} + a_2 SIZE_t + a_3 CR + a_4 PV_t + a_5 INT_t + a_6 EQ_t + \varepsilon_t \quad \ldots (1)$$

where, LIQ_t is monthly trading volume of corporate bond, LIQ_{t-11} is the previous period liquidity and since the trading volume prevailing in the previous period is expected to affect the investment behavior in the current time period called inertia. Therefore, it is reasonable to include

the lagged liquidity term also in the model. $SIZE_t$ denotes the issue size of the bond, *CR* denotes the credit rating and it is dichotomous variable which takes 1 for bonds which are rated less than A and zero for the bonds which are rated in the range of AAA-AA and A, PV_t measures bond price volatility. INT_t is change in interest rate and measured by month KIBOR average which is indicator of interest rate risk and EQ_t denotes KSE 100 index which is indicator of equity market condition. The αs are parameters to be estimated and ε_t is random error term. The corporate bonds volume, issue size and bond prices of Term Finance Certificates (TFCs) are available on daily basis on mutual fund website that is converted into monthly observations.

The dynamic panel specification of liquidity given in model (1) contains lag dependent variable on the right hand side which is correlated with error term and creates problem of endogeiniety. The Ordinary Least Square will give biased results. To deal with problem Generalized Method of Moments is used and lags of variables is used as instruments.

The financial time series have the characteristics of autoregressivevess and heteroscedasticity and LM ARCH test confirms this for data. The autoregressive conditional heteroscedasticity (ARCH) family of models introduced by Engle (1982) are suitable for estimating the time varying relationship between bond liquidity and derivers of bond liquidity. Among these models, the GARCH (1, 1) specification suggested by Bollerslev (1986) is considered far better specification because it is parsimonious and avoids over fitting. The autoregressive-moving average (ARMA) model is suitable.to specify conditional mean equation along with derivers of liquidity. In the time varying bond liquidity model (2) ARMA (1, 0) with GARCH (1, 1) specification is used based on Schwarz Bayesian information criteria (SBC). The conditional mean equation and conditional variance equation are given below:

$$LIQ_t = \alpha_0 + \alpha_1 LIQ_{t-1} + \alpha_2 SIZE_t + \alpha_3 CR + \alpha_4 PV_t + \alpha_5 INT_t + \alpha_6 EQ_t + \varepsilon_t$$

$$log(h_t) = \theta_0 + \theta_1 log(h_{t-1}) + \theta_2 \varepsilon^2_{t-1} + \beta_1 SIZE_t + \beta_2 CR + \beta_3 PV_t + \beta_4 INT_t + \beta_5 EQ_t \quad \ldots (2)$$

The parameters of conditional mean equation contains same as in equation (1). In conditional variance equation ε_{t-1}, h_t, h_{t-1} are lag error, conditional variance and lag conditional variance respectively. The θ_0, θ_1, θ_2 are constant, GARCH and ARCH parameters and βs are coefficients of factors effecting volatility of bond liquidity. Maximum Likelihood estimation technique is applied.

4.3 Data and Sample

The data for analysis are collected from mutual fund website MUFAP, Karachi Stock Exchange website (KSE), Securities and Exchange Commission of Pakistan (SECP) and Financial Market Association of Pakistan (FMA). The trade data of corporate bond Term Finance Certificates are consolidated that is available on the website of Mutual Funds Association of Pakistan. The corporate bonds volume, issue size and bond prices of Term Finance Certificates (TFCs) are available on daily basis on mutual fund website that is converted into monthly observations. This data are available from March 2009 to March 2018, because prior to this period the data are not available. These data include all the trades in listed TFCs carried by all the market participants in the Pakistan corporate debt market. This data do not include the trades in unlisted TFCs carried out between the market participants other than mutual funds. The interest rate data is obtained from the Financial Market Association of Pakistan. Data regarding the capital market conditions that are captured by KSE 100 index are obtained from Pakistan Stock Exchange. The authenticity of the data is confirmed by the fact that such data contain only the listed TFCs where trade take place and KSE 100 is also extracted from KSE website and all sources of data are highly reliable.

All TFCs for which prices are reported to MUFAP is selected. The total volume of trade in individual TFCs is consolidated on monthly basis from daily data and used to measure liquidity. The price volatility is estimated by moving average of standard deviation for 5 days (1 week) using daily data and converted into monthly. The credit rating of TFCs is grouped into two categories to create a dummy variable. The category

consists of low rated bonds is taken as one the category consists of high rating bonds in the range of AAA-AA and A takes value zero to capture credit risk. The change in monthly KIBOR is used for measuring interest rate risk. The KSE 100 index on each month end is used as indicator for capital market conditions. This gives monthly time series data of corporate bond related variables and other variables.

5. Empirical Results

This study examines that previous period liquidity, bond issue size, price volatility, credit risk, interest rate risk and equity market conditions have impact the liquidity of TFCs from March 2009 to March 2018 in case of Pakistan.

The analysis begins with the summary statistics of the data reported in Table 5.1. The average trading value is 38.66 million rupees per month with high standard deviation of 55.5. The monthly mean KIBOR rate is 9.56% and standard deviation is 2.7. The KSE 100 index has mean value 24018.3 and standard deviation is high because the maximum value reaches to 50591.6.

Table 5.1: Descriptive Statistics

	Mean	Median	Maximum	S Dev.	Skewness	Kurtosis
Trade Value (Rs million)	38.66	26.63	523.4	55.5	6.7	56.1
Trade Price % of Face Value	96.23	99.63	110.5	13.9	-6.1	42.1
KIBOR	9.56	9.94	13.4	2.7	-0.1	1.5
KSE100	24018.3	22160.9	50591.6	13088.0	0.4	1.7

The unit root results are presented in Table 5.2 The trading volume and issue size is stationary so logarithmic transformation is done. The interest rate, KSE 100 index and prices are non-stationary, therefore, log first difference is used for analysis. The credit rating is dummy variable which takes value 1 for low credit rating bonds and zero otherwise.

Table 5.2: Unit Root

	Level	
Issue size	-3.05**	I(0)
Liquidity	-5.49***	I(0)
Price Volatility	-4.74***	I(0)
Return KSE100	-11.25***	I(0)
Change in Interest Rate	-6.20***	I(0)

Note: Mackinnon (1996) critical values -3.49, -2.88 and -2.58 at 1%, 5% and 10%.

The data show the very low trading volume in corporate bonds and particularly in lower rating category. The data source of this study is mutual fund sector and in Pakistan mutual funds normally invest in high credit rating bond, apparently this is reason for more trading is done in high rating bonds. Table A1 in appendix split the data into three groups on the basis of credit rating; first group consist of AAA and AA credit rating, second group consist of A rating and third group consist of below A rating. Majority of trades are carried out in AAA-AA rating category and A rating category, 60% and 34%, respectively. In below A rating category there are only 6% trades. Table A2 in appendix split the data according to issue size. Summary statistics shows that majority of trades are carried out in the category of above Rs.1000M to Rs.3000M. The average size of trades in this category is Rs.63M and maximum trade was of Rs.397M. This table shows that trading in below Rs.1000M and above Rs.5000M bond size are minimum. From the review of descriptive statistics, it is observed that corporate bond market is illiquid represented by low volume and infrequent trades.

For the analysis of derivers of corporate bond liquidity, the study uses monthly data from March 2009 to March 2018. The GMM is used to estimate the liquidity model (1) and lags of variables are used as instruments. The liquidity model (2) has ARMA (1,0)-GARCH(1,1) specification it estimates the factors that effects liquidity in conditional mean equation and factors that effects volatility of liquidity in conditional variance equation.

The results of regression analysis for models (1) and (2) are reported in Table 3. Lag of liquidity is used to assess the existence of inertia in the trading volume and results suggest that pervious liquidity positively impacts the current liquidity in models (1) and (2). The result shows that the size of the corporate bond has significant positive impact on the liquidity of bond as dealers can more easily manage their inventory of larger issues. This result is according to the expectations, because as inventory paradigm argument suggests that large issues are normally traded at higher frequency. This implies to enhance liquidity more frequent and systematic issuance in primary market is important. Moreover, this result is also in consistent with the finding of Chabchitrchaidol and Panyanukul (2005) and Hotchkiss and Jostova (2017) that the bond issue size as the most important determinant of bond trading.

The regression results of both models show that there is negative and significant relationship between low credit rating and trading volume in the bonds. This result reveals that high credit risk reduces the trading volume in the bonds in case of Pakistan. These result are as per theory that uncertainty of value is likely to be higher for lower credit quality issues. The speculation about changes in the bond's credit quality, which are more likely for lower grade bonds induces more trading. This is because lower grade bonds go to illiquid section of market and because traders normally hastate to trade in high risk instruments. Moreover, as data consist of trades of mutual fund sector, and mutual funds mostly invest in high grade bonds. Therefore, the credit risk decreases liquidity as trades in lower grade bonds are limited confirms the hypothesis 2. Hotchkiss and Ronen (2002) show that lower grade bonds are more likely to reflect firm specific information. Alexander, Edwards, and Ferri (2000) document more trading in high-yield bonds with higher credit risk.

The third hypothesis is that there is positive and significant relationship between interest rate risk and liquidity. The results of both models indicate that interest rate risk increases liquidity. This suggests that changes in market interest rates increase the trading volume in the bond which is in conformity with theoretical literature (Harris and Raviv

(1993) indicating that differences in investors' forecasts should lead to more speculative trading in the highest duration issues. The changes in market interest rate adversely affect high duration bonds, which push the traders to trade such bonds in the changing interest rate environment [Alexander, Edwards, and Ferri, 2000 and Hotchkiss and Jostova (2017)].

The equity market conditions have positive impact on corporate bond trading. The firm-specific news should affect trading in both the equity and debt of a firm. This implies that equity market conditions increase the bond trading activity. Hotchkiss and Ronen (2002) find support for the hypothesis that bond and stock returns react jointly to common factors. This result is consistent with the finding of Gallant, Rossi, and Tauchen (1992) that observe a positive relation between market volatility and trading volume of New York Stock Exchange traded stocks. The bond price volatility increases bond liquidity that is in confirmation with theory Harris and Raviv (1993) and previous empirical evidence [Hotchkiss and Jostova 2017, Alexander, Edwards, and Ferri, 2000]. They find that bond trading increases with bond returns volatility because price volatility reflects differences in investors' opinions. This in turn induces more speculative trading

These results of liquidity model with ARMA(1,0)-GARCH (1, 1) specification also confirm that previous liquidity, issue size, price volatility, interest rate credit rate and equity market conditions are key derivers of trade activity of Pakistan bond market (Table 5.3). The results of conditional variance equation show that previous residuals square and previous volatility increase the volatility and this effect is persistent. The issue size, price volatility, credit risk, interest rate risk and equity market conditions increase liquidity volatility. These findings are supported by Chabchitrchaidol and Panyanukul (2005) and Hotchkiss and Jostova (2017).

On policy side the finding that issue size has important and significant contribution to trading volume and implication is that to enhance liquidity there is more frequent and systematic issuance in primary market.

Table 5.3: Derivers of Liquidity of Corporate Bond Market

Variable	Model 1	Model 2	
		Conditional Mean Equation	Conditional Variance Equation
Constant	1.75	2.23	4.54
	(2.93)	(2.01)	(2.02)
Lag Liquidity	0.08***	0.11***	
	(3.88)	(2.19)	
Price Volatility	0.19***	0.11***	0.15***
	(2.88)	(2.24)	(3.35)
Issue Size	0.33***	0.32***	0.27***
	(2.56)	(3.59)	(2.02)
Credit Risk	-0.32**	-0.31**	0.12
	(-1.88)	(-1.97)	(1.02)
Interest Rate Risk	0.23***	0.17***	0.19***
	(3.12)	(2.43)	(2.71)
Equity Market Conditions	0.26***	0.31***	0.46***
	(2.88)	(2.56)	(2.82)
ARCH			0.43***
			(3.65)
GARCH(1)			0.56***
			(5.62)
R-squared	0.71	0.73	
ARCH LM test p value			0.268
F-stat (p value)	0.00	0.00	

Note: GMM is applied to estimate model (1) and lag variables are used as instruments. The ***, ** and * indicate significance at 1%, 5% and 10% respectively. In OLS rob ust standard errors are reported.

McCauley and Remolona (2000) suggest lumping bonds of different maturity, bond buy-back of small issues that have small outstanding size together with more sizable auctions that are favored by the market to increase liquidity. The result that interest rate risk, credit risk and price volatility risk has impact on liquidity and policy

implication is clear to find ways to hedge excess risk. Chabchitrchadol and Panyanukul (2005) suggest for Thai bond market that effective hedging interest rate and credit risk can be done by creating derivative market and also develop active and well-functioning private repurchase market. Mares (2002) also support the role of a highly liquid future market to generate liquidity for cash market. The results of liquidity model with ARMA-GARCH (1, 1) model reveal that derivers of liquidity are same in the conditional mean equation. However, the results of conditional variance equation indicate that the pervious volatility and past residuals have positive impact on liquidity volatility. The price volatility, interest rate risk, and credit risk and equity market conditions also increase the liquidity volatility and volatility is found persistent. The implication for policy is that there is need of widening the investors and market participants. Chabchitrchadol and Panyanukul (2005) propose for Thai market that an increase in market participants will diversify players' risk profiles. Homogeneity of market participants in terms of transactions needs, risk assessment and investment horizon enhance market liquidity.

6. Conclusions and Policy Implications

The current study undertakes analysis of key derivers of the liquidity for the bonds market in Pakistan using the data of Term Finance Certificates from March 2009 to March 2018. The liquidity is measured by trading volume and lag liquidity, issue size, price volatility risk, interest rate risk, credit risk and equity market conditions are found as factors that affect corporate bond liquidity.

These results are very useful for all the participants of corporate bond market including asset management companies, investment advisors, treasures, insurance companies and policy makers to understand the liquidity of corporate bond market. This understanding will give them an insight to the local environment of Pakistani corporate bond market. The results of this study leads to the implications that authorities should take steps to improve the bond market in general and promote the flow of trading of these bonds in a centralized way are discussed above.

Some other suggestion by Kalid (2007) and Hamid (2006) are emphasized by this study as well: bond buy-back program of small issues and the reissuance will increase the trading volume by new auctions, permitting market participants to short sell, development of repurchase market to improve market structure, tool for market participants to hedge their position and mange liquidity, expanding market participants and investor to make the market more resilient to risks. The understanding of derivers for liquidity increases the efficiency of the current trading and reporting system and designing new trading mechanism.

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Appendix

Table A1: Descriptive Statistics of Variables According to Credit Rating Group

	AAA and AA	A	Below A
No of Trade	359.00	205.00	33.00
Mean	85.84	80.12	57.03
Median	45.35	38.38	36.99
Maximum	971.62	1408.16	282.76

Table A2: Descriptive Statistics of Variables According to Issue Size Group

Issue Size	Issue up to Rs 1000M	Above Rs. 1000M to Rs.3000M	Above Rs. 3000M to Rs.5000M	Above Rs.5000M
No of trades	82.00	315.00	137.00	56.00
Mean	27.66	62.58	115.22	187.33
Median	16.68	40.00	55.72	121.70
Maximum	157.87	397.34	1408.16	971.62