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Spread Determinants in Corporate Bond Pricing: The Effect of Market and Liquidity Risks

Summary: This paper investigates the effect of market and liquidity risks on corporate bond pricing in Turkey, an emerging market, and in Europe. Results show that corporate bond returns have exposure to liquidity factors and not to market factors in both settings. Corporate bonds issued in Turkey have significant exposure to fluctuations in benchmark treasury bond liquidity and corporate bond market liquidity; while corporate bonds issued in Eurozone have exposure to equity market liquidity and are sensitive to fluctuations in a 10-year generic government bond liquidity. The total estimated liquidity risk premium is 0.7% per annum for Turkish "A" and above graded corporate bonds, and 1.08% for the last investment grade level (BBB-) long-term bonds. For Eurozone, the total liquidity risk premium is 0.27% for investment grade 5-10 year term bonds, 1.05% for high-yield 1-5 year term bonds and 1.02% for high-yield 5-10 year term category.

Keywords: Corporate bond, Liquidity risk, Credit spread, Risk premium.

JEL: G12, G13.

In the Turkish corporate bond market, the developing one, and the European market, the developed one, spreads are not determined solely by historical default losses. Since Turkey is a young and emerging market, conjectural changes originating from worldwide events affect capital market instruments and investors a lot. As capital market instruments, corporate bonds are subject to these effects as well. In young markets like Turkey, investors face the risk of having to hold the security until maturity. Even if they want to sell it at some point during the bond's term, they cannot do so easily because of illiquid conditions in the secondary market, Moreover, contrary to Eurozone corporate bond market, many Turkish companies with corporate bonds issued are not public. Therefore, using solely stock market indicators would not capture market specific risks.

The aim of this paper is to contribute to the literature by studying the impact of liquidity and selected market risk factors on corporate bond spreads in Turkey and compare the findings to Europe. To the best of our knowledge, this is the first study to investigate the determinants of corporate bond spreads in Turkey, which has a younger bond market compared to developed countries. Since corporate bonds are affected by liquidity and market originated shocks besides the risk of default, the related risk premia that help to explain the credit yield spread will be estimated. Debt capital market is a proper ground to test the liquidity in asset pricing because corporate bonds are correlated

with the treasury bond returns and stock returns (Simon H. Kwan 1996). Moreover, corporate bond yields are corrected for the expected loss (Murillo Campello, Long Chen, and Lu Zhang 2008).

1. Literature Review

Earlier studies on corporate bond markets mostly focused on the default component of credit spreads assuming that non-default components for bonds of different classes are the same (Hui Chen et al. 2018). For instance, Lawrence Fisher (1959) found that the yield spread on bonds depends on the probability that the issuing firm would default. However, the theory that bond credit spreads can be explained by default risk only is at odds with empirical evidence and several other factors affecting bond credit spreads were also considered in the literature. In one such study, James O. Horrigan (1996) employed accounting data in determining long-term credit standing and administration, and found that total assets, long-term liquidity ratio, short-term capital-turnover ratio, long-term capital-turnover ratio, and profit-margin ratio were significant predictors of corporate bond ratings. In their seminal paper, Robert C. Merton (1974) showed that the default-free interest rate and the variance of the firm's operations determine the risk premium. Subsequently, Mark Weinstein (1981) studied corporate bond yields from the systematic risk perspective and provided some evidence that systematic risk of corporate bond pertained to the interest rate and default risk. In a more recent study, John Trussel (1997) developed and tested a contingent claims model of default probability that was based on five variables: firm value, face value of the debt, time to maturity of the debt, instantaneous return, and standard deviation of firm value.

In 2000s, the questions about how well credit risk models explain market prices and whether there are factors other than default risk affecting the corporate bond spread began to intensify. A group of studies focused on private information and bond price jumps. In one such study, Daniel Folkinshteyn (2019) demonstrated that earnings surprises are positively related to bond price changes for firms with non-investment grade ratings. On the contrary, George J. Jiang, Ingrid Lo, and Adrien Verdelhan (2011) found that the association between announcement surprises and bond price jumps is limited. Similarly, Ramazan Gençay and Nikola Gradojevic (2013) found that private information explains a minor portion of variation in bond returns. In another study by Jiang and Lo (2014), they found that bond price changes associated with high intensity of private information flow display persistence over time. Paola Paiardini (2015) investigated the market microstructure in Italian government bond market, which is the largest market in Eurozone, and showed a lower probability of informed trading in dealer-to-customer market compared to the inter-dealer market.

To estimate bond spreads, Edwin J. Elton et al. (2001) used risk free rate, bankruptcy probability, tax and risk premium and found that most of the bond returns were due to systematic risk. Yakov Amihud (2002) showed that equity returns were affected by the expected and unexpected liquidity, and the ILLIQ index measure of liquidity that he developed has been used in a large number of subsequent studies. For instance, Joel Hasbrouck (2003) demonstrated that ILLIQ was highly correlated with transactions data based price impact estimates.

In their study, Joost Driessen (2005) adopted a different approach and provided an empirical decomposition of default, liquidity, and tax factors that determine expected corporate bond returns and documented significant tax and liquidity effects in explaining corporate bond returns. Francis A. Longstaff, Sanjay Mithal, and Eric Neis (2005) and Long Chen, David A. Lesmond, and Jason Wei (2007) also showed that a significant part of corporate bond yield spread could not be ascribed solely to default risk, and that non-default elements were forcefully related to measures of illiquidity. This finding was compatible with verification on illiquidity in secondary corporate bond markets (e.g., Amy K. Edwards, Lawrence E. Harris, and Michael S. Piwowar 2007; Jack Bao, Jun Pan, and Jiang Wang 2011). Sheen Liu et al. (2009) also showed that term structure models should include total common risk factors in order to better explain the dynamics of corporate bond yields.

Madhu Kalimipalli and Subhankar Nayak (2012) underlined the dominant character of illiquidity on bond prices in the Driessen's (2005) study and showed that both equity volatility and bond liquidity were significant factors in US corporate bond market. Of particular relevance to this study is the paper by Frank De Jong and Joost Driessen (2012), which analyzed the impact of market risk and liquidity risk on US and European corporate bonds for the period between 1993 and 2002. The authors documented that liquidity risk is a priced factor in the determination of corporate bond returns.

In their study, Kay Giesecke et al. (2011) studied corporate bond default rates using a data set that covers the 1866-2008 period and found that stock returns, stock return volatility, and changes in Gross Domestic Product (GDP) were powerful estimators of default rates while credit spreads were not. In another study, David Aboody, John S. Hughes, and Bugra N. Ozel (2013) studied the effect of financial crisis on corporate bond returns by focusing on the effect of government actions and policies. They used earnings returns as a mediator for cash flow news and government bond returns as an intermediary for discount rate news. Their results showed a positive relationship between earnings changes and corporate bond returns. However, a negative relationship for T-Bill returns was documented during non-crisis periods. In another study, Zihuguo He and Konstantin Milbradt (2014) internalized market liquidity to give prominence to liquidity-driven default and default-driven liquidity elements in addition to solely liquidity and default elements in credit spread. More recently, Chen et al. (2018) suggested a decomposition design to catch both credit and illiquidity risk premium by adjusting historical moments of default probabilities and measures of illiquidity.

In a non-US study, Victor Fang and Chi-Hsiou D. Hung (2014) examined the relation between firm-specific risk and corporate bond prices in Australia. They found that idiosyncratic volatility had no effect on bond prices while the direction of the systematic risk did. Moreover, idiosyncratic diffusion in the stock returns in the preceding week was positively associated with bond price changes. This effect was most pronounced for firms with lower default risk. In another non-US study, Kiyotaka Nakashima and Makoto Saito (2009) explored the determinants of the credit spread of corporate bond rates over interest swap rates by using secondary market data on corporate bonds issued in Japan between 1997 and 2005. They found that credit spreads correctly reflected firm level financial factors debt-to-equity ratios, volatility, and maturity, especially for longer-term bonds. In addition, they emphasized that an economy-wide

factor played a significant role in determining credit spreads. In one of the rare studies focusing on emerging markets, Eduardo Vieira dos Santos Paiva and José Roberto Ferreira Savoia (2008) analyzed the factors that influence the issuing price of corporate bonds in Brazil in the period from year 2000 to 2004. They applied a factor model, in which exogenous variables explained return and price behavior. They found that the index variable, the probability of default and the bond's maturity affect pricing and pointed out associations of long-term bonds with better rating issues.

Given the cross-sectional and temporal variation in their liquidity, emerging equity markets provide an ideal setting to examine the impact of liquidity on expected returns (Geert Bekaert, Campbell R. Harvey, and Christian Lundblad 2007). However, as is clear from the above discussion, only a limited number of studies focused on corporate bond returns in emerging markets and none has investigated the impact of liquidity risk and market risk on corporate bond spreads in Turkey, a gap which we are trying to fill.

2. Corporate Bond Market Spread Determinants in Turkey

2.1 Data

For the analysis on Turkish bond markets, data on TRY-denominated corporate bonds issuances between 2010 and 2015 were collected from Borsa İstanbul A.Ş (2017)[1]. Each company's long-term national rating grade was gathered from the websites of rating agencies and Public Disclosure Platform. Corporate bonds without credit ratings were excluded. Data on the issuance credit spread and maturity (in days) were also collected for each bond issue. Bonds with issuance amounts below TRY 10 million and private placements were excluded. No distinction was made between public offerings and sales to qualified investors. While both bonds and bills were included in the sample, SUKUKs (Islamic bond certificates), asset backed securities and structured debt securities were excluded. All issues were categorized based on their rating and maturity without distinction based on sector or debt security type. For rating categorization JCR, S&P and Fitch Rating's scaling methodology was used. Data for market risk factors were collected for the period January 2010 and December 2015 from Bloomberg.

In the Turkish Corporate Bond Market, there are limited type of debt securities for the sample period. Most of them are floating / fixed coupon paying bonds, discount bills and SUKUKs. In the period of analysis, the maturity of corporate bonds varied from 30 to 1859 days. Within each rating category, bond issues were classified as short (less than and equal to 365 days) and long (greater than 365 days). There is only a limited number of bonds issued by companies with long-term national grade "BBB- or below" investment of mutual and pension funds in such under-investment level corporate bonds are not allowed by Capital Markets Board of Turkey and these bonds not welcomed by investors in general. Therefore, bonds issued by companies with a long-term national grade of "BBB- and below" were classified into a single category. As a result, the following ten categories were created: AAA-short, AAA-long, AA-short, AA-long,

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[1] **Borsa İstanbul A.Ş.** 2017. https://www.borsaistanbul.com/tr/ (accessed June 20, 2017).

A-short, A-long, BBB-short, BBB-long, (BBB category includes both BBB+ and BBB ratings) BBB- and below-short, BBB- and below-long.

For discount bonds, daily traded spread levels were obtained from "Portfolio Risk Performance (PRP) Fixed Income" program which is released by Rasyonet. According to the program "traded credit spread level" is the discount margin which is defined as the difference between the annual compound yield of the bond and the annual compound yield of the reference Treasury bond (i.e., the treasury bond which has the closest duration to the corporate bond). For coupon bonds, the traded credit spread levels are calculated by subtracting the annual compound yields of the Treasury Benchmark Bond from the compound yield of the corporate bonds for each trading day. The Treasury Benchmark Bond is a fixed coupon paying two-year bond issued by the Turkey Prime Ministry Undersecretariat of Treasury every 3-4 months. The benchmark bond is considered an approximation for the market since it becomes the most traded bond right after the issuance. If the bond is not traded right after the issuance day, the issuance spread is used for the following non-trading days. For other non-trading days, last traded spread is used. For each category, the spread levels calculated using the above procedure are averaged across all issuances in a daily frequency from January 2010 until December 2015.

2.2 Dependent Variable

To construct estimates for expected corporate bond yields, we follow the methodology by De Jong and Driessen (2012) and approximate each corporate bond index by a discount bond which has the same duration as the corporate bond index. Then we employ the following equation to estimate the expected return on a corporate discount bond with maturity T:

$$E\,[r_{t,T}] = [\pi_D\,(1- l) + (1- \pi_D)]\,(1+ Y_{g,t} + S_t)^T - 1, \tag{1}$$

where:

- $r_{t,\,T}$ is the return on a corporate discount bond that matures at time $t + T$;
- π_D is the probability of default before maturity;
- l is the loss rate if default occurs;
- $Y_{g,t}$ is the yield of the government bond which has the approximate maturity with the associated corporate bond index;
- S_t is the t-maturity traded credit spread.

JCR Eurasia Rating's "Test Statistics for 2015" report is used to estimate the default probabilities π_D. These data are used to calculate default probability for each corporate bond index category which has an average maturity T. Since average maturities of corporate bond indices are not integers, the pertinent default rate is calculated by interpolation for each index group. For "BBB- and below" category the average default rate is interpolated from the average of JCR's C, CC, CCC, BB-, BB, BB+ and BBB- categories' cumulative default rates. Similarly, to find "BBB" categories' default probability, JCR Eurasia Rating's BBB and BBB+ categories' cumulative default rates are averaged, then interpolated according to average maturities of "BBB long" and "BBB short" categories. Since there is no bankruptcy case of a

company which has issued corporate bond in Turkey at the writing time of this paper, there is no study about loss rates. Therefore, for loss rate, l, Moody's "Annual Default Study: Corporate Default and Recovery Rates, 1920-2015" report is used. Since the average maturities of corporate bond indices are not integers, the appropriate loss rate is calculated by interpolation for each index group. Like default rate, the loss rate for "BBB- and below" category is interpolated from the average of Moody's Ba, B and Caa-C categories' average annual loss rates.

For the government bond yields, daily yield levels, issuance and maturity dates for fixed coupon paying and discounted government bonds issued between January 2010 and December 2015, are obtained from PRP Fixed Income Program. Floating rate or inflation indexed government bonds are excluded because their annual yield level changes according to coupon periods. By taking the bonds' issuance and maturity dates into consideration daily yield levels are gathered across each outstanding bond for January 2010 and December 2015 period. Since each corporate bond index category is grouped as "less than or equal to 365 days" (short) and "greater than 365 days" (long), the same classification is made for government bonds to approximate their maturity with the associated corporate bond index. Finally, expected excess returns for each category are calculated daily by taking the difference between the expected return calculated from Equation (1) and the corresponding government bond yield.

Figure 1 below shows the average traded credit spreads and average expected excess returns for each of the ten categories. Even high-rated bonds have credit spreads at least 60 basis point while BBB and lower credit categories have credit spreads between 2.2% and 3.65%. The graph also shows that that credit spread level follows the shape of the expected excess returns very closely across all categories and the expected return increases with credit risk. Moreover, for investment grade bonds, the estimated excess return is immensely small according to the observed credit spreads. For "BBB and Below" rating category excess returns are higher.

2.3 Independent Variables

Two liquidity factors are considered. The first one is Turkish Benchmark Treasury Bond's daily bid-ask spread (L_1) which is considered the most useful measure for assessing liquidity especially for government bonds (Michael J. Fleming 2003). The second liquidity measure is the ratio of daily corporate bond market trading volume to outstanding corporate bond issuances (L_2). To calculate this ratio, daily outstanding corporate bond amount is calculated across all issuances according to their issuance dates, and maturity dates for January 2010 and December 2015 period is divided by corporate bond market trading volume.

The selection of market risk factors is based on a theoretical firm value model. In one-factor Merton (1974) model and its posterior versions, the diffusive shocks in the firm values can be priced and this effect is captured by including index return as a risk factor (De Jong and Driessen 2012). However, in Turkey, not every firm that has a corporate bond is publicly traded. Therefore, rather than taking index return alone to gauge market risk, three market risk factors are included: change in USD / TRY exchange rate (M_1), Borsa Istanbul 100 Index (BIST100) daily return (M_2), and Turkey Sovereign 10-year Credit Default Swap Contracts (CDS) daily price change (M_3).

Figure 1 Observed (Traded) Credit Spreads vs. Expected Excess Returns (Turkey)

2.4 Estimation

We follow the methodology by De Jong and Driessen (2012) and run a Fama-Macbeth (Eugene F. Fama and James D. Macbeth 1973) regression consisting of two steps. In the first step, we regress excess returns (traded credit spreads) that are calculated by subtracting the appropriate government bond yield from the yield associated with corporate bonds on three market risk and two liquidity risk factors using Equation (2) below. Since there are ten bond categories and the period of analysis covers five years (9,916 working days), this first step consists of ten regressions with over 9,916 days each. To control autocorrelation and heteroskedasticity in the error terms, Newey-West (Whitney K. Newey and Kenneth D. West 1987) estimator is used:

$$r_{i,t} = \alpha_i + \beta_{M1,i}\, M_1 + \beta_{M2,i}\, M_2 + \beta_{M3,i}\, M_3 + \beta_{L1,i}\, L_1 + \beta_{L2,i}\, L_2 + e_{i,t}, \qquad (2)$$

where:

- i is the corporate bond index i grouped by credit rating and maturity;
- $r_{i,t}$ is the excess corporate bond return;
- α_i is a constant;
- $\beta_{M1,i}$, $\beta_{M2,i}$ and $\beta_{M3,i}$ are the loadings of market risk factors;
- M_1, M_2 and M_3 are the market risk factors;
- $\beta_{L1,i}$, and $\beta_{L2,i}$ are the loadings of liquidity risk factors;
- L_1 and L_2 are the liquidity risk factors;
- $e_{i,t}$ is the error term.

In the second step, we used Equation (3) below and regress the estimates of the excess returns of corporate bonds on the estimated loadings from Equation (2). The

second step consists of 9,916 regressions, each with over ten observations. For each day, a cross sectional regression is run and then final estimates are obtained as the average of the estimates from the 9,916 regressions. Standard errors are calculated using Shanken's formula using the variance-covariance matrix of estimates of the expected excess returns $\hat{E}[r_{i,t}]$ (De Jong and Driessen 2012):

$$\hat{E}[r_{i,t}] = \hat{\beta}_{M1,i}\,\tau_{M1} + \hat{\beta}_{M2,i}\,\tau_{M2} + \hat{\beta}_{M3,i}\,\tau_{M3} + \hat{\beta}_{L1,i}\,\tau_{L1} + \hat{\beta}_{L2,i}\,\tau_{L2} + u_i, \qquad (3)$$

where:
- i is the corporate bond index i grouped by credit rating and maturity;
- $\hat{E}[r_{i,t}]$ is the expected excess corporate bond return;
- τ_{M1}, τ_{M2} and τ_{M3} are the regression coefficients representing market risk premia;
- τ_{L1} and τ_{L2} are the regression coefficients representing liquidity risk premia;
- u_i is the error term.

2.5 Empirical Results for Turkey

The *p*-values from the estimation of the Equation (2) are presented on Table 1 below. Corporate bonds show significant exposure to Turkish Benchmark Treasury Bond's daily bid-ask spread (L_1) and the ratio of daily corporate bond market trading volume to outstanding corporate bond issuances (L_2) as shown by their significant *p*-values. However, excess corporate bond returns are not associated with the market risk factors including change in USD / TRY exchange rate (M_1), BIST100 index return (M_2), and Turkey Sovereign 10-Year CDS return (M_3). Therefore, in the remainder of the analysis, independent variables of market risk are dropped from Equations (2) and (3).

Table 1   Corporate Bond Betas and *p*-values: Turkish Market

Category	M1 (USD / TRY)		M2 (BIST100)		M3 (CDS)		L1 (BIDASK)		L2 (CBLQ)	
	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value	Coefficient	*p*-value
AAA-short	0.7615719	0.2900	0.2191622	0.5340	-0.0033802	0.9860	0.4198254	**0.0000**	.7043308	0.9240
AAA-long	-0.3034802	0.6210	-0.1528644	0.6100	-0.0650161	0.6910	0.0180876	0.7270	9.014317	0.1900
AA-short	1.915111	0.0800	-0.0455698	0.9260	-0.3654027	0.2100	**0.8798337**	**0.0000**	**-12.4875**	**0.0140**
AA-long	-0.4485083	0.7450	-0.3005115	0.6270	-0.3865363	0.2090	-0.1356917	0.1610	-10.67998	0.2480
A-short	3.800775	0.1360	-0.800054	0.5520	**-1.45302**	**0.0420**	**1.047744**	**0.0010**	**-108.8851**	**0.0010**
A-long	1.529873	0.4160	0.0616838	0.9410	-0.4131503	0.3450	**1.753505**	**0.0000**	**-30.37304**	**0.0210**
BBB-short	-0.0121379	0.9970	-0.9701092	0.5510	-1.013951	0.3040	0.1246684	0.7390	64.8369	0.1090
BBBlLong	1.576649	0.6040	-0.2208609	0.8780	-0.0469858	0.9500	**1.656658**	**0.0000**	**-86.10839**	**0.0060**
BBB- and below-short	0.3602664	0.9200	0.8212291	0.6980	**3.060598**	**0.0110**	**2.960286**	**0.0000**	71.69626	0.2620
BBB- and below-long	-1.412817	0.4960	-0.5161084	0.6140	-0.2470006	0.7170	**1.770756**	**0.0000**	18.81537	0.4450

Source: Authors' calculations.

In Table 2, factor betas and associated *p*-values of liquidity risk factors are presented when Equation (2) is reestimated dropping the market risk factors. Results on Table 2 show that Turkish corporate bonds have critical exposure to liquidity risk that especially emanates from Turkish Benchmark Treasury Bond. In fact, this is not very surprising because Benchmark Treasury Bond's yield levels comprise the basement for most of the corporate bonds' pricing. Returns for 7 out of the 10 portfolios have a significant positive relationship at the 5 percent level with the bid-ask spread of

Benchmark Treasury bond. The positive sign indicates that when bid-ask spread of Treasury Benchmark Bond increases, corporate bond spreads increase. In other words, the increase of daily bid-ask spread is a sign of illiquid market conditions wherein a higher return is asked.

On the other hand, 4 out of the 10 of the portfolios have negative exposure to the corporate bond market liquidity measurement. The negative sign indicates that when the liquidity of corporate bond markets increases, corporate bond spreads decrease. This is expected because under liquid corporate bond market conditions, investors do not have to hold the bond until maturity. They can sell it whenever they want. As a result, a lower return is required and corporate bond spreads decrease.

Table 2 Corporate Bond Betas and *p*-values: Turkish Market

Category	L_1 (BIDASK)		L_2 (CBLQ)	
	Coefficient	*p*-value	Coefficient	*p*-value
AAA-short	0.41763	0.0000	0.9918	0.8930
AAA-long	0.01984	0.7020	8.6362	0.2060
AA-short	0.87922	0.0000	-12.5446	0.0130
AA-long	-0.13108	0.1770	-10.6216	0.2500
A-short	1.05058	0.0010	-109.4366	0.0010
A-long	1.75421	0.0000	-30.1582	0.0220
BBB-short	0.13434	0.7200	62.7504	0.1130
BBB-long	1.65713	0.0000	-86.2555	0.0050
BBB- and below-short	2.93935	0.0000	62.8265	0.3160
BBB- and below-long	1.77696	0.0000	17.2675	0.4810

Source: Authors' calculations.

Table 3 presents the estimation results when the estimates of the excess returns of corporate bonds are regressed on the loadings of the two liquidity factors which are Turkish Benchmark Treasury Bond's daily bid-ask spread and the ratio of daily corporate bond market trading volume to outstanding corporate bond issuances (Equation (3)).

The estimate for premium on "Treasury Bond Market's liquidity measure" is positive and significant, while the estimate for "corporate bond market's liquidity measure" is negative and significant. These results mean that investors who hold corporate bonds that have high vulnerability to Turkish Benchmark Treasury Bond liquidity shocks are compensated for this risk by realizing a higher expected return. On the other hand, the negative sign of corporate bond market's liquidity measure indicates that the second-hand market illiquidity risk of investors is compensated by higher expected returns. The R^2, calculated as the average of the R^2 values from each of the 9,916 regressions, is 60% which means that the liquidity betas together explain most of the cross-sectional variation in expected corporate bond returns (De Jong and Driessen 2012). The reported coefficient signs are interpretable for AA-short, A-short, A-long, and BBB-long categories.

Table 3   Estimated Liquidity Risk Premia: Turkish Market

	Coefficients	p-value	R^2
L_1 (BIDASK)	0.2245846	0.0000	
L_2 (CBLQ)	-0.0082097	0.0420	60%

Source: Authors' calculations.

Figure 2 below shows the direct estimates of expected Turkish corporate bond spreads from Equation (1) and model implied values from Equation (3). The liquidity premium is the sum of the premia on corporate bond market and Treasury bond market liquidity and is calculated by multiplying the betas from Table 2 with the corresponding coefficients on Table 3. For instance, for the AA-short category, the beta of the bid-ask spread is 0.87922 (Table 2) and the coefficient of the bid-ask spread is 0.2245846 (Table 3). This translates into risk premium of 0.2245846 x 0.87922 = 0.1975% for the Treasury bond market measure of liquidity. For the corporate bond market liquidity measure, the premium is 0.0082097 x 12.5446 = 0.1030%. Thus, the total liquidity risk premium is 0.3005% for the AA-short category. Calculated in the same way, the total liquidity premiums for A-short, A-long, and BBB-long categories are 1.13%, 0.64% and 1.08%, respectively.

An interesting result, which emerges from our analysis, is that the model estimates a higher liquidity risk premium for the A-short category compared to BBB-long category. An explanation for this finding could be that the A-short category mostly consists of short-term-borrower factoring companies. From the Turkish investors' point of view, these companies are considered riskier than banks that generally have ratings AA and above. Therefore, most investors seek short-term high yields and do not prefer buy-and-hold strategies. As a result, they may need second-hand liquidity more than the other categories. On the other hand, BBB-long category is composed of industrial companies which usually use project-finance or borrow long-term from banks to finance their capital investments. Therefore, industrial companies' corporate bond investors are aware of the generally "buy-and-hold" habit, although second-hand market liquidity still does matter.
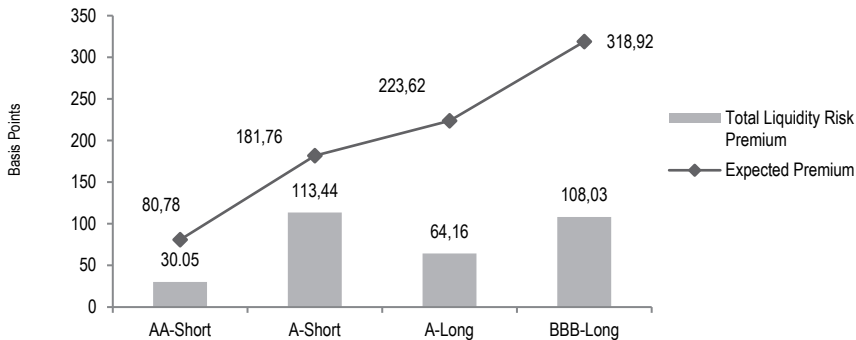
Source: Authors' calculations.

Figure 2   Expected Turkish Corporate Bond Spreads and Model-Implied Values

3. Corporate Bond Spread Determinants in Eurozone

3.1 Data

For Eurozone analysis part of the paper, corporate bond data that are aggregated according to riskiness and maturity level are collected from Bloomberg Eurozone (2017)[2] corporate bond indices for EUR currency denominated bonds. For both investment grade and high yield categories, 6 indices which have maturities 1 to 5 years, 5 to 10 years, and above 10 years in total are used. Information for 1 to 5 years, 5 to 10 years, and above 10 years maturity Euro-zone sovereign bond indices are downloaded from Bloomberg as well. For each index, daily yield-to-maturity averaged across all issues in the index for the period from January 2010 to December 2015 are collected. Then credit spread time series are created for each index by subtracting the pertinent sovereign bond yield from the yield related to the corporate bond index.
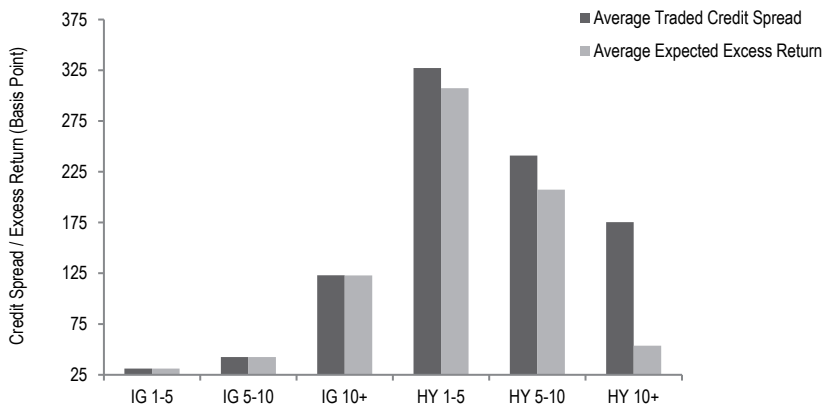
3.2 Dependent Variable

To construct the estimates for Eurozone corporate bond indices, Equation (1) is used. For default rate (π_D), Moody's "Annual Default Study: Corporate Default and Recovery Rates, 1920-2015" report is used (Moody's Investor Services 1997). For investment grade categories, the average default rate is 0.149% while it is 2.778% for speculative grade categories. Since these default rates are annual, to come up with the corresponding index category's specific default rate, each index category's average maturity is calculated and corresponding default rate is calculated by interpolation. To calculate each index category's corresponding loss rate, interpolation methodology is used according to each index category's maturity. For $Y_{g,t}$, which is the yield of the government bond that has the same approximate maturity with the associated corporate bond index, 1 to 5 years, 5 to 10 years, and above 10 years maturity Euro-zone sovereign bond indices downloaded from Bloomberg are used. Finally, for S_t, the credit spreads, which are calculated by subtracting the pertinent sovereign bond yield from the yield related to the corporate bond index, are used. The expected returns are estimated on a daily basis for each category. Finally, the credit spreads are calculated by subtracting the associated government yield from the estimated credit spreads.

      Figure 3 below shows the average credit spreads and average expected excess returns for each of the index categories. Average credit spreads ranges from 30 basis point for short-term investment grade category to approximately 330 basis point for middle-term high yield category. The graph presents that credit spread level follows the shape of expected excess returns very closely across investment grade categories and the expected return increases with credit risk. Moreover, for investment grade bonds, the estimated excess return is very small according to the observed credit spreads. However, contrary to Turkish results (Figure 1), both expected excess return and traded credit spread levels are not increasing linearly with the increasing default probability level across high yield index categories. Additionally, while both observed and expected levels reach their top level for 1-5 year term high yield category, they begin to decrease for 5-10 year term high yield and 10+ high yield categories. This sounds surprising at first

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[2] **Bloomberg.** 2017. https://www.bloomberg.com/europe (accessed June 05, 2017).

glance because normally when term lengthens the required return should increase. However, when the data is inspected for high yield categories, it is seen that 1-5 year term high yield category index mostly consists of corporate bonds of economically unstable countries like Spain, Greece, and Portugal. This could explain why this category requires higher return and spread level compared to other high yield categories. For the 10+ year term high yield category, we have relatively low number of bond issues of economically strong countries like Germany, France, and United Kingdom compared to 5-10 year term high yield category. Overall, the expected European corporate bond returns are marginally lower than Turkey corporate bond returns across all index categories.

Source: Authors' calculations.

Figure 3 Observed (Traded) Credit Spreads vs. Expected Excess Return: Eurozone

3.3 Independent Variables

In the analysis of Eurozone corporate bond market risk premia, two market and two liquidity risk factors are included in Equation (2). For the market risk, daily return of Morgan Stanley Capital International (MSCI) Europe Index and daily return of Euro Stoxx 50 Volatility Index for January 2010 and December 2015 period are used. Volatility index is included into the analysis because previous studies showed that volatility risk is a priced factor that affects bond returns (Gurdip Bakshi and Nikunj Kapadia 2003; De Jong and Driessen 2012). On the other hand, two liquidity factors are considered. For sovereign bond market liquidity, the quoted bid-ask spreads of Bloomberg based 10-Year-Generic-Eurozone Sovereign Bond's daily bid-ask spread (Fleming 2003) are calculated by simply taking the difference of bid and ask quotations for the mentioned bond for January 2010 to December 2015 period. According to Bloomberg explanation, rates of the generic bond are comprised of German 10-year government bonds.

For the equity market liquidity measure, Amihud's (2002) illiquidity measure ILLIQ is used. This method measures the price impact of trade, by proportioning volume

to the size of absolute returns. To establish ILLIQ measure, daily equity returns, volume and market capitalization for Euro Stoxx 50 Index, which is Europe's leading blue-chip index for Eurozone and covers 50 stocks from 12 Eurozone countries, are gathered from Bloomberg. For each stock, daily ILLIQ time series are created by calculating the median of ILLIQ measures across 50 stocks each day. ILLIQ measure for stock i in time interval t is calculated as follows (De Jong and Driessen 2012):

$$ILLIQ_{i,t} = 1/D_t \sum_{d=1}^{Dt} |r_{i,t}^d| / V_{i,t}^d, \tag{4}$$

where:

- D_t is the number of trading days in time interval t;
- $r_{i,t}^d$ is the return on stock i in the dth day of time interval t;
- $V_{i,t}^d$ is the trading volume for stock i in the dth day of time interval t, as a percentage of the market capitalization of the stock.

3.4 Estimation

The same methodology as in Section 2.4 is applied for the Eurozone market. This time, there are six main categories over five years (approximately 9,175 workdays). The objective is to test whether the two market risk factors (MSCI Europe Index and Euro Stoxx 50 Volatility Index) and two liquidity factors (ILLIQ measure and 10-Year-Generic-Eurozone Sovereign Bond's bid-ask spread) explain the variation in credit spreads. The first step consists of six regressions, each over 9,175 days while the second step consists of 9,175 regressions, each over 10 observations.

3.5 Empirical Results for the European Market

The p-values from the regression of observed spread levels on MSCI EUR Index, Euro Stoxx 50 Volatility Index, 10-Year-Generic-Eurozone Sovereign Bond's bid-ask spread and ILLIQ are shown on Table 4. According to the results, corporate bonds show significant exposure to 10-Year-Generic-Eurozone Sovereign Bond's bid-ask spread and ILLIQ measure, while they do not have significant vulnerability to MSCI EUR Index daily return and Euro Stoxx 50 Volatility Index return. Therefore, in the remainder of the analysis independent variables of market risk are dropped.

Table 4 Corporate Bond Betas and p-values: Eurozone Market

Category	MSCI EUR INDEX		EURO STOXX VOLATILITY		BID-ASK SPREAD		EUR ILLIQ	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
IG 1-5	**-1.614099**	**0.053**	-0.2052149	0.128	**35.3523**	**0.000**	0.0001223	0.237
IG 5-10	-0.7701874	0.672	-0.174612	0.566	**-47.8395**	**0.000**	**-0.0005098**	**0.002**
IG 10+	2.608353	0.483	0.2202485	0.708	**-159.9398**	**0.000**	**-0.0010591**	**0.001**
HY 1-5	-1.419813	0.643	-0.7854192	0.090	**-87.43694**	**0.000**	**0.0030163**	**0.000**
HY 5-10	-3.495054	0.401	-1.136413	0.072	**-192.9936**	**0.000**	**0.0051587**	**0.000**
HY 10+	1.703799	0.444	0.1295809	0.709	**177.5368**	**0.000**	0.0003425	0.142

Source: Authors' calculations.

Table 5 shows factor betas and associated *p*-values of liquidity risk factors. Four out of six portfolios have negative loading on equity market illiquidity, the ILLIQ measure. The negative sign indicates that when the illiquidity of stock market increases, because of the falling corporate bond prices, credit spreads increase. Similarly, five out of six portfolios have positive exposure to bid-ask spread of government bond. The positive sign indicates that when bid-ask spread of government bond increases, corporate bond spreads increase. In other words, the increase of daily bid-ask spread is a sign of illiquid market conditions and under illiquid market conditions, more return is required.

Table 5 Corporate Bond Betas and *p*-values: Eurozone Market

Category	BID-ASK SPREAD		EUR ILLIQ	
	Coefficient	*p*-value	Coefficient	*p*-value
IG 1-5	35.20592	0.000000	0.0000976	0.342000
IG 5-10	47.82127	0.000000	-0.0005244	0.002000
IG 10+	-159.698	0.000000	-0.0010254	0.001000
HY 1-5	87.05197	0.000000	-0.002964	0.000000
HY 5-10	192.6004	0.000000	-0.005073	0.000000
HY 10+	177.7393	0.000000	0.0003635	0.117000

Source: Authors' calculations.

Table 6 presents the r estimation results when the estimates of the excess returns of corporate bonds are regressed on the loadings of the two liquidity factors, which are the 10-Year-Generic-Eurozone Sovereign Bond's daily bid-ask spread and the Euro Stoxx 50 Index ILLIQ measure. The estimate for premium on government bond market liquidity measure is positive and significant, while the estimate for stock market illiquidity measure is negative and significant. Increase of daily bid-ask spread is a sign of illiquid market conditions and under illiquid market conditions, more return is required. On the other hand, negative sign of ILLIQ measure indicates that when the illiquidity of stock market increases because of the falling corporate bond prices, credit spreads increase. The cross-sectional R^2 is 54.9%, which means that the two liquidity betas together explain more than half of the variation in expected corporate bond returns. The reported coefficient signs are interpretable for 5-10 Year Term Investment Grade (IG 5-10), 1-5 Year Term High Yield (HY 1-5) and 5-10 Year Term High Yield (HY 5-10) categories.

Table 6 Estimated Liquidity Risk Premia: Eurozone Corporate Bond Market

	Coefficients	*p*-value	R^2
BID-ASK SPREAD	0.0026301	0.000	
EUR ILLIQ	-278.5088	0.000	54.9%

Source: Authors' calculations.

Figure 4 displays presents the direct estimates of expected Eurozone corporate bond spreads and model implied values. The total liquidity premiums for IG 5-10, HY 1-5 and HY 5-10 categories are 0.27%, 1.05% and 1.92%, respectively. The liquidity contribution to the total risk premium is nearly 64% for IG 5-10 and 93% for HY 5-10

categories while it is 34% for HY 1-5 category. As it is explained above, this category's components are economically risky countries like Spain, Greece and Portugal heavily.
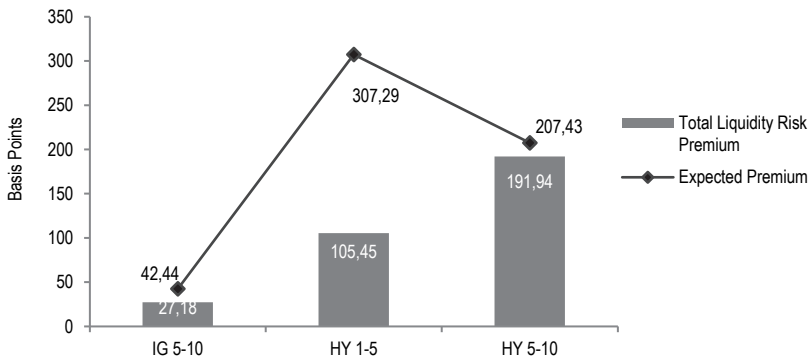
Source: Authors' calculations.

Figure 4 Expected Eurozone Corporate Bond Spreads and Model-Implied Values

4. Conclusion

The aim of this study is to investigate the role of liquidity risk and market risk in explaining corporate bond returns in an emerging market, Turkey, and compare the findings using data from the Eurozone. Market risk and liquidity risk are considered together because returns on corporate bonds are open to shocks both on government bond market and equity market (Kwan 1996). Stock market dynamics are strongly affected by country specific factors especially in emerging markets like Turkey. Therefore, rather than using stock market indicators alone, we also considered USD/TRY exchange rates and CDS rates as part of market risk.

Analysis results showed that, both in Turkey and Europe, corporate bond markets have significant exposure to the liquidity risk factors but not to market risk. For Turkish corporate bond market, regarding credit spread or expected returns, the total estimated liquidity risk premium is calculated 0.7% per annum on average for Turkish "A" and above graded (AA and AAA) short-term corporate bonds. For last investment grade level (BBB-) long-term bonds, which are expected to have higher exposures to liquidity factors, the liquidity risk premium is approximately 1.08%. The results are validated by replicating the analysis for European corporate bond market. For investment grade 5-10 year term Eurozone corporate bonds the total liquidity risk premium is calculated around 0.27%, while for high yield Eurozone 1-5 year term and for 5-10 year term corporate bonds they are around 1.05% and 1.92%, respectively. For both cases, liquidity risk premium seems to explain an important part of the credit spread.

In sum, our results revealed that corporate bond yield spreads are much broader than is explained by only historical default losses. This finding is consistent with the previous literature (e.g. Driessen 2005; Longstaff, Mithal, and Neis 2005; Chen, Lesmond, and Wei 2007; De Jong and Driessen 2012; Kalimipalli and Nayak 2012). Although the calculated liquidity premium in this study helps to explain an important

part of the total credit spread of corporate bonds, there are other risks for which corporate bondholders expect to be compensated by credit spread. Future studies could consider additional risk factors like inflation risk, which is the risk of reduction the real value of future fixed cash flows the previously issued bond when inflation rises, supply risk, which is the risk of depressing the price of a previous issuance when new bonds are issued, and non-systematic risk factors.

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