Liquidity and Credit Risk in Emerging Debt Markets

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Liquidity risk is an important component of the yield spread for both corporate and sovereign bonds in emerging markets. Using three measures of liquidity, including the bid-ask spread and liquidity based estimates from a model extension of the limited dependent variable model (Lesmond, Ogden, and Trzincka (1999)), and a unique data set of emerging market bonds spanning 16 countries and eight years, we demonstrate the importance of modeling liquidity as a component of yield spreads. Liquidity is highly significant in explaining cross-sectional variation in yield levels and changes across rated and unrated categories, for both corporate and sovereign issuers. Liquidity risk appears to dominate credit risk in explaining cross-sectional variations in yield spreads for both corporate and sovereign debt instruments across all of the emerging markets examined.

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Abstract

Liquidity risk is an important component of the yield spread for both corporate and sovereign bonds in emerging markets. Using three measures of liquidity, including the bid-ask spread and liquidity based estimates from a model extension of the limited dependent variable model (Lesmond, Ogden, and Trzincka (1999)), and a unique data set of emerging market bonds spanning 16 countries and eight years, we demonstrate the importance of modeling liquidity as a component of yield spreads. Liquidity is highly significant in explaining cross-sectional variation in yield levels and changes across rated and unrated categories, for both corporate and sovereign issuers. Liquidity risk appears to dominate credit risk in explaining cross-sectional variations in yield spreads for both corporate and sovereign debt instruments across all of the emerging markets examined.

Introduction

Recent research has suggested the importance of liquidity premia in U.S. corporate bond markets (Chacko (2002) and Chen, Lesmond, and Wei, 2006), in corporate markets implied by credit default swaps (Longstaff, Mithal, and Neis, 2005), in developed euro-denominated developed debt markets (De Jong and Driessen, 2005), and in the valuation of sovereign debt (Duffie, Pedersen, and Singleton, 2004). The sizeable trading volume and face value of $US emerging market debt, conservatively estimated at $2.1 trillion for over $250 billion of debt outstanding as of 2004, underscores the importance in understanding the possible ramifications of liquidity's influence on yield spreads. Central to that objective is the estimation of liquidity and the determination of the pricing consequences of liquidity on the yield spread of emerging market bonds. This paper estimates bond-specific liquidity for a broad spectrum of $US denominated emerging market corporate and sovereign bonds and examine the association between bond-specific liquidity estimates and yield spreads.

As some have noted (notably Bekaert, Harvey, and Lundblad (2003) and Chacko (2002)) it is somewhat surprising that much of the debate on liquidity risk and premia has taken place within the context of the US equity market, arguably one of the most liquid in the world. Much of this focus is attributable to data availability, although in markets where data is plentiful and easily accessible, liquidity risk is less likely to be of first-order magnitude.[1] By comparison, liquidity effects are widely (if only anecdotally) linked to emerging markets (in particular, during discussions of the LTCM and Asian crises), and these markets provide a unique opportunity to study liquidity risk across a wide cross-section of asset characteristics. In addition, large pools of sovereign debt issuance in emerging markets leads to frequent trading and thus plentiful data on at least a subset

[1] For example, as in the arguments of Vayanos (1998).

of bonds, precisely in a market where liquidity is expected to be of critical importance.[2] We both confirm this hypothesis directly by estimating liquidity effects on a dataset of over 1600 bond-years spanning both crisis and boom periods in 16 countries, and provide valuable evidence on the magnitude of these effects and the differences in liquidity across sovereign and corporate issuers. Such a comparison is only possible in emerging debt markets.

While there is wide variation in models and determinants, none of the existing literature on emerging market debt directly investigates liquidity effects. In general, the bulk of the existing literature focuses on macroeconomic determinants (for example, Ferrucci (2003) or Min (1999), although recent work has examined the importance of volatility as in, Hilscher and Nosbusch (2004)) and risk appetite (as in Baek, Bandopadhyaya, and Du (2005)). Martell (2003) investigates the determinants of sovereign bond and US domestic bond yield spreads, and finds that after controlling for fundamentals motivated by structural credit models there are still significant unexplained components of the yield spread. All of these studies, as well as earlier work by Westphalen (2001) and Kamin and von Kleist (1999) assume that the yield spread is fully determined by compensation for default risk.[3]

We document that a large portion of these spreads, as in US corporate debt, is attributable to liquidity factors and potentially point to fruitful areas of inquiry concerning the common components of residual risk for all USD denominated bonds. Also, as the first study to address the determinants of emerging market corporate debt, we show that most factors which influence sovereign spreads also affect corporate bonds, in particular political risk, legal origin, and development of domestic financial markets. Additionally, we contribute to the large and growing body of literature which explores the determinants

[2] As an example, markets for credit derivatives developed first for emerging market sovereign debt, because of the ease of trading in many of the underlying bonds.

[3] Duffie, Pedersen, and Singleton (2004) is an exception to the research that focuses on pure default risk as they include and estimate a liquidity component to the spread on Russian bonds.

of emerging market yield spreads, particularly those of sovereign bonds.

Historically, the lack of data on bond markets has presented a problem for research on liquidity. Emerging market debt trades over-the-counter, in a broker market, and emerging market data is notoriously noisy. To circumvent these problems, we use three different measures of bond liquidity: the bid-ask spread obtained from *Bloomberg*, the percentage of zero returns, and the limited dependent variable estimate of Lesmond, Ogden, and Trzcinka (1999) (hereafter, LOT). [4] While the bid-ask spread is the more direct measure, the advantage of the latter two measures is that they require only the time series of returns on the bonds.

The percentage of zero returns proxies for liquidity in that the investors will trade less frequently in the presence of transactions costs, and the size of these costs is directly related to the infrequency of trade. The intuition of the LOT model is that measured prices of bonds will reflect new information only if the information value of the marginal trader exceeds the total liquidity costs, which implies that there will be a liquidity cost threshold for each bond related to the minimum information value of a trade. Within this liquidity cost threshold, there is a greater probability of observing a zero return than outside of it; the LOT measure uses a maximum likelihood method to jointly estimate the market-wide information and the liquidity cost threshold. One can think of the LOT estimate as a shadow "bid-ask" spread derived from the information contained in zero returns. We find that the bid-ask spread and LOT measure are more powerful measures of liquidity risk than the percentage of zero returns, which is perhaps unsurprising due to the fact that the LOT measure incorporates more information than the relatively noisy percentage of zero

[4] Other researchers have employed other strategies to attack the problem of limited and noisy data. Longstaff, Mithal, and Neis (2005) employ a more liquid market (the credit derivatives market) to provide estimates of the relative importance of default, liquidity, and tax components, whereas several researchers (including Bekaert, Harvey, and Lundblad, 2003, Lesmond, 2004, and Stahel, 2005) employ the percentage of zero returns as a proxy for illiquidity. Chacko (2005) constructs a liquidity proxy based on holdings of corporate bonds by a custodian.

returns proxy.

While there is increasing consensus that liquidity risk is a significant component of asset returns, there is still widespread debate over its definition and parameterization. As in Chacko (2005), we consider liquidity to be the discrepancy between the fundamental value of the asset and its transaction price. This difference on the buy and sell sides of a transaction leads to a bid-ask spread charged by a market maker as compensation for inventory service. Purchasers of assets will pay a lower price for assets which are illiquid (as in Amihud and Mendelson (1986) and Glosten and Milgrom, 1984); in addition, as in Lo, Mamaysky, and Wang (2004) investors will demand compensation for the inability to continuously hedge risks, further lowering prices relative to their fundamental value.[5] In the context of bonds, the risk that a future transaction will occur at an unfavorable gap to fundamental value leads to lower prices for less liquid bonds and thus higher computed yield spreads. In this paper we employ three measures of liquidity on a unique set of data drawn from *Datastream*, *Bloomberg*, and proprietary market maker data, and show that after controlling for bond-specific characteristics and credit risk, in all specifications liquidity is a significant component of the credit spread. This result is robust to alternative econometric specifications in which we control for endogeneity by employing three-stage least squares (3SLS) and instrumental variable (IV) techniques.

Regardless of how we measure liquidity, liquidity is a significant and economically important component of the yield spread on emerging market bonds. Liquidity alone explains as much as 25% of the cross-sectional variation in emerging market corporate bond yield spreads, and 22% in sovereign yield spreads. Liquidity remains an important determinant of yield spreads even after inclusion of bond-specific variables (such as amount outstanding, coupon, maturity and age), credit risk controls (such as credit rating,

[5] This latter channel is closely related to liquidity adjustments in VAR models of risk management, as less liquid assets are "charged" a discount due to a bank's inability to trade out of or hedge their position.

political risk, and legal origin), and a host of macroeconomic variables (including US term structure level and slope, and variables related to the reserves and debt service, economic development, and business cycle of the emerging market). Controlling for country effects in issuers and endogeneity biases using both 3SLS and IV methods, we find that the LOT measure and the bid-ask spread are more robust proxies for liquidity risk, and extremely significant for explaining the variation in yield spreads. More telling is the lack of significance displayed by credit rating, once we control for country effects and endogeneity biases.

Extension to yield spread changes reveals that liquidity is again priced and economically significant. Liquidity changes alone explain as much as 22% of the cross-sectional variation in emerging market corporate bond yield spreads, and 32% in sovereign yield spread changes. These results persist after controlling for credit risk changes (described by credit rating and political risk), and changes in macroeconomic variables (including the level and slope of the US term structure, and variables related to the reserves and debt service, economic development, and business cycle of the emerging market). Surprisingly, credit rating changes for corporate bonds are not significantly associated with yield spread changes after controlling for country effects in issuers.

Understanding liquidity effects in emerging markets is important on several levels. First, emerging market debt is a large and rapidly growing asset class, growing from 3 trillion dollars of traded volume in 1997 to nearly 5 trillion dollars of traded volume in 2005, more than half of which is non-local currency denominated debt of the type we study here.[6] More importantly, much of the significant discussion on contagion effects in emerging market crises postulates the existence of a liquidity shock channel for transmission (for instance, Calvo (2002) and Kodres and Pritsker (2002) as examples of a

[6] Estimates are provided by the Emerging Markets Traders Association; third quarter 2005 estimates indicate that 2005 trading volumes should meet or exceed those of 2004.

very large literature); such a channel would necessarily imply the significant compensation for liquidity risk that we document in this paper.

Third, we provide methods and estimates to guide the parameterization of valuation models for sovereign debt (such as Duffie, Pedersen, and Singleton, 2004) which assume a significant portion of the return on such bonds to be attributed to liquidity. Fourth, we point to differences in the liquidity profiles of risky sovereign and corporate bonds, an endeavor which is only possible in markets where sovereign issuers routinely issue external debt. Lastly, we confirm the critical importance of modeling liquidity risk in bond yield spreads, especially in speculative-grade markets, implying that much of the return on risky bonds is attributable to the liquidity concerns, a finding which suggests that improvements in market transparency could greatly enhance the borrowing ability of countries and companies most in need of capital.

The remainder of the paper is organized as follows. Section 1 describes the data, our liquidity measures, and control variables for the yield spread. Section 2 summarizes the data and presents initial tests on the association between our liquidity measures and initial tests of the relation between yield spreads and liquidity. Section 3 presents the formal tests of the relationship between liquidity and yield spreads, with controls for the effect of endogeneity and country effects. Section 4 extends the results to changes in the yield spread and liquidity. Section 5 concludes.

1. Data Description and Liquidity Measures

Our sample contains both corporate and sovereign bonds spanning non-convertible, convertible[7] , non-callable, and callable $US denominated bonds listed in *Datastream* and issued by an emerging market firm or country. We choose $US denominated debt to

[7] We have 30 bonds that contain the convertibility feature and, aggregating over all the years in our sample, equates to 87 bond-years in total. However, only 21 of these bond-years are rated bonds with the remainder non-rated bonds.

eliminate the sizeable exchange rate risk. We include convertible bonds to both increase the sample size and because the convertibility option is not likely to be exercised given the price and lockout periods observed for our sample. Our data begin in 1997 and runs through 2004, because *Datastream* does not have comprehensive daily bond data prior to 1997. We follow *Datastream's* classification in identifying countries as an emerging market.

Yield spreads for all bonds are obtained from *Datastream* as the computed yield on the bond less the U.S. Treasury bond closest matched to the bond's (risk-free) maturity. In some instances we supplement yield spreads on *Datastream* with data from *Bloomberg*[8] and a proprietary market maker in emerging market bonds, since *Datastream* deletes yield spreads for defaulted or exchanged securities. We also find it necessary to reclassify bonds into sovereign and corporate categories based on their categorization in *Bloomberg*, as *Datastream* occasionally identifies sovereign issued Eurobonds as corporate.[9]

For each bond, we collect a history of changes in Moody's and Standard & Poor's ratings from *Bloomberg*, using Moody's as the primary rating and substituting the S&P rating only if the bond is not rated by Moody's. Bond specific variables such as coupon, issue date, amount outstanding, and maturity are from *Datastream*. The US macroeconomic variables such as the one-year Treasury note rate and the slope of the UST term structure are derived from the *Federal Reserve Bank*.

We also collect a large amount of data on each country in the dataset. A measure of political risk is obtained from the *International Country Risk Guide*, which publishes a ranking of political stability for countries, with those countries with the least political

[8] This was a particular concern for Argentina during the default on their debt obligation. *Datastream* does not adequately compute the yields for these bonds. *Bloomberg* provided more accurate yields with consequent yields spreads. It is interesting to note that the time trends of the yield spreads matched exactly in shape, but differed only as to the level of the underlying bond yields.

[9] For most of the larger emerging markets (e.g. Argentina, Brazil, Mexico, and Venezuela.) we hand compare the universe of bonds from *Datastream* with that available from *Bloomberg*, and cross-validate much of the data. We find that there is a high degree of correspondence between those bonds with information on *Datastream* and those bonds that are actually priced in *Bloomberg*.

stability (most risk) ranked lowest. The legal origin of the country is taken from LaPorta, Lopez-de-Silanes, Shleifer, and Vishny (1999). Emerging market country macroeconomic and economic development variables, such as number of listed companies, percentage of domestic credit provided by the private sector, external trade balance, total reserves, and GDP, are from the World Development Indicators database provided by the *World Bank*.

We also collect from *Institutional Brokers Estimates System, I/B/E/S* the number of annual one year ahead equity analyst forecasts. This count is then aggregated across all companies for each year on each respective market, regardless of whether the firm issued corporate bonds or not.

The number of listed companies, the percentage of domestic credit provided by the private sector, the number of analyst's equity forecasts for all companies for each year within each country, and the bond volatility will be used as additional exogenous variables in the instrumental variable regression tests.

1.1 Liquidity measures

We collect daily bid-ask quotes for all available bonds from *Bloomberg*. The stated quotes are the consensus quotes among market participants. [10] From these, we compute the proportional spread defined as the ask minus the bid divided by the average of the bid and ask prices. Each bond-year's proportional bid-ask spread is the annual average of the daily proportional spreads, and we include all bonds for which there is at least one week of available quotes. To compute the LOT measure and the percentage of zero returns measure, we use the daily clean prices recorded in *Datastream* (which uses Merrill Lynch as a data provider). The percentage of zero returns counts the incidence of days where zero price changes occur. These are adjusted for missing prices and presented on a percentage basis using the available days per year.

[10] This procedure will underestimate the effects of liquidity by aggregating the best bids and offers from multiple market makers and bias the results against our hypothesis.

The construction of our LOT measure broadly follows that discussed in Chen, Lesmond, and Wei (2005). Below we briefly sketch the method for convenience, and highlight the differences precipitated by our focus on emerging markets.

The primary input to the construction of the LOT measure is a series of daily (clean) bond prices that we obtain from *Datastream*, deleting all observations that deviate from the previous observation by more than 50%. Each year of data is estimated separately, resulting in an estimate of liquidity for each bond-year. Since the LOT method is a joint estimation of the information value and liquidity cost threshold, we must specify a return-generating process for the bonds. For these bonds, we assume that returns are generated by a two-factor model, with the factors being the yield on the risk-free bond (which we proxy by the 10 year Constant Maturity Treasury (CMT) rate) and the return on $U.S. (USD) denominated equity markets (which we proxy by the S&P 500 daily return). We use the S&P 500 return as a factor due to our belief that the intra-marginal trader in these markets are US based pension and hedge funds, since we focus on USD-denominated bonds.[11] We scale each factor's risk coefficient by the duration of the bond, as in Jarrow (1987). Denoting the risk-free factor as r, and the equity factor as e, and the duration of the j^{th} bond at time t as $D_{j,t}$, the true (unobserved) return, $R^*_{j,t}$ on the j^{th} bond at time t is:

$$R^*_{j,t} = \beta^1_j D_{j,t} \Delta r + \beta^2_j D_{j,t} \Delta e + \varepsilon_{j,t}$$

The existence of a liquidity premium implies that more illiquid assets to be priced at a discount to fundamental values to compensate investors for liquidity costs, as in Amihud and Mendelson (1986, 1987). Thus there will be a gap between the observed and fundamental values of the asset, which we break into two components, $\alpha_{1,j}$, the

[11] Conversations with emerging market bond dealers and hedge fund managers confirms that it is not uncommon for them to hedge their risk in US equity markets, most usually the liquid S&P 500 futures market, but occasionally in the more volatile NASDAQ market.

sell side cost of bond j and $\alpha_{2,j}$, the buy side cost of bond j.[12] Observed returns will differ from fundamental values of the asset and will be related via the implied "liquidity cost" estimates, α_1 and α_2. Consistently, negative returns will only be observed if the fundamental value change exceeds the threshold α_1, and positive returns will only be consistently observed if the change exceeds the threshold α_2; if the information value of a day does not exceed the liquidity cost threshold, a zero return results. Splitting the observed returns, $R_{j,t}$, into positive, negative, and zero return regions (R^+, R^-, and R^0 respectively), and combining the return generating process above with the liquidity constraint results in:

$$\begin{array}{lllll} R_{j,t} = R^*_{j,t} - \alpha_{1,j} & \text{if} & R^*_{j,t} < \alpha_{1,j} & \text{and} & \alpha_{1,j} < 0 \\ R_{j,t} = 0 & \text{if} & \alpha_{1,j} \leq R^*_{j,t} \leq \alpha_{2,j} & & \\ R_{j,t} = R^*_{j,t} - \alpha_{2j} & \text{if} & R^*_{j,t} > \alpha_{2,j} & \text{and} & \alpha_{2,j} > 0 \end{array}$$

The resulting log-likelihood function is stated as:

$$\sum_1 \text{Ln}\frac{1}{(2\pi\sigma_j^2)^{1/2}} - \sum_1 \frac{1}{2\sigma_j^2}(R_j + \alpha_{1,j} - \beta_{j1}\text{Duration}_{j,t} * \Delta R_{ft} - \beta_{j2}\text{Duration}_{j,t} * \Delta\text{S\&P Index}_t)^2$$

$$+\sum_2 \text{Ln}\frac{1}{(2\pi\sigma_j^2)^{1/2}} - \sum_2 \frac{1}{2\sigma_j^2}(R_j + \alpha_{2,j} - \beta_{j1}\text{Duration}_{j,t} * \Delta R_{ft} - \beta_{j2}\text{Duration}_{j,t} * \Delta\text{S\&P Index}_t)^2$$

$$+\sum_0 \text{Ln}(\Phi_{2,j} - \Phi_{1,j}), \tag{4}$$

where $\Phi_{i,j}$ represents the cumulative distribution function for each bond-year evaluated at $(\alpha_{i,j} - \beta_{j1}\text{Duration}_{j,t} * \Delta R_{ft} - \beta_{j2}\text{Duration}_{j,t} * \Delta\text{S\&P Index}_t)/\sigma_j$. $\sum_1$ (region 1) represents the negative nonzero measured returns, $\sum_2$ (region 2) represents the positive nonzero measured returns, and $\sum_0$ (region 0) represents the zero measured returns. Maddala (1983) and Lesmond et al. (1999) outline the estimation procedure.

To form the percentage of zero returns liquidity measure, we simply calculate the percentage of daily returns that are equal to zero; we compute this measure if we have at least 2 months of daily data for the bond in a given bond-year.

[12] These derived quantities are analogous to the "half-spreads" discussed in Chacko (2005).

2. Country Summary Statistics and Initial Comparisons

Our dataset of emerging market bonds is composed of 538 bonds issued by 423 issuers in 16 countries over the period 1997-2004, and comprises a total of 2070 bond-years. However, due to data constraints in estimating our liquidity measures, we have differing bond-years for each liquidity measure. For instance, the LOT measure requires enough zero returns to adequately estimate the liquidity costs; hence it contains more aged bonds than the bid-ask spread sample. The bid-ask spread, on the other hand, focuses on bonds that are more frequently traded by institutional investors; hence it focuses on more recently issued bonds. The percentage of zero returns encompasses all bonds since it requires only prices. Table 1 presents yield spreads and liquidity estimates across corporate and sovereign bonds for both rated and non-rated bonds. Included in Table 1 are means, medians, and sample sizes for both yield spreads and liquidity estimates.

Several observations are apparent. First, the corporate sample, Panel A of Table 1, is fairly well distributed across regions, while the sovereign data, Panel B of Table 1, is dominated (as expected) by Latin American issuers. Another immediate observation is that the LOT estimates display far greater variation and are of much greater magnitude than the bid-ask estimates, which is consistent with the fact that the LOT estimate incorporates *all* relevant costs of liquidity, including search costs and commission costs.

Finally, yield spreads and liquidity costs for non-rated bonds are predictably higher than rated bonds. This is consistent with a credit quality issue for firms that either forego coverage or find their ratings withdrawn by Moody's. Sovereign bonds, in general, have lower average yield spreads than corresponding corporate bonds. [13]

Table 2 more closely explores the relationship between our liquidity measures and credit spreads as a function of sovereign/corporate issuance and credit rating. We aggregate

[13] Notable exceptions here include Argentina and Russia, where average spreads of sovereign bonds are very high, reflecting a preponderance of observations from the default periods.

the sample across all countries in order to examine the general trend in yield spreads, liquidity, and credit rating minimizing country influences on the inferences. The results presented coincide with intuition that credit spreads are monotonically increasing with the underlying credit risk as measured by the Moody's ratings. To facilitate a comparison between liquidity measures, we form four sets of the data reflecting the sub-samples of the data for which measures are available. The first set is the subset of data for which all three liquidity measures are computed. The second set contains the intersection of the percentage of zero returns measure (hereafter, %Zeros) and the LOT measure, while the third contains the intersection of the %Zeros and the bid-ask measure. The last set is the entire dataset.

For corporate bonds, the results indicate that as credit quality declines, yield spreads increase along with liquidity costs. This is found regardless of the liquidity measure. The relationship between yield spreads and liquidity is strongest for the LOT measure, with %Zeros performing well for corporate bonds. There also appears to be a large increase in both liquidity costs and yield spreads between investment grade bonds (those rated Aaa to Baa3) and speculative grade bonds (those rated Ba1 to Caa3). Both liquidity costs and yield spreads more than double between these two classes of bonds, with the the LOT liquidity measure demonstrating more variability between these two credit classes. The bid-ask spread and the %Zeros also demonstrate increases across these two classes of credit quality, although it is somewhat muted compared to the LOT measure. For completeness, we show that non-rated corporate bonds appear to experience significant yield spreads and significant liquidity costs.

For sovereign bonds, liquidity, as measured by the LOT measure and the bid-ask measure, and yield spreads rise monotonically with decreasing credit quality. For instance, the LOT measure rises from 21.17 bp to 172.86 bp, while the bid-ask spread rises from

31.78 bp to 60.86 bp for bonds rated A1-A3 and B1-B3, respectively. The %Zeros display an inconclusive relationship with sovereign credit. For investment grade (ratings A1-A3 through Baa1-Baa3) sovereign bonds, yield spreads and liquidity costs are less than those of similarly rated corporate debt. This would be expected given that sovereign debt is traded more frequently than corporate debt. For speculative grade sovereign bonds, except for the Ba1-Ba3 category, liquidity costs are approximately half that of similarly rated corporate debt, but yield spreads are measurably larger than that of similarly rated corporate debt. Yield spreads in the lowest credit rating category are heavily skewed, representing the influence of trading in defaulted or nearly defaulted securities, such as Argentina, Russia, and Venezuela. For these countries, liquidity risk was overshadowed by heightened default risk concerns, and this effect is reflected in the sovereign bond results.

2.1 Validation and correlation of liquidity measures

While a substantial body of literature uses the LOT measure (Lesmond (2005) for use in emerging equity markets, and Chen, Lesmond, and Wei (2006) for applications in corporate bond markets) or the %Zeros measure as estimates of liquidity costs (Bekaert, Harvey, and Lundblad, 2003), there are reasons to be cautious in employing them in emerging debt markets. The LOT estimate is an joint estimation of both the liquidity threshold and the return-generating process, and the %Zeros measure is a noisy measure that is incapable of distinguishing lack of trading due to low information or high liquidity costs. In this section we examine the correspondence between the LOT liquidity estimate and the %Zeros with the underlying bid-ask spread[14] by estimating the regression:

[14] Some caution should be noted concerning the bid-ask spread. The bid-ask spread, as reported by *Bloomberg* is not the inside quote, rather it is a consensus quote amalgamated across all available market makers. Hence, it is not a quote around which actual trades could occur nor is it perceived to be current. Consequently it only partially reflects the trading costs faced by the marginal, informed trader. However, it is a measure of liquidity costs that is commonly reported, hence it acts as the benchmark.

$$\begin{aligned}\text{Bid-Ask}_{it} = \eta_0 + \eta_1 \text{Liquidity Estimate}_{it} + \eta_2 \text{Maturity}_{it} + \eta_3 \text{Age}_{it} + \eta_4 \text{Amount Outstanding}_{it} \\ + \eta_5 \text{Bond Volatility}_{it} + \eta_6 \text{Credit Rating}_i + \eta_7 \text{Call Dummy} \\ + \eta_8 \text{Political Risk} + \eta_9 \text{Code/Civil Law} + \epsilon_t\end{aligned}$$

where the subscript it refers to bond i for each year t. These liquidity risk determinants are examined by Houweling, Mentink, and Vorst (2003), Chen, Lesmond, and Wei (2006), and Lesmond (2005). Bond volatility is the variance of the daily bond price over an annual trading period. The regression results are presented in Panel A of Table 3.

As shown in Panel A of Table 3, all of our estimates of liquidity costs are highly associated with the bid-ask spread.[15] For corporate bonds, the LOT liquidity measure alone explains 26.74% of the cross-sectional variation in the bid-ask spread and this rises to only 33.37% when we include a host of other variables found in previous work to determine liquidity, including maturity, age, amount outstanding, bond volatility, credit rating, and proxies for legal origin and political risk. Of these, only bond age and bond volatility are significant once we include the LOT estimate. %Zeros is far less effective at explaining the bid-ask spread, although still significantly related for both corporate and sovereign bonds. For comparison, Chen, Lesmond, and Wei (2006) find that the LOT liquidity measure explains 6.82% of the bid-ask spread variation in a large dataset of over 4,000 corporate bonds, and Schultz (2003) finds only an R^2 of 3.43% in a study of investment grade bonds trading costs relationship with bid-ask spreads. We conclude that both of our liquidity cost estimates are indeed capturing liquidity, and capturing it effectively, with the LOT estimate being a far more powerful measure of liquidity costs.

As an indication of the economic significance of liquidity in explaining the variation in yield spreads, we report univariate regression results. These are presented in Panel B of

[15] We also compute the pairwise correlations between our liquidity measures. The LOT measure is highly correlated with the %Zeros measure at .56 (.71) for corporate/(sovereign) samples. This is not surprising, because the percentage of zero returns is a key component of the estimation of the LOT model.

Table 3 for a matched sample of our three liquidity measures for corporate and sovereign bonds. All liquidity measures are significant predictors of yield spreads for both rated and unrated corporate debt and rated sovereign debt. The LOT measure captures 26% of the variation in the yield spread of corporate bonds, nearly twice that of the next closest estimate, the %Zeros measure. For sovereign bonds the results across measures are both significant and remarkably consistent, with all liquidity measures capturing approximately 15% of the variation in the yield spread. By comparison, Chen, Lesmond, and Wei (2006) on a similarly sized dataset of speculative grade US corporate debt find that the liquidity measures explain approximately 7% of the yield spread variation; preliminary estimates here indicate that liquidity costs may be nearly four times more important in explaining emerging market yield spreads. These results would indicate that liquidity alone explains as much as 100 bp of the variation in the average 400 bp variation in yield spreads (as shown in Table 2). This appears to be both statistically and economically significant. For sovereign bonds, liquidity alone explains approximately 90 bp of the total 500 bp variation in the yield spread.

Finally, noting the association between liquidity and credit rating with yield spreads reported in Table 2, we provide initial tests of association for each hypothesized component of the yield spread. These results are reported in Panel C of Table 3 and provide a direct comparison of the relative explanatory power of liquidity and rating in explaining the variation in the yield spread. For corporate bonds, the %Zeros and the LOT liquidity measures explain approximately half as much of the variation in yield spreads as does credit rating, while the bid-ask spread explains less than a quarter of the yield spread as explained by the credit rating. The falloff in the explanatory power for the bid-ask spread is due to the lack of variation in the bid-ask spread across the rating categories and consequent yield spreads and reflects the averaging across all of the market-makers.

Assessing the relative importance of liquidity and credit rating, we would predict that liquidity explains as much as 100 bp (LOT model) of the 400 bp variation for corporate bonds, while credit rating explains as much as 160 bp of the variation in the yield spread. However, given the intuitive importance of credit rating, the sizeable percentage of the variation captured by liquidity alone underscores the importance of liquidity in understanding emerging market bonds yield spreads.

3. Yield Spread and Liquidity Tests

The existence of liquidity risk in emerging debt markets should lead to higher yield spreads as investors demand a premium for the inability to continously trade their assets, and for the risk that this cost of hedging will be positively correlated with (negative) changes in wealth. As models of contagion (Calvo (1999), and as an additional factor in the more general model of Kodres and Pritsker (2002)) posit transmission channels due to correlated liquidity shocks in emerging debt and currency markets, we might expect that yield spreads should incorporate some component of liquidity premia. Pricing models for emerging market sovereign debt like that in Duffie, Pedersen, and Singleton (2004) also assume that a portion of the return on the sovereign bond is attributable to a liquidity risk process. In this section, we directly test the relationship between our liquidity measures and yield spreads, and find that liquidity is an important component of the yield spread, regardless of how one proxies for it.

3.1 Yield Spread Determinants: OLS Specification Tests

Regressions are conducted with the yield spread as the dependent variable and the various yield spread determinants as independent variables determined for each year and for each bond. The explanatory variables are the same for both corporate bond and corporate bonds, except that for the corporate bonds we exclude the unemployment[16]

[16] The corporate bond regressions do not use the unemployment rate because three countries do not provide data on this variable. We therefore abstract from using unemployment for the corporate bonds. However, for

variable. The regression is generally stated as:

$$\begin{gathered}\text{Yield Spread}_{it} = \eta_0 + \eta_1 \text{Liquidity}_{it} + \eta_2 \text{Maturity}_{it} + \eta_3 \text{Age} + \eta_4 \text{Amount Outstanding}_{it} \\ + \eta_5 \text{Coupon}_{it} + \eta_6 \text{T-Bill Rate}_t + \eta_7 \text{10Yr -2Yr T-Bill Rate}_t + \eta_8 \text{EuroDollar}_t + \eta_9 \text{Bond Rating}_{it} \\ + \eta_{10} \text{Political Risk}_t + \eta_{11} \text{Call Dummy}_{it} + \eta_{12} \text{Civil/Code Law Dummy}_{it} \\ + \eta_{13} \text{Inflation}_{it} + \eta_{14} \text{Unemployment}_{it} + \eta_{15} \text{External Balances}_{it} + \eta_{16} \text{Total Reserves/GDP}_{it} \\ + \eta_{17} \text{Total Debt/Total Exports}_{it} + \eta_{18} \text{Total Trade/GDP}_{it} + \epsilon_t\end{gathered}$$

where the subscript it refers to bond i for each year t. Liquidity is either one of our three possible measures: the LOT measure, the bid-ask spread, or the %Zeros. Specific controls are incorporated for bond characteristics, default risk, US macroeconomic risk, political risk in the country of issuance, and macroeconomic and development variables for the issuing country. The choice of yield spread determinants is largely based on Elton et al. (2001) and Campbell and Taksler (2003), and Chen, Lesmond, and Wei (2006).

Our bond characteristic controls follow Chen, Lesmond, and Wei (2006), and include maturity, age of the bond, amount outstanding, and the coupon rate as an measure of tax effects (Elton, Gruber, Agarwal, and Mann, 2001). We also include an indicator whether the bond is callable.[17] The US business cycle is controlled for by the inclusion of variables found important by Duffee(1998), such as the yield on the UST 1YR bond, the difference between UST 10YR and 2YR rates (term slope). We include as global liquidity proxies, the difference in the yield between Eurodollar deposits and the three month U.S. Treasury Bill because this quantity is related to the short-term swap rates (Campbell and Taksler, 2004). Credit rating (numerically generated from Moody's ratings) are converted to a

the sovereign bonds, all of the countries report the unemployment statistic so it is included in the regression tests.

[17] We include callable bonds in the sample to maximize its size. While this presents some issues in interpreting the yield spread (as it will be misspecified vs. the Option Adjusted Spread), several facts mitigate this concern. Most importantly, most of the bonds in the sample trade at a substantial discount and the call option (usually at par) is far out of the money. Second, it is not clear that there is an obvious relation between the call option and liquidity. Last, we re-estimate regressions in this section dropping the callable bonds, with negligible impact on the significance of our liquidity measures.

numerical scale with one representing the Aaa rated bonds and 19 representing Caa3 rated bonds as done in Kamin and von Kleist (1999).

We also include a large number of controls motivated by the determinants of emerging market sovereign bond literature. As in Martell (2003), we include political risk rankings from the International Country Risk Guide. Since the legal environment of the country of issue could influence recovery (especially for corporate issuers) we include legal origin variables used in La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999). As in Min (1999), Ferrucci (2003), Martell (2003), and Hilscher and Nosbusch (2004), we incorporate variables which encompass the debt burden (total debt/total exports and percentage of external debt with maturity less than a year), macroeconomic condition (inflation and unemployment rates, external balance on the current account as a percentage of GDP), and reserve liquidity of the issuing country (total reserves minus gold/GDP) and the openness of the economy (as proxied by the % of GDP represented by trade).

Table IV presents the OLS results of the regressions for the three liquidity measures across rated and non-rated corporate bonds and rated sovereign issuers. The number of bonds in each specification differs due to the varying requirements for computing the liquidity measures, with the %Zeros sample being the most expansive.

In all specifications and across both rated and unrated corporate and sovereign categories, all three liquidity measures are significantly associated, at the 1% level, with the yield spread. The magnitudes of the liquidity coefficients (for the LOT and bid-ask measures) can be interpreted as the marginal increase in the yield spread for a 1 bp increase in liquidity costs, implying that a 1 bp increase in LOT liquidity costs would lead to an increase of .25 bp in the yield spread of corporate rated bonds; the incremental liquidity effect more than doubles (to .63 bp) for sovereign bonds. By comparison, an increase (downgrade) in credit rating of one step (e.g. from B1 to B2) leads to a 26 bp increase

in yield spreads for corporate bonds but an order of magnitude larger (278 bp) change in yield spreads for sovereign bonds, presumably reflecting the dominance of defaulting Latin American bonds in the sovereign sample. The bid-ask spread results indicate a greater incremental effect on yield spreads with a 1 bp increase in the bid-ask spread leading to a 3.22 bp increase in the yield spread. The incremental differences in the incremental liquidity effects on yield spreads between the LOT measure and the bid-ask spread stem from the increased number of potential liquidity cost elements measured by the LOT estimate (such as opportunity costs, commission costs, and search costs).

It is difficult to discern consistent patterns in the other determinants of yield spreads for the corporate bond sample, possibly pointing to the dominance of our credit and liquidity measures and indicating that inclusion of liquidity measures is a crucial step in understanding the determinants of emerging debt yield spreads. Legal origin appears significant for the rated bonds in several liquidity specifications, indicating that civil law countries exhibit higher yield spreads even after controlling for liquidity issues and credit spreads. US interest rates have surprisingly little effect, as does political risk.

For the sovereign sample, several interesting relationships exist in the yield spread determinants. As noted above, all liquidity measures are strongly significant in all specifications as is default risk as proxied by credit ratings. However, several macroeconomic controls also significantly related to yield spreads, even after controlling for rating and liquidity. Variables that have been found significant in other studies (for instance, Martell, 2003) such as total debt to exports and reserves/GDP are highly significant with intuitive signs as is unemployment, reflecting the influence of the economic cycle. Since these are publicly available numbers, it is somewhat puzzling that they add power to the credit rating, but this may reflect primarily on the aggregation over the year. More perplexing is the significance for the legal origin of the issuer for the sovereign

bond yield spreads. Since the domestic legal environment may be largely irrelevant for externally-denominated debt issued by a sovereign, this may be more of an indicator of development and less a proxy for creditor rights.

3.2 Yield Spread Determinants: Feasible Generalized Least Squares

Although the results concerning liquidity and yield spreads with the OLS specification are suggestive, there is potentially a significant variation in the error structure across countries (which we control for in the OLS regressions using robust standard errors). To control for the heterogeneity, we re-estimate the model using a Feasible Generalized Least Squares (FGLS) approach incorporating the specific country variance for each of the 13 countries (in the sovereign bond case) or 16 countries (in the corporate bond case). This method provides a heteroskedasticity-consistent estimator to obtain efficient asymptotic variances. The FGLS is a two-stage procedure that first estimates the residual's variance as an input into the second stage estimation. The setup estimates a unique country variance with each country's variance stacked on the main diagonal of the variance-covariance matrix. The stacked variance-covariance matrix is then used to estimate the regression coefficients.[18] We present the results from this specification for all three of our liquidity measures and across corporate and sovereign debt categories in Table 5.

In general, correcting for panel level heteroskedasticity strengthens our results for the LOT and bid-ask spread, and (very) slightly weakens the estimates for the %Zeros measure. All liquidity measures are still significant at the 5% level with the LOT and bid-ask measures significant at the 1% level. The primary differences between the OLS specified model results and the FGLS specified model results reside primarily in the

[18] Note that under modest assumptions, this is a generalization of the random-effects panel estimator for the model. We also ran the random effects model and the results were largely invariant with those of the OLS specification. We also performed Hausman tests to determine the applicability of fixed effects specification (a model without the code/civil law variable) and a random effects model specification. The Hausman test indicated that neither the random effects nor the fixed effects model were preferred over each other or over the OLS specification.

estimated standard errors that clearly indicate the OLS specification produces inefficient standard error estimates, as would be expected once heteroskedasticity is considered. The coefficients for the LOT and bid-ask spreads are still much greater for sovereign bonds than corporate bonds, in most cases nearly two and a half times larger.

3.3 Yield Spread Determinants: Three Stage Least Squares

In the preceding sections we demonstrate a substantial and significant relationship between measures of liquidity and yield spreads. However, this relationship does not necessarily mean that the entire effect we document is due to liquidity risk, for any of the measures we use. To control for potential endogeneity problems due to the contemporaneous measurement of the yield spread and liquidity costs, we employ a three stage simultaneous equation model using two equations representing each potentially endogenous variable allowing for cross equation covariation. We estimate the model for rated corporate, non-rated corporate, and rated sovereign bonds. For this model, we assume that the credit rating of the bond is exogenous.[19]

The system of equations is generally (again, excluding unemployment for corporate bonds) stated as:

$$\begin{aligned}\text{Yield Spread}_{it} = \eta_0 + \eta_1 \text{Liquidity}_{it} + \eta_2 \text{Maturity}_{it} + \eta_3 \text{Age} + \eta_4 \text{Amount Outstanding}_{it} \\ + \eta_5 \text{Coupon}_{it} + \eta_6 \text{T-Bill Rate}_t + \eta_7 \text{10Yr -2Yr T-Bill Rate}_t + \eta_8 \text{EuroDollar}_t + \eta_9 \text{Bond Rating}_{it} \\ + \eta_{10} \text{Political Risk}_t + \eta_{11} \text{Call Dummy}_{it} + \eta_{12} \text{Civil/Code Law Dummy}_{it} \\ + \eta_{13} \text{Inflation}_{it} + \eta_{14} \text{Unemployment}_{it} + \eta_{15} \text{External Balances}_{it} + \eta_{16} \text{Total Reserves/GDP}_{it} \\ + \eta_{17} \text{Total Debt/Total Exports}_{it} + \eta_{18} \text{Total Trade/GDP}_{it} + \epsilon_{1t}\end{aligned}$$

[19] This is also necessitated because there is very little available corporate data on financial ratios, as used by Campbell and Taksler (2003) in explaining corporate bond credit ratings, for these emerging market bonds or firms. For our bond sample, we found fewer than 100 bond-years of available corporate accounting information. The small size of the available accounting information precluded an effective treatment of the instruments that would be useful in endogenizing the credit rating. The credit ratings for sovereign bonds in our sample appear to have the same macroeconomic instruments (Cantor and Packer, 1996) as did the yield spread limiting our ability to endogenize the credit rating. For these reasons, we abstract from endogenizing credit rating in the 3SLS estimation.

$$\text{Liquidity}_{it} = \eta_0 + \eta_1 \text{Maturity}_{it} + \eta_2 \text{Age}_{it} + \eta_3 \text{Amount Outstanding}_{it}$$
$$+ \eta_4 \text{Bond Volatility}_{it} + \eta_5 \text{Credit Rating}_{it} + \eta_6 \text{Political Risk}$$
$$+ \eta_7 \text{Call Dummy} + \eta_8 \text{Code/Civil Law} + \eta_9 \text{Yield Spread}_{it} + \epsilon_{2t}$$

The specification for each equation stems from the prior OLS regressions for the bid-ask spread (Table 3) and for the yield spread (Table 4) with the estimation results presented in Table 6. We allow the disturbances ϵ_{1t} and ϵ_{2t} to be both correlated with each other and with the other regressors in the model.[20] The results are presented separately for rated corporate, non-rated corporate, and rated sovereign bonds. As is shown, the potential endogeneity bias does not affect the relation between liquidity and the yield spread for either the LOT or bid-ask spread liquidity measures across rated of non-rated corporate bonds or rated sovereign bonds.

Both the LOT and bid-ask liquidity measures remain significant at the 1% level. Interestingly, credit rating is now insignificantly related to the yield spread regardless of examining corporate or sovereign bonds. The negative contribution of the yield spread to the liquidity estimate for the rated corporate bonds illustrates that as yield spreads increase, a larger percentage of the yield spread is due to default risk. The opposite effect is noted for the sovereign bonds where the positive yield spread coefficient for all liquidity measures indicates that as yield spreads increase, a larger percentage of the yield spread is principally due to liquidity, not default risk. In addition, controlling for the contemporaneous movement in liquidity, the relationship between yield spreads and risk-free rates (Duffee 1998) is strengthened, possibly indicating that there are linkages between liquidity risk and risk-free rates.

However, the %Zeros liquidity measure is reduced to insignificance regardless of

[20] We do find that there is substantial cross-equation correlation in the estimated specification (on the order of 60%) as shown by the percentage cross correlation at the bottom of Table 6, indicating the necessity of controlling for endogeneity biases in methods such as those we employ.

examining corporate or sovereign bonds. We conclude that the %Zeros measure of liquidity is at best a noisy proxy for liquidity risk, and much of its significance in previous specifications is due to spurious co-movement.

3.4 Yield Spread Determinants: Instrumental Variable Regression Tests

Lacking a natural specification for the credit rating[21] , yet assuming that credit rating (default risk) is endogenous to the yield spread, requires an instrumental variables approach. We will assume as before that liquidity is endogenous, but now allow credit rating (default risk) to also be endogenous. However, for both credit rating and liquidity we further assume that the same instruments can be used to define the levels in each of these endogenous variables.

The instruments chosen for liquidity and credit rating rely on the notion that each of these endogenous variables are influenced by the development of the financial sector, the amount of information produced by the financial sector, and the variability of the price process. The degree of development of the countries' financial markets is proxied by the number of publicly listed companies and the percentage of domestic credit provided by the private sector. We include the number of *I/B/E/S* based analyst earnings forecasts to provide a measure of the general information environment of each country. Finally bond volatility indicates the degree of uncertainty in the market over time. The key element in the instrumental variable choice is that the instruments must be correlated with the included endogenous variables (liquidity and credit rating) and orthogonal to the error process of the yield spread equation. Hansen's J-statistic more formally tests the overidentifying restrictions as to whether these instruments are indeed orthogonal to the error process, yet correlated with both liquidity and credit spreads. The IV regression is

[21] This is principally due to the lack of sufficient accounting information for corporate bonds or the lack of sufficient local macroeconomic variables that are used by the ratings agencies, but not by market participants in pricing yield spreads.

estimated using a GMM procedure with robust standard errors. This is preferable in the presence of heteroskedasticity, even with smaller samples.

The IV regression is generally stated as:

$$\begin{aligned}\text{Yield Spread}_{it} &= \eta_0 + \eta_1 \text{Liquidity}_{it} + \eta_2 \text{Maturity}_{it} + \eta_3 \text{Age} + \eta_4 \text{Amount Outstanding}_{it} \\ &+\eta_5 \text{Coupon}_{it} + \eta_6 \text{T-Bill Rate}_t + \eta_7 \text{10Yr -2Yr T-Bill Rate}_t + \eta_8 \text{EuroDollar}_t + \eta_9 \text{Bond Rating}_{it} \\ &+\eta_{10} \text{Political Risk}_t + \eta_{11} \text{Call Dummy}_{it} + \eta_{12} \text{Civil/Code Law Dummy}_{it} \\ &+\eta_{13} \text{Inflation}_{it} + \eta_{14} \text{Unemployment}_{it} + \eta_{15} \text{External Balances}_{it} + \eta_{16} \text{Total Reserves/GDP}_{it} \\ &+\eta_{17} \text{Total Debt/Total Exports}_{it} + \eta_{18} \text{Total Trade/GDP}_{it} + \epsilon_t.\end{aligned}$$

The instrumented variables are specified as:

$$\begin{aligned}\text{Liquidity, Credit Rating} &= \eta_0 + \eta_1 \text{Number of Listed Companies} + \eta_2 \text{Domestic Credit} \\ &+\eta_3 \text{Bond Volatility} + \eta_4 \text{Number of Earnings Forecasts} + \epsilon.\end{aligned}$$

The number of listed companies, bond volatility, and the number of earnings forecasts are log scaled. The results from the IV regression are presented in Table 7 for only both rated corporate an sovereign bonds.

Our first observation from the results is that we have identified valid instruments for liquidity and the credit spread. Hansen's J-statistic reports the test results under the null that the instruments satisfy the orthogonality conditions. For all of our liquidity measures, we are unable to reject the null hypothesis and we conclude that these instruments are exogenous to the yield spread equation while correlated with liquidity and credit spread variables. This is confirmed by the high partial R^2 statistics that report the goodness of fit for each equation separately. For either liquidity measure or the credit spread, the reported goodness of fit measures appear robust. This is especially true for the credit rating results

that indicate the chosen instruments explain over 50% of the cross-sectional variation in the credit ratings for corporate bonds and over 70% of the cross-sectional variation in yield spreads for sovereign bonds. However, it should be noted that for the %Zeros liquidity measure, the goodness of fit statistic is rather anemic compared to the other competing liquidity measures. These results confirm our prior findings concerning the power of the %Zeros liquidity measure.

Second, and most importantly, liquidity, as measured by either the LOT or bid-ask spread measures, is positively and significantly associated with the underlying yield spread with estimated coefficients largely of the same magnitude as estimated by the simultaneous equation system. This is found even after controlling for bond specific, US macroeconomic, local macroeconomic, and country specific variables that are known to be associated with the yield spread.

Finally, consistent with our prior three stage least squares results, the credit rating falls from significance for any specification of liquidity. Evidently, instrumenting the credit rating does little to enhance its explanatory power. These results, coupled with those of the 3SLS results, indicates that credit rating may be secondary to liquidity in explaining emerging market bond yield spreads.

4. Liquidity Effects on the Yield Spread Changes

We conduct regression tests to study whether issue-specific liquidity changes are a determinant of yield spread changes. This test offers a glimpse into how the dynamics of liquidity are incorporated into yield spread changes and allows for specific controls for

potential auto-correlative influences that may cause spurious results due to time-series trends.

4.1 Yield Spread Change Determinants: OLS Specification

We include a list of independent variables used in Collin-Dufresne et al. (2001) and Campbell and Taksler (2003). Unlike Collin-Dufresne et al., we directly control for the default probability by using the changes experienced each year in the credit ratings for each bond. We believe this is a better control than using the change in the forward jump rate in the option market. Explicitly we estimate,

$$\Delta(\text{Yield Spread})_i = \gamma_0 + \gamma_1\Delta(\text{Liquidity})_i + \gamma_2\Delta(\text{Credit Rating})_i + \gamma_3\Delta(\text{Treasury Rate})_i$$
$$+\gamma_4\Delta(\text{10 yr - 2 yr Treasure Rate})_i + \gamma_5\Delta(\text{30 Day EuroDollar Rate})_i$$
$$+\gamma_6\Delta(\text{Political Risk})_i + \gamma_7\Delta(\text{Inflation})_i$$
$$+\gamma_8\Delta(\text{Unemployment})_i + \gamma_9\Delta(\text{External Balances})_i + \gamma_{10}\Delta(\text{Total Reserves/Exports})_i$$
$$+\gamma_{11}\Delta(\text{Total Reserves/GDP})_i + \gamma_{12}\Delta(\text{Total Trade/GDP})_i + \epsilon$$

where, Δ represents the first difference (yearly difference) in each variable for each bond i. Regarding changes in credit rating, for approximately 75% of the sample pertaining to each liquidity measure there is no change in the rating from the previous year. To account for the preponderance of zero changes in credit rating, versus the relatively fewer cases where changes in credit ratings occur, we use a ordinal scale in place of the actual ratings change. Thus, the credit rating is set to negative one if the credit quality decreases, to zero if there is no change in the credit rating, and to positive one if the credit quality increases. This is done to equally weight increases and decreases in credit quality with zero changes in credit quality. Otherwise, spurious results between yield spreads and credit rating would result,

namely a positive and significant association, simply because of changing yield spreads with zero changes in the credit ratings. The results are presented in Table 8.

As expected, a deterioration of bond quality (rating) is related to a significant increase in the yield spread. Similarly, a rise in interest rates leads to a reduction in the yield spread, especially for investment grade bonds (Duffee, 1998, and Longstaff and Schwartz, 1995) as does a deterioration in political risk. However, even after controlling for this and other factors, changes in liquidity are highly associated with changes in the yield spread, especially for the bid-ask spread and the LOT estimate. This is the case for both corporate and sovereign bonds.

Economically, for corporate bonds, a one basis point increase in LOT liquidity costs over time results in a 0.21 basis point increase in the yield spread, while a one basis point increase in the bid-ask spread over time results in a 3.13 basis point increase in the yield spread. The corresponding impact for sovereign bonds is 0.70 basis points (LOT liquidity costs) and 5.67 basis points (bid-ask spread).

At the bottom of Table 8 we report the regression of the change in the yield spread on the change in each liquidity measure alone using the full sample whenever the measure is available. For each measure, we also regress the change in the yield spread on the change in bond rating alone for that sample as a comparison. For corporate bonds, changes in the LOT liquidity measure explain 22.0% of the cross-sectional variation in the change of yield spread, while changes in the bid-ask spread explain almost 6% of the cross-sectional variation in the change of yield spread. Changes in the %Zeros alone have a relatively

lower explanatory power for both corporate or sovereign bonds.

4.2 Yield Spread Change Determinants: Feasible Generalized Least Squares

To control for the heterogeneity between countries, we re-estimate the OLS specification using the Feasible Generalized Least Squares[22] approach. The results, presented in Table 9, can be summarized as follows.

For the bid-ask spread or the LOT estimates, an increase of liquidity costs causes a significantly positive increase in yield spreads, for both the corporate bonds and sovereign bonds. For the %Zeros, an increase of liquidity costs causes a significant increase in yield spreads for sovereign bonds, but not for corporate bonds. Interestingly, changes in credit rating do not appear to be consistently associated with changes in the yield spread. This may be the result of over-aggregation of the sample whereby the significance of the change in yield spread caused by changes in credit rating are localized around the event. Aggregating yield spreads by year allows for confounding influences to mitigate the effect of credit rating changes.

Regardless of this concern, it does appear that credit rating lacks explanatory power, at least for corporate bonds, once we control for the effect of liquidity costs in explaining yield spreads. These results appear to coincide with the yield spread level results and indicate that corporate credit ratings have much of their power in explaining yield spreads removed once we more properly specify the variance-covariance structure across countries.

Finally, changes in political risk appear to be consistently related to changes in the yield spread. Increasing (decreasing) political risk leads to increasing (decreasing) yield

[22] A simultaneous equation approach does not yield satisfactory results with neither the yield spread equation nor the liquidity equation yielding significant parameter estimates, regardless of the liquidity specification. This is inevitably due to the use of annual changes in both the yield spread and liquidity that fails to produce enough time-series variation to be explained by our choice of explanatory variables. In addition, instrumenting changes in liquidity proved difficult. No instruments that we tested yielded significant correlations with changes in liquidity. Consequently, the IV regression lacked adequate specification.

spreads, regardless of focusing on corporate or sovereign bonds, although the incremental effect appears much stronger for sovereign bonds.

5. Conclusions

Liquidity matters greatly for the pricing of emerging market bonds, both corporate and sovereign. Using a unique data set of emerging market bonds spanning 16 countries and eight years, we develop methods for assessing the liquidity component of these relatively illiquid securities and demonstrate the importance of modeling liquidity as a component of yield spreads.

Liquidity is significant in explaining cross-sectional variation in yields across rated and unrated categories and for both corporate and sovereign bonds, and remains highly significant after controlling for credit, macroeconomic, bond-specific characteristics and endogeneity biases. Sovereign bonds are slightly more liquid than corporate bonds, but there is great similarity in the effects across both categories. We are also the first study to examine the determinants of emerging market corporate bonds and document the similarity of these determinants to those of emerging market sovereign bonds as well as speculative-grade US domestic bonds.

Our results suggests that future research into determinants of sovereign and corporate emerging market spreads should incorporate liquidity effects, and that incorporation of liquidity components into pricing and risk management models (as in Duffie, Pedersen, and Singleton, 2004) is of critical importance. We also confirm at least a necessary condition for liquidity based contagion in emerging markets, namely the existence of significant liquidity premia embedded in emerging market bond returns.

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Table 1

Emerging Markets Summary

Yield spreads, liquidity, and ratings are presented by country separated for corporate and sovereign debt categories. The yield spread is the difference between the bond yield and the yield of a comparable maturity treasury bond as determined from *Datastream*. LOT refers to the modified Lesmond et al. (1999) model's liquidity estimate. The bid-ask is the proportional spread derived from daily quotes from *Bloomberg*. *Bloomberg* is used to determine the credit ratings history for each bond and we use Moody's as the principal rating, or when unavailable, we use the S&P rating. The first row is the mean estimate, the second row provides the median estimate, and the last row provides the of bond-years for each category. bp stands for basis points.

	Corporate Bonds								
	Rated Bonds					Non-Rated			
Country	Yield Spread (bp)	LOT (bp)	Bid-Ask (bp)	Zeros (%)	Rating Span	Yield Spread (bp)	LOT (bp)	Bid-Ask (bp)	Zeros (%)
Argentina	1286.26	492.66	53.64	73.82	Aa3-Caa1	1513.00	1337.72	57.53	94.62
	767.79	328.00	53.50	80.18	B2	1128.12	980.00	53.16	99.62
	(91)	(56)	(51)	(91)	(91)	(44)	(11)	(13)	(44)
Brazil	638.07	351.83	48.91	64.08	Baa1-B3	1110.90	782.05	47.42	80.20
	546.86	164.00	46.21	66.67	B1	719.71	392.00	48.30	89.23
	(109)	(65)	(55)	(109)	(109)	(67)	(39)	(40)	(67)
Chile	359.61	446.26	47.58	90.07	A2-B2	538.22	NA	85.87	99.90
	348.85	220.00	44.94	98.85	Baa1	536.00		85.87	100.0
	(79)	(19)	(44)	(79)	(79)	(4)		(2)	(4)
China	1673.12	208.43	51.32	74.37	A2-Caa3	2552.80	917.67	78.70	88.59
	382.29	36.50	45.95	100.0	Ba3	2520.77	492.00	75.89	100.0
	(46)	(16)	(19)	(46)	(46)	(9)	(3)	(4)	(9)
Hong Kong	358.22	66.15	45.39	40.61	Aa3-Ba3	291.75	178.18	52.78	66.87
	168.89	25.00	43.69	23.94	A3	188.00	98.00	50.28	70.50
	(112)	(83)	(95)	(112)	(112)	(25)	(11)	(9)	(25)
India	338.54	169.03	42.03	64.08	Baa2-Ba2	932.11	701.60	165.42	90.56
	324.27	56.50	39.55	66.67	Ba2	353.28	170.00	200.65	100.0
	(70)	(52)	(70)	(109)	(70)	(17)	(5)	(7)	(17)
Indonesia	806.99	569.11	73.63	88.86	B2-Caa2	3576.41	820.75	297.47	93.57
	545.94	300.50	46.01	96.93	B3	2502.00	653.50	425.57	97.88
	(46)	(18)	(35)	(46)	(109)	(18)	(4)	(8)	(18)
Kazakistan	415.97	79.95	43.60	26.22	Baa2-Ba2	405.81	19.00	30.80	48.40
	426.36	15.00	45.08	11.56	Baa3				
	(24)	(24)	(24)	(24)	(24)	(1)	(1)	(1)	(1)
Korea	583.04	154.52	57.15	63.06	Baa1-B2	925.54	876.22	91.80	94.46
	207.73	45.00	40.21	75.68	Baa2	576.72	875.00	78.86	100.0
	(131)	(69)	(77)	(131)	(109)	(59)	(7)	(23)	(59)
Mexico	475.90	279.22	41.22	74.18	A2-Caa2	3135.76	143.00	40.39	82.66
	376.47	127.00	42.81	89.08	Baa3	3316.60	97.00	40.40	100.0
	(218)	(106)	(80)	(218)	(218)	(13)	(4)	(2)	(13)
Poland	291.49	10.33	42.16	10.46	Baa2-Baa3				
	272.91	9.50	45.02	6.17	Baa3				
	(7)	(6)	(7)	(7)	(7)				
Russia	546.74	18.37	33.49	24.19	Baa2-B3	579.13	19.00	33.85	26.07
	531.38	14.00	33.56	11.29	Ba3	610.02	11.50	34.48	10.23
	(51)	(43)	(49)	(51)	(109)	(12)	(10)	(9)	(12)
Singapore	203.33	84.73	44.22	34.28	Aaa-B3	221.21	58.76	76.81	21.81
	150.86	9.00	39.91	11.32	Aa3	145.44	25.50	54.25	10.00
	(51)	(41)	(33)	(51)	(109)	(13)	(12)	(7)	(13)
South Africa	31.24	4.53	14.66	5.55	Aaa				
	31.24	4.53	14.66	5.55	Aaa				
	(2)	(2)	(2)	(2)	(2)				
Thailand	394.72	272.00	54.27	74.86	A3-B3	2631.44	844.44	60.19	91.33
	304.44	197.64	48.89	88.33	Ba2	1797.54	764.00	26.23	100.0
	(59)	(34)	(33)	(59)	(2)	(37)	(9)	(22)	(37)
Venezuela	876.68	NA	NA	99.88	B1-B3	557.68	73.00	NA	42.55
	666.33			100.0	B2				
	(20)			(20)	(20)	(1)	(1)		(1)

Country	Sovereign Bonds				
	Yield Spread (bp)	LOT (bp)	Bid-Ask (bp)	Zeros (%)	Rating Span
Argentina	3095.66	641.90	81.72	53.61	Ba3-Caa2
	1952.64	203.00	67.69	51.34	B2
	(114)	(78)	(95)	(114)	(114)
Brazil	610.69	85.92	55.97	47.76	A2-B2
	571.19	33.00	46.79	16.29	B2
	(156)	(89)	(82)	(156)	(156)
Chile	143.51	35.86	43.93	19.43	Baa1
	138.92	16.00	40.55	13.21	Baa1
	(16)	(15)	(10)	(16)	(16)
China	163.69	127.29	34.50	37.26	A3-Baa1
	138.23	13.00	36.20	15.08	A3
	(28)	(24)	(22)	(28)	(28)
Indonesia	500.82	420.11	52.13	65.48	Ba1-B3
	434.52	384.00	38.77	63.46	B3
	(9)	(6)	(9)	(9)	(9)
Kazakistan	215.58	131.22	29.19	63.27	Baa3-B1
	166.62	79.00	34308	67.82	Baa3
	(9)	(9)	(8)	(9)	(9)
Korea	154.35	44.38	36.45	19.51	A3-Ba2
	124.98	13.00	36.31	10.19	A3
	(58)	(55)	(42)	(58)	(58)
Mexico	283.74	20.43	41.00	11.20	Baa2-Ba2
	291.46	9.00	38.21	6.13	Baa2
	(77)	(74)	(74)	(77)	(77)
Poland	140.27	70.08	11.51	20.20	A2-Baa1
	127.68	21.50	11.50	12.59	A2
	(12)	(12)	(5)	(12)	(12)
Russia	1267.59	53.68	66.57	89.79	Ba2-B3
	816.08	23.00	49.47	67.30	Ba3
	(48)	(46)	(48)	(48)	(48)
South Africa	228.27	10.70	17.76	7.31	Baa2-Baa3
	218.62	8.53	13.47	5.62	Baa2
	(10)	(10)	(10)	(10)	(10)
Thailand	181.50	82.710	40.90	42.75	Baa1-Ba1
	156.21	67.00	42.81	24.20	Baa3
	(9)	(7)	(8)	(9)	(9)
Venezuela	753.03	109.62	53.70	62.76	B1-B3
	627.19	40.00	56.23	95.58	B2
	(79)	(36)	(69)	(79)	(79)

Table 2

Yield Spreads and Liquidity: Initial Comparisons

We present liquidity and yield spread statistics for corporate and sovereign bonds from 1997 to 2004. %Zeros is the percentage of zero returns for a given year adjusted for missing prices. LOT refers to the modified Lesmond et al. (1999) model's liquidity estimate. The bid-ask is the proportional spread derived from daily quotes from *Bloomberg*. To assign bond ratings, we use the extant Moody's credit rating from *Bloomberg*, and, when unavailable, we use the extant rating S&P credit rating. The yield spread is the difference between the bond yield and the yield of a comparable maturity treasury bond as determined from *Datastream*. Four separate samples for each bond category are presented. The first sample is restricted to only bonds with all available liquidity estimates, the second sample is restricted to only bonds with available LOT estimates, the third sample is restricted to only bonds with available bid-ask spreads, and the fourth sample contains all bonds. bp stands for basis points and N is the sample size.

	Corporate Bonds							
Liquidity &	Moody's Credit Ranking							
Yield Spreads	Aaa	Aa1-Aa3	A1-A3	Baa1-Baa3	Ba1-Ba3	B1-B3	Caa1-Caa3	NR
Zeros (%)	7.90	10.27	26.23	25.53	39.30	51.41	80.04	50.30
LOT (bp)	12.00	17.28	106.72	159.05	225.24	324.04	944.75	419.37
Bid-Ask (bp)	13.48	40.14	42.97	41.57	49.41	48.99	71.06	73.30
Yield Spread (bp)	32.07	118.62	182.16	252.92	444.43	633.69	1055.99	577.11
N	3	21	91	132	108	91	4	69
Zeros (%)	7.90	10.82	27.66	33.86	44.88	56.46	74.33	52.02
LOT (bp)	12.00	15.57	105.40	118.25	282.21	379.66	774.60	409.89
Yield Spread (bp)	32.07	126.69	170.43	270.52	442.00	662.93	941.94	544.70
N	3	33	106	188	166	128	5	108
Zeros (%)	7.90	27.52	41.75	42.25	52.85	67.56	94.50	74.66
Bid-Ask (bp)	13.48	40.44	42.18	41.62	56.42	51.52	98.55	159.17
Yield Spread (bp)	32.07	123.08	167.99	264.30	451.67	756.51	3241.21	1351.84
N	3	26	123	178	156	145	16	148
Zeros (%)	30.95	28.22	45.03	60.33	64.18	77.26	95.70	82.25
Yield Spread (bp)	57.07	134.42	179.41	406.67	587.58	868.88	2962.53	1443.13
N	4	41	148	337	289	265	32	322

	Sovereign Bonds				
Liquidity &	Moody's Credit Ranking				
Yield Spreads	A1-A3	Baa1-Baa3	Ba1-Ba3	B1-B3	Caa1-Caa3
Zeros (%)	12.66	13.92	13.79	16.75	50.72
LOT (bp)	20.17	30.62	85.59	172.86	987.20
Bid-Ask (bp)	31.78	36.60	45.38	60.85	100.58
Yield Spread (bp)	121.29	213.59	546.25	980.42	5598.24
N	51	88	64	169	30
Zeros (%)	12.93	15.09	14.36	17.91	46.75
LOT (bp)	19.01	39.39	64.20	149.80	664.51
Yield Spread (bp)	124.05	212.52	525.19	906.17	5757.19
N	72	97	69	189	27
Zeros (%)	27.94	14.95	17.50	34.32	57.26
Bid-Ask (bp)	33.66	36.29	48.52	59.11	104.39
Yield Spread (bp)	156.87	207.82	643.10	983.18	5438.69
N	57	91	70	219	42
Zeros (%)	28.08	16.84	18.81	49.49	60.93
Yield Spread (bp)	158.34	207.50	625.59	903.44	5061.89
N	81	100	75	318	46

Table 3

Liquidity Measure Tests

Panel A reports the regression of the bid-ask spread on the percentage of zero returns and the LOT estimate and other liquidity controls. Age and maturity are in years referenced from the year the bond was issued or its maturity date relative to the year being analyzed. The amount outstanding is the dollar amount of the bond that has not been redeemed and is log scaled. The bond volatility is log scaled. The bond ratings are numbered from one to 19 (Moody's ratings, Aaa to C). We control for the added risk of the call option by providing a dummy variable that is set to zero for non-callable bonds to one for callable bonds. Political risk rankings are provided by the International Country Risk Guide (ICRG). Political risk ranges from zero to 100 with lower political risk ratings indicating reduced political stability. Code/Civil is set to zero for English/code law countries and one for French/civil law countries. Bonds with 100% zero returns are deleted for the aggregate regressions because bond volatility is incalculable. Panel B reports an OLS regression of the yield spread on each liquidity measure for a matched sample using a matched sample with the bid-ask as a basis. Panel C is a univariate regression of the yield spread on either liquidity or credit rating alone using only the bond-specific sample for each liquidity measure. White's (1980) t-statistics are in parentheses. An * denotes significance at the 1% level, while a † denotes significance at the 5% level.

Panel A: Bid-Ask Spread on Liquidity Measures and Control Variables

Variable	Corporate Bonds				Sovereign Bonds			
Intercept	0.0040*	0.0069*	0.0038*	0.0095*	0.0044*	-0.0167	0.0049*	-0.0231
	(36.59)	(3.00)	(26.89)	(2.69)	(25.25)	(1.49)	(26.58)	(1.80)
LOT	**0.0286***	**0.0204**†			**0.0735***	**0.0634**†		
	(3.99)	(2.37)			(2.57)	(1.99)		
% Zeros			**0.0021***	**0.0010***			**0.0014**†	**0.0055**†
			(4.16)	(3.13)			(2.47)	(2.38)
Maturity		0.0001		0.0000		0.0001		0.0001
		(0.22)		(0.19)		(1.47)		(1.73)
Age		0.0001*		0.0001*		-0.0001		-0.0001
		(2.79)		(2.85)		(1.68)		(1.10)
Ln(Amt. Outstanding)		-0.0001		-0.0001		0.0011*		0.0016*
		(0.18)		(0.47)		(2.85)		(3.03)
Ln(Bond Volatility)		0.0003*		0.0005*		0.0005†		0.0008*
		(3.60)		(4.43)		(1.95)		(4.31)
Credit Rating		0.0001		0.0001		0.0002*		0.0001
		(1.05)		(1.24)		(2.57)		(1.64)
Call Dummy		0.0008†		0.0010†		-0.0009		-0.0017†
		(2.17)		(2.26)		(1.38)		(2.00)
Political Risk		-0.0001		-0.0001		-0.0001		-0.0000
		(0.31)		(0.30)		(0.48)		(0.38)
Code/Civil Dummy		-0.0003		-0.0003		-0.0002		0.0001
		(1.71)		(1.85)		(0.69)		(0.10)
Sample Size	467		663	503	402		477	422
% Adjusted R^2	26.74	33.37	4.24	25.21	21.76	45.99	1.40	15.03

Panel B: Yield Spread on Liquidity Measures

	Corporate Bonds						Sovereign Bonds		
Variable	Bid-Ask	Rated LOT	% Zero	Bid-Ask	Non Rated LOT	% Zero	Bid-Ask	LOT	% Zero
Coefficient	**5.2273***	**0.4477***	**0.0390***	**1.1758***	**0.2204***	**0.0726***	**16.5585***	**1.3310***	**0.2441***
	(3.32)	(6.96)	(6.65)	(2.82)	(4.39)	(3.63)	(3.24)	(5.16)	(4.63)
N		467			77			402	
% R^2	11.03	26.43	13.92	3.26	20.53	12.08	15.19	17.25	11.44

Panel C: Yield Spread on Liquidity Measures and Rating Alone

	Corporate Bonds						Sovereign Bonds					
	LOT	Rating	Bid-Ask	Rating	% Zeros	Rating	LOT	Rating	Bid-Ask	Rating	% Zeros	Rating
Coefficient	0.3536*	0.0055*	4.4123*	0.0093*	0.0736*	0.0102*	1.2326*	0.0245*	16.6037*	0.0279*	0.0551*	0.0231*
	(6.81)	(11.59)	(4.29)	(7.15)	(9.51)	(10.10)	(5.36)	(10.09)	(3.92)	(11.88)	(3.84)	(11.59)
% R^2	24.22	40.17	3.74	18.35	7.73	13.80	15.55	33.49	15.55	33.63	1.87	26.58

Table 4

Yield Spread Determinants and Liquidity Tests

The yield spread determinants are based on bond-specific variables (amount outstanding, coupon rate, and maturity and age in years), U.S. macroeconomic variables (One-year Treasury note rate (T-Note), the difference between the 10-year and 2-year Treasury rates (Term Slope), and the 30-day Eurodollar rate minus the 3-month T-Bill Rate (Eurodollar)), business cycle variable (inflation), and the country macro economic variables of external balance of goods, the total reserves, and the total debt service all as a percentage of GDP and the total debt to total exports. For sovereign bonds we also include the level of unemployment in each particular country. A dummy variable of zero is used for non-callable bonds and one for callable bonds. Default risk is based on Moody's ratings and numbered from one (Aaa rated bonds) to 19 (C rated bonds). Political risk rankings range from zero to 100 with lower political risk ratings indicating reduced political stability. Code/Civil dummy is set to zero for English/code law countries and one for French/civil law countries. The liquidity cost estimates are based on the modified LOT model, the percent zero returns, and the bid-ask spread. White's (1980) t-statistics are presented in parentheses. An * or a † signifies significance at the 1% or 5% level, respectively.

	Corporate Bonds						Sovereign Bonds		
Variable	Rated			Non-Rated					
Intercept	0.0482	0.1049	-0.1256	0.2501	0.1251	-0.5210†	-0.0330	-0.3703	-0.0225
	(1.55)	(1.08)	(1.35)	(1.05)	(0.25)	(2.23)	(0.13)	(1.29)	(0.11)
LOT	**0.2550***			**0.3293***			**0.6305***		
	(4.63)			(3.77)			(4.40)		
Bid-Ask		**3.2219***			**1.0959***			**9.0350***	
		(3.22)			(4.56)			(2.56)	
% Zeros			**0.0232***			**0.1120***			**0.0471***
			(3.22)			(3.72)			(2.51)
Maturity	0.0001	0.0021	0.0011	-0.0010†	-0.0079*	-0.0028*	-0.0014†	-0.0016*	-0.0008
	(0.52)	(1.88)	(1.41)	(2.06)	(3.28)	(2.64)	(2.38)	(2.60)	(1.35)
Age	-0.0009†	0.0011	0.0039*	0.0085*	0.0244*	0.0257*	-0.0024	-0.0076*	-0.0088*
	(2.30)	(1.30)	(3.07)	(2.55)	(3.59)	(5.51)	(1.27)	(3.86)	(5.19)
Amount	0.0007	-0.0047	0.0003	-0.0123	0.0073	0.0022	0.0028	-0.0043	0.0018
	(1.17)	(1.69)	(0.22)	(1.73)	(1.11)	(0.38)	(0.46)	(0.63)	(0.33)
Coupon	0.4928*	0.3190†	0.1402	0.3446	0.8583	0.7181	-0.6541	-0.2679	0.4492
	(6.89)	(2.06)	(0.70)	(1.73)	(1.31)	(1.66)	(1.60)	(0.61)	(1.61)
T-Note	-0.6493	-1.0491	0.2833	3.1890	-0.2398	-0.9032	-0.6904	2.8848	-1.6898
	(1.81)	(0.97)	(0.29)	(1.70)	(0.06)	(0.36)	(0.39)	(1.25)	(1.01)
Term Slope	-2.7531*	-1.3182	-0.1803	9.6695	13.1867	7.6920	-4.9523	8.0659	-5.0456
	(3.50)	(0.48)	(0.07)	(1.60)	(0.94)	(0.94)	(1.07)	(1.43)	(1.21)
EuroDollar	-0.0724*	-0.0174	-0.0575	0.1510	0.6096	0.3769	-0.2804*	-0.0089	-0.2266†
	(2.99)	(0.25)	(0.91)	(0.93)	(1.60)	(1.69)	(2.61)	(0.07)	(2.28)
Credit Rating	0.0026*	0.0091*	0.0119*				0.0278*	0.0290*	0.0250*
	(5.77)	(4.09)	(7.21)				(7.50)	(6.30)	(7.65)
Political Risk	-0.0001	-0.0010†	-0.0000	-0.0044*	-0.0087*	-0.0057*	0.0008	0.0023*	0.0010
	(0.72)	(2.32)	(0.04)	(3.03)	(3.79)	(4.03)	(1.02)	(2.88)	(1.49)
Call Dummy	0.0020	-0.0118	0.0329*	-0.0209	-0.0021	-0.0327	-0.0284	-0.0270	-0.0062
	(0.75)	(1.34)	(3.23)	(1.71)	(0.82)	(0.97)	(1.40)	(1.15)	(0.48)
Code/Civil Dummy	-0.0009	0.0351*	0.0499*	0.0433	0.0224	0.0209	0.0402*	0.0284†	0.0261
	(0.33)	(2.91)	(4.83)	(1.85)	(0.49)	(0.71)	(2.81)	(1.98)	(1.74)
Inflation	-0.0457*	-0.0826	-0.1210*	-0.0663	0.0469	0.0658	-0.1136*	-0.1363*	-0.1368*
	(2.55)	(1.59)	(2.76)	(0.82)	(0.31)	(0.65)	(2.92)	(3.35)	(3.69)
Unemployment							0.0137†	0.0104*	0.0066†
							(2.45)	(2.86)	(2.45)
External Balances	0.0007*	0.0018	0.0021	0.0038	0.0013	-0.0001	0.0000	0.0012	0.0014
	(2.57)	(1.79)	(1.87)	(1.05)	(0.34)	(0.02)	(0.00)	(0.74)	(0.90)
Total Reserves/GDP	-0.0343†	-0.0465	0.1014	0.0718	-0.0223	0.2374	-0.2866*	-0.3480*	-0.2899*
	(2.29)	(0.94)	(1.78)	(0.80)	(0.08)	(1.33)	(2.88)	(3.05)	(3.18)
Total Debt/Total Exports	0.0001	-0.0005†	-0.0007*	-0.0002	-0.0007	-0.0005	-0.0018*	-0.0023*	-0.0020*
	(1.77)	(2.24)	(4.92)	(0.88)	(0.83)	(1.06)	(5.17)	(6.27)	(7.21)
Total Trade/GDP	0.0001	0.0001	-0.0002†	-0.0001	0.0003	-0.0003	-0.0002	-0.0009†	-0.0007†
	(1.35)	(1.18)	(2.04)	(0.69)	(0.46)	(0.84)	(0.86)	(2.24)	(2.19)
N	582	602	1040	107	143	312	431	451	592
% Adj. R^2	61.10	31.27	24.74	64.77	57.40	31.90	62.35	60.08	53.10

Table 5

Feasible Generalized Least Squares: Yield Spread Determinant Tests

Cross-sectional (country) panel effects are examined with bond-specific variables (amount outstanding, coupon rate, and maturity and age), U.S. macroeconomic variables (One-year Treasury note rate, the 10-year minus 2-year Treasury rates, and the 30-day Eurodollar rate minus the 3-month T-Bill Rate), business cycle variable (inflation), and the country macro economic variables of external balance of goods, the total reserves, and the total debt service all as a percentage of GDP and the total debt to total exports. The level of unemployment is used for sovereign bonds. A dummy variable of zero is used for non-callable bonds and one for callable bonds. Default risk is based on Moody's ratings. Political risk rankings range from zero (worst) to 100 (best). Code/Civil dummy is zero (English/code) or one (French/civil). The liquidity cost estimates are based on the modified LOT model, the percent zero returns, and the bid-ask spread. There are 16 countries that report $US denominated corporate debt and 13 countries that report $US denominated sovereign debt. The significance of the regression is reported by the χ^2 statistic. An * or a † signifies significance at the 1% or 5% level, respectively.

	Corporate Bonds						Sovereign Bonds		
Variable	Rated			Non-Rated					
Intercept	0.0295	0.0284	-0.0524	0.2791	0.0446	-0.1321	0.1828	0.0342	0.1856
	(1.04)	(0.44)	(0.65)	(1.69)	(0.15)	(0.42)	(1.27)	(0.02)	(1.58)
LOT	**0.2136***			**0.3083***			**0.5529***		
	(10.20)			(7.03)			(4.18)		
Bid-Ask		**2.6634***			**1.2990***			**5.8508***	
		(5.13)			(6.41)			(4.24)	
% Zeros			**0.0208***			**0.0591**†			**0.0190**†
			(3.81)			(2.27)			(2.00)
Maturity	0.0001	0.0002	-0.0000	-0.0009	-0.0062*	-0.0002	0.0001	-0.0003	0.0002
	(0.90)	(1.20)	(0.08)	(1.90)	(2.53)	(0.24)	(0.31)	(0.64)	(0.62)
Age	-0.0014*	-0.0008†	-0.0002	0.0043†	0.0163*	0.0171*	-0.0030*	-0.0034†	-0.0039*
	(5.24)	(2.00)	(0.24)	(2.09)	(4.55)	(6.24)	(2.58)	(2.47)	(4.41)
Amount	0.0011	-0.0002	0.0012	-0.0099	0.0024	0.0038	-0.0016	-0.0043	0.0029
	(1.71)	(0.23)	(1.06)	(1.86)	(0.50)	(0.79)	(0.47)	(1.01)	(1.05)
Coupon	0.4486	0.4936*	0.4294*	0.3918†	0.0402	0.7501†	0.1757	0.3465†	0.5700*
	(12.44)	(6.80)	(4.57)	(2.24)	0.106)	(2.32)	(1.15)	(2.12)	(5.44)
T-Note	-0.5161	-0.6300	-0.0685	1.4820	-0.8031	-1.1052	-1.6945	0.0469	-1.6917
	(1.64)	(1.01)	(0.07)	(0.96)	(0.30)	(0.34)	(1.13)	(1.10)	(1.63)
Term Slope	-2.3229*	-1.7962	-0.9678	3.8688	10.1068	3.9625	-6.1547†	-0.8442	-5.1528†
	(2.32)	(1.01)	(0.41)	(0.31)	(0.90)	(0.48)	(1.96)	(0.22)	(2.47)
EuroDollar	-0.0660*	-0.0340	-0.0321	0.0334	0.4823†	0.1866	-0.1782*	-0.0818	-0.1474†
	(3.88)	(0.94)	(0.67)	(0.32)	(2.23)	(1.03)	(2.59)	(1.01)	(2.47)
Credit Rating	0.0026*	0.0035*	0.0067*				0.0122*	0.0118*	0.0107*
	(7.45)	(4.99)	(7.81)				(6.24)	(5.38)	(7.15)
Political Risk	-0.0001	-0.0003	-0.0004	-0.0042*	-0.0069*	-0.0057	-0.0004	0.0008	-0.0002
	(1.18)	(1.09)	(1.16)	(5.33)	(3.94)	(4.18)	(0.76)	(1.32)	(0.55)
Call Dummy	0.0039	0.0058	0.0163*	-0.0172	-0.0307	-0.0050	-0.0060	-0.0053	0.0143
	(1.87)	(1.48)	(2.70)	(1.55)	(1.73)	(1.24)	(0.37)	(0.29)	(1.57)
Code/Civil Dummy	0.0004	0.0034	0.0219*	0.0365†	0.0388	0.0619†	0.0008	0.0019	-0.0041
	(0.19)	(0.66)	(3.53)	(2.27)	(1.17)	(2.39)	(0.11)	(0.20)	(0.52)
Inflation	-0.0193	-0.0228	-0.0692†	-0.0682	0.1008	-0.0326	-0.0405	-0.0438	-0.0645
	(1.55)	(0.96)	(2.39)	(1.31)	(0.41)	(0.24)	(1.08)	(1.14)	(1.88)
Unemployment							0.0211*	0.0173*	0.0115*
							(6.78)	(7.11)	(5.47)
External Balances	0.0006*	0.0004	0.0009	0.0018	0.0009	-0.0013	-0.0002	0.0011	0.0013
	(3.15)	(1.00)	(1.76)	(1.37)	(0.41)	(0.62)	(0.27)	(1.05)	(1.63)
Total Reserves/GDP	-0.0229†	-0.0021	0.0160	0.0302	0.0319	0.1822	-0.0510	-0.0652	-0.0473
	(1.96)	(0.09)	(0.43)	(0.73)	(0.19)	(1.30)	(0.09)	(0.92)	(0.99)
Total Debt/Total Exports	0.0001†	0.0001	-0.0002†	-0.0002	-0.0001	-0.0011*	-0.0003	-0.0007*	-0.0005*
	(2.15)	(0.42)	(2.15)	(0.91)	(0.29)	(2.74)	(1.84)	(3.22)	(3.30)
Total Trade/GDP	0.0001	-0.0000	0.0001	0.0018	0.0001	-0.0004	-0.0001	-0.0006†	-0.0003
	(1.00)	(0.21)	(0.46)	(1.37)	(0.41)	(1.42)	(0.44)	(1.99)	(1.47)
N	581	602	1040	107	143	301	431	453	590
χ^2	1309.07*	339.39*	218.42*	161.31*	168.19*	265.37*	276.85*	303.25*	326.66*

Table 6

Three-Stage Least-Squares Estimation: Yield Spread Determinants

The simultaneous equation model results are presented using three liquidity measures, the modified LOT estimate, the percentage of zero returns, and the bid-ask spread. The yield spread determinants are based on bond-specific effects (bond rating, amount outstanding, coupon rate, and maturity and age in years), US macroeconomic variables (One-year Treasury note rate (T-Note), the difference between the 10-year and 2-year Treasury rates (Term Slope), and the 30-day Eurodollar rate minus the 3-month T-Bill Rate (Eurodollar)), business cycle variable (inflation), and the country macro economic variables of external balance of goods, the total reserves, and the total debt service all as a percentage of GDP and the total debt to total exports. For sovereign bonds we also include the level of unemployment in each particular country. A dummy variable of zero is used for non-callable bonds and one for callable bonds. Default risk is based on Moody's ratings and numbered from one (Aaa rated bonds) to 19 (C rated bonds). Political risk rankings range from zero to 100 with lower political risk ratings indicating reduced political stability. Code/Civil dummy is set to zero for English/code law countries and one for French/civil law countries. σ_B refers to bond volatility. The amount outstanding and bond volatility are log scaled. An * denotes 1% significance while a † denotes 5% significance.

	Corporate: Rated Bonds					
Instrumental Variable	Yield Spread	LOT	Yield Spread	Bid-Ask	Yield Spread	%Zeros
Intercept	0.0973†	0.2110*	0.1068	0.0155*	0.8196	0.6332†
	(2.35)	(5.16)	(1.47)	(5.88)	(0.94)	(2.47)
Liquidity	**0.6194***		**21.5344***		-1.8656	
	(9.43)		(3.74)		(1.58)	
Maturity	-0.0001	-0.0001	-0.0003	0.0000	0.0049	0.0020
	(0.11)	(1.19)	(1.02)	(0.63)	(1.37)	(1.36)
Age	-0.0017*	0.0018*	-0.0045*	0.0002*	0.0439	0.0219*
	(3.49)	(2.59)	(3.40)	(3.81)	(1.48)	(4.76)
Amount	0.0018†	-0.0031†	0.0010	-0.0001	-0.0836	-0.0456*
	(2.26)	(2.49)	(0.63)	(1.66)	(1.58)	(5.81)
Coupon	0.5330*		0.8772*		-1.6183	
	(9.56)		(4.90)		(1.14)	
T-Note	-1.0417†		-3.0415*		-5.0545	
	(2.27)		(3.28)		(0.49)	
Term Slope	-4.4119*		-8.0764*		0.5924	
	(3.79)		(3.46)		(0.04)	
Eurodollar	-0.1240*		-0.1563*		0.4100	
	(4.47)		(2.93)		(1.13)	
$Ln(\sigma_B)$		0.0170*		0.0008*		0.0188
		(8.80)		(7.52)		(1.58)
Credit Rating	0.0010	0.0038*	-0.0005	0.0002*	0.0772	0.0448*
	(1.79)	(3.70)	(0.37)	(4.42)	(1.60)	(6.85)
Political Risk	-0.0002	0.0002	0.0004	-0.0001	0.0098	0.0048*
	(1.34)	(0.93)	(1.38)	(1.85)	(1.40)	(2.97)
Call	-0.0028	0.0124†	-0.0137	0.0012*	0.2447	0.1368*
	(0.76)	(2.16)	(1.65)	(4.09)	(1.55)	(3.77)
Code/Civil	-0.0043	0.0109*	-0.0034	0.0001	0.2186†	0.1404*
	(1.33)	(2.88)	(0.61)	(0.41)	(2.00)	(5.92)
Inflation	-0.0507*		-0.0539		0.3496	
	(3.26)		(1.52)		(0.83)	
External Balances	0.0009*		0.0008		-0.0057	
	(3.22)		(1.74)		(0.89)	
Total Reserves/GDP	-0.0292		-0.0361		-0.7381	
	(1.56)		(1.02)		(0.71)	
Total Debt/Total Exports	0.0001		0.0002		-0.0003	
	(1.56)		(1.67)		(0.90)	
Total Trade/GDP	0.0001		-0.0000		0.0018	
	(0.31)		(0.10)		(0.74)	
Yield Spread		-0.3218†		-0.0429*		-2.3718†
		(1.94)		(4.57)		(2.28)
Sample Size	581		444		643	
System R^2	49.82		46.80		30.26	
% Cross Correlation	-49.12		-62.58		96.61	

	Corporate: Non-Rated Bonds					
Instrumental Variable	Yield Spread	LOT	Yield Spread	Bid-Ask	Yield Spread	%Zeros
Intercept	0.3537 (1.28)	0.9680† (2.33)	0.3134 (0.58)	0.0596* (3.47)	7.6895 (0.10)	4.9509* (5.55)
Liquidity	**0.4598*** (5.23)		**32.8891*** (2.56)		-2.7738 (0.12)	
Maturity	-0.0007 (1.13)	0.0009 (0.84)	0.0073 (1.21)	-0.0002 (1.29)	0.0022 (0.02)	0.0047 (1.87)
Age	0.0065† (2.26)	-0.0026 (0.44)	0.0112 (1.77)	0.0002 (1.02)	0.0561 (0.17)	0.0162 (1.34)
Amount	-0.0045 (0.51)	-0.0207† (2.23)	0.0024 (0.18)	-0.0008 (1.84)	-0.1448 (0.06)	-0.1649* (5.85)
Coupon	0.2178 (0.96)		2.4834† (2.38)		-5.9621 (0.27)	
T-Note	1.6801 (1.03)		-4.4344 (1.20)		19.9394 (0.41)	
Term Slope	2.9373 (0.58)		-13.998 (1.20)		-75.471 (0.36)	
Eurodollar	-0.0324 (0.25)		-0.4281 (1.35)		-3.1310 (0.43)	
$Ln(\sigma_B)$		0.0298* (3.91)		0.0017* (3.68)		0.0214 (1.24)
Political Risk	-0.0050* (4.03)	-0.0006 (0.23)	-0.0033 (0.98)	-0.0002 (1.69)	-0.0926 (0.10)	-0.0164* (2.75)
Call	-0.0109 (0.78)	-0.0072 (0.26)	0.0161 (0.52)	-0.0007 (0.81)	0.4859 (0.16)	0.0761 (1.30)
Code/Civil	0.0465† (2.45)	-0.0056 (0.24)	0.0037 (0.08)	-0.0013 (1.51)	-1.1033 (1.04)	0.1589* (3.23)
Inflation	-0.1317† (2.00)		0.1147 (0.88)		-1.1033 (1.04)	
External Balances	0.0051* (3.06)		-0.0046 (1.24)		0.0237 (0.76)	
Total Reserves/GDP	-0.0129 (0.13)		0.0621 (0.27)		-4.7302 (0.37)	
Total Debt/Total Exports	-0.0004 (1.38)		-0.0008 (1.45)		-0.0027 (0.85)	
Total Trade/GDP	-0.0001 (0.10)		0.0000 (0.01)		0.0071 (0.36)	
Yield Spread		0.5052 (1.38)		-0.0465† (1.99)		-0.7632 (0.90)
Sample Size	102		70		110	
System R^2	51.13		59.55		50.65	
% Cross Correlation	-61.30		-24.21		-94.70	

	Sovereign Bonds: All Rated					
Instrumental Variable	Yield Spread	LOT	Yield Spread	Bid-Ask	Yield Spread	%Zeros
Intercept	0.0861 (0.45)	0.0302* (5.37)	0.7844 (1.75)	-0.0095 (1.73)	-7.9935 (1.66)	2.7336* (10.03)
Liquidity	**15.1952*** (6.18)		**63.2508*** (3.81)		2.0446 (0.56)	
Maturity	-0.0006 (1.42)	-0.0001† (2.43)	-0.0070* (3.13)	0.0001* (3.15)	-0.0016 (0.33)	0.0005 (0.40)
Age	-0.0032† (2.40)	0.0001 (1.53)	0.0029 (0.49)	-0.0001 (0.68)	-0.0297* (0.65)	0.0138* (3.46)
Amount	0.0204* (4.73)	-0.0010* (5.08)	-0.0447† (2.26)	0.0007* (3.71)	0.2780* (0.68)	-0.1249* (12.60)
Coupon	0.2464† (2.29)		-0.3214 (1.93)		-0.2341* (0.25)	
T-Note	-4.3346† (2.32)		-0.2435 (0.11)		21.2098 (0.48)	
Term Slope	-12.779* (2.78)		-1.3801 (0.22)		45.4586 (0.49)	
Eurodollar	-0.2610* (3.15)		-0.1022 (0.68)		0.3811 (0.54)	
$Ln(\sigma_B)$		0.0014* (7.64)		0.0003 (1.71)		0.0014 (0.14)
Credit Rating	0.0024 (0.81)	0.0002 (1.73)	0.0034 (0.27)	0.0001 (1.30)	0.0162 (0.11)	0.0114† (2.40)
Political Risk	-0.0018* (2.56)	0.0001* (3.95)	0.0009 (0.51)	-0.0001 (0.22)	0.0038 (0.55)	-0.0017 (1.21)
Call	-0.0185 (1.03)	0.0021† (2.34)	0.0514 (0.80)	-0.0001 (0.96)	-0.0228 (0.13)	0.0110 (0.25)
Code/Civil	-0.0017 (0.17)	0.0001 (0.22)	0.0446 (1.43)	-0.0003 (0.66)	0.1663 (0.77)	-0.0244 (1.06)
Inflation	-0.0275* (0.96)		-0.1140 (1.21)		-0.4617 (0.41)	
Unemployment	0.0171* (13.14)		0.0063* (2.75)		-0.0096 (0.66)	
External Bal.	0.0001 (0.08)		0.0013 (0.96)		-0.0044 (0.48)	
Total Reserves/GDP	0.0610 (1.07)		-0.1842 (1.73)		0.9890 (0.50)	
Total Debt/Total Exports	-0.0002 (1.35)		-0.0011 (1.82)		-0.0033 (0.39)	
Total Trade/GDP	0.0001 (0.39)		0.0000 (0.01)		0.0006 (0.37)	
Yield Spread		0.0067† (2.11)		0.0077* (3.39)		0.3450 (2.83)
Sample Size	357		393		453	
System R^2	67.39		57.05		43.95	
% Cross Correlation	-65.55		-95.65		-95.28	

Table 7

Instrumental Variable Regression: Yield Spread Determinant Tests

The instrumented variables are credit rating and liquidity. For both the corporate and sovereign bonds, the exogenous variables excluded from the regression are the number of publicly listed companies, domestic credit, the number of analysts forecasts, and log scaled bond volatility. Callable bonds are set to zero for non-callable bonds and one for callable bonds. Default risk is based on Moody's ratings. Political risk rankings range from zero to 100 with lower political risk ratings indicating reduced political stability. Code/Civil is a variable that is set to zero for English/code law countries and one for French/civil law countries. The liquidity cost estimates are based on the modified LOT model, the percent zero returns, and the bid-ask spread. Hansen's J statistic reports the test results that the excluded exogenous variables are uncorrelated with the error term and correctly excluded from the estimated equation. Rejection casts doubt on the validity of the instruments. An * or a † signifies significance at the 1% or 5% level, respectively.

Variable	Corporate Bonds			Sovereign Bonds		
Intercept	0.0515	0.0558	-0.2045	-1.4618	-0.1614	-3.4998
	(1.19)	(0.61)	(1.54)	(1.59)	(0.63)	(1.04)
LOT	**0.6299***			**7.2525***		
	(5.13)			(2.68)		
Bid-Ask		**28.2702***			**55.4229***	
		(3.20)			(4.00)	
% Zeros			0.8126			2.6607
			(0.26)			(1.14)
Credit Rating	-0.0001	-0.0030	-0.0104	-0.0351	0.0029	-0.0651
	(0.01)	(0.90)	(0.15)	(1.20)	(0.23)	(0.62)
Maturity	-0.0001	-.00002	-0.0027	-0.0053†	-0.0091*	-0.0015
	(0.43)	(0.79)	(1.33)	(2.21)	(3.93)	(0.65)
Age	-0.0015*	-0.0034*	-0.0027	0.0061	-0.0091*	-0.0382
	(3.53)	(3.42)	(1.33)	(0.66)	(3.93)	(1.26)
Amount	0.0016†	0.0011	0.0085	0.1067†	-0.0184†	0.2962
	(2.05)	(1.04)	(1.64)	(2.11)	(2.09)	(1.09)
Coupon	0.5777*	1.1466*	0.2631	-1.0400	0.0728	0.0605
	(6.34)	(4.39)	(1.86)	(1.92)	(0.47)	(0.05)
T-Note	-0.1641	-2.5189	-0.1997	-5.8172*	-3.1191	-35.302
	(1.12)	(1.73)	(0.21)	(1.32)	(1.49)	(0.93)
Term Slope	-2.4808†	-6.5042	-2.4879	-7.3695	0.6930	-77.497
	(2.08)	(1.88)	(1.14)	(0.67)	(0.15)	(0.58)
EuroDollar	-0.1070*	-0.1416†	-0.1036	-0.1460	0.1015	-0.8103
	(2.91)	(2.19)	(1.65)	(1.30)	(1.05)	(0.73)
Political Risk	-0.0003	0.0002	0.0004	0.0001	0.0027*	0.0054
	(1.47)	(0.93)	(1.00)	(0.11)	(3.77)	(0.99)
Call Dummy	-0.0015	-0.0181	-0.0290	-0.0397	-0.0002	-0.0421
	(0.39)	(1.52)	(1.64)	(1.48)	(0.02)	(1.83)
Code/Civil Dummy	-0.0033	-0.0039	-0.0158	0.0069	0.0061	0.0304
	(0.54)	(1.42)	(1.29)	(0.49)	(0.51)	(1.56)
Inflation	-0.0479†	0.0339	-0.3433	0.3133	-0.0704	-0.0798
	(2.19)	(0.53)	(1.23)	(1.47)	(0.28)	(0.87)
Unemployment				0.0290*	0.0075	0.0194
				(3.29)	(1.25)	(1.68)
External Balances	0.0013*	-0.0000	0.0016	0.0009	0.0032	0.0046*
	(3.96)	(0.01)	(0.21)	(0.87)	(1.02)	(0.43)
Total Reserves/GDP	0.0001	0.0582	0.6294	-0.2914	-0.3642*	-1.5907
	(1.48)	(1.05)	(0.24)	(0.97)	(2.11)	(1.23)
Total Reserves/Total Exports	0.0017	0.0002	-0.0007	0.0031	-0.0014	0.0035
	(0.60)	(1.33)	(0.28)	(1.47)	(1.53)	(0.60)
Total Trade/GDP	-0.0001	-0.0002	-0.0014	0.0009	-0.0012†	-0.0003
	(0.57)	(1.57)	(0.27)	(0.87)	(2.25)	(0.11)
N	582	455	644	431	394	394
Hansen J Statistic	0.15	2.12	1.04	1.43	1.51	5.89
Liquidity Partial R^2	25.21	13.99	9.19	12.44	22.64	6.62
Rating Partial R^2	52.96	62.60	53.09	73.08	75.36	71.79

Table 8

Yield Spread Change Determinants and Liquidity Tests

The yield spread change determinants are based on bond-specific effects, macroeconomic effects, and firm-specific operating characteristics. Annual changes in all variables are examined for the 1997-2004 period. The liquidity cost proxies include the LOT estimate, the percentage of zero returns, and the bid-ask spread. Changes in default risk is based on Moody's ratings and is set to minus one if the change in the credit rating is negative, zero of there is no change in the credit rating, and one if the change in the credit rating is positive. Political risk ranges from zero to 100 with lower political risk ratings indicating reduced political stability. The liquidity cost estimates are based on the modified LOT model, the percent zero returns, and the bid-ask spread. T-Note Rate is the one-year Treasury rate. Term-Slope is the difference between the 10 year and 2-year Treasury rates. Eurodollar refers to the difference between the 30-day Eurodollar rate and the 3-month T-Bill rate. The last partition is a univariate regression of the yield spread on either liquidity or credit rating alone using only the available bond-specific sample for each liquidity measure. White's (1980) t-statistics are presented in parentheses. An * denotes 1% significance while a † denotes 5% significance.

Variable	Corporate Bonds			Sovereign Bonds		
Intercept	-0.0037†	-0.0045†	-0.0006	0.0014	-0.0102*	0.0050
	(2.44)	(2.01)	(0.29)	(0.45)	(3.70)	(1.66)
Δ(LOT)	**0.2026***			**0.7028***		
	(3.45)			(5.61)		
Δ(Bid-Ask)		**3.1350***			**5.6772**†	
		(3.39)			(2.06)	
Δ(%Zero)			0.0286			**0.1205***
			(0.75)			(4.24)
Δ(Credit Rating)	0.0090*	0.0056	0.0037	0.0339*	0.0120†	0.0267*
	(3.24)	(1.74)	(0.81)	(5.67)	(1.98)	(4.07)
Δ(TBill)	-3.2820*	-3.9809*	-2.5878*	-2.5727†	-4.7352*	-5.0212*
	(6.53)	(4.93)	(4.25)	(2.11)	(5.13)	(5.17)
Δ(Delta)	-7.6952*	-9.2848*	-5.0863*	-4.0426	-8.9201*	-7.5388*
	(6.14)	(4.90)	(3.19)	(1.45)	(3.95)	(3.25)
Δ(Euro)	-0.1437*	-0.1905*	-0.0956*	-0.0507	-0.1464*	-0.0617
	(6.40)	(5.07)	(2.81)	(1.00)	(2.77)	(1.19)
Δ(Political Risk)	-0.0017*	-0.0024*	-0.0017*	-0.0033*	-0.0019	-0.0044*
	(3.55)	(4.52)	(3.55)	(3.58)	(1.84)	(5.17)
Δ(Inflation)	-0.0393	-0.0426	-0.0170	-0.0800*	-0.0334	-0.0521†
	(1.81)	(1.02)	(0.74)	(3.02)	(1.67)	(1.96)
Δ(Unemployment)				0.0049†	0.0004	0.0032†
				(1.95)	(0.40)	(2.21)
Δ(External Balances)	0.0005	-0.0003	-0.0002	-0.0004	-0.0007	0.0009
	(0.94)	(0.37)	(0.28)	(0.68)	(1.65)	(1.20)
Δ(Total Reserves/GDP)	-0.0404	-0.0750	-0.0000	-0.2683*	-0.0012†	-0.1598
	(0.85)	(1.38)	(0.00)	(3.00)	(2.11)	(1.34)
Δ(Total Reserves/Total Exports)	-0.0002	-0.0003	-0.0007	-0.0012*	-0.0004	-0.0009*
	(1.25)	(2.12)	(1.70)	(3.41)	(1.10)	(3.38)
Δ(Total Trade/GDP)	-0.0002†	-0.0001	-0.0000	-0.0001	0.0193	-0.0014†
	(2.44)	(1.78)	(0.12)	(0.09)	(0.26)	(2.29)
Sample Size	305	357	718	304	318	450
Adj R^2 (%)	41.68	33.99	9.50	58.43	31.20	42.14
Liquidity Alone	0.2913*	4.1807*	0.0070†	0.9524*	9.5267*	0.1820*
	(3.35)	(3.00)	(1.95)	(4.79)	(3.95)	(3.92)
% Adj. R^2	22.00	5.85	0.15	31.67	10.20	14.12
Credit Risk Alone	0.0064	0.0060	0.0025	0.0644*	0.0650*	0.06236
	(1.80)	(1.43)	(0.59)	(4.25)	(4.11)	(4.68)
% Adj. R^2	1.05	0.69	0.08	15.98	13.47	12.92

Table 9

Feasible Generalized Least Squares: Yield Spread Change Tests

Cross-sectional (country) panel effects for yield spread change determinants are based on bond-specific effects, macroeconomic effects, and firm-specific operating characteristics. Annual changes in all variables are examined for the 1997-2004 period. The liquidity cost proxies include the LOT estimate, the percentage of zero returns, and the bid-ask spread. Changes in default risk is based on Moody's ratings and is set to minus one if the change in the credit rating is negative, zero of there is no change in the credit rating, and one if the change in the credit rating is positive. Political risk ranges from zero to 100 with lower political risk ratings indicating reduced political stability. T-Note Rate is the one-year Treasury rate. Term-Slope is the difference between the 10 year and 2-year Treasury rates. Eurodollar refers to the difference between the 30-day Eurodollar rate and the 3-month T-Bill rate. There are 16 countries that report $US denominated corporate debt and 13 countries that report $US denominated sovereign debt. The country forms the basis of the cross-sectional panel effect. The significance of the regression is reported by the χ^2. An * or a † signifies significance at the 1% or 5% level, respectively.

Variable	Corporate Bonds			Sovereign Bonds		
Intercept	-0.0054*	-0.0052*	-0.0081*	-0.0024	-0.0051	-0.0061†
	(5.52)	(4.15)	(8.68)	(0.86)	(1.36)	(2.04)
Δ(LOT)	**0.1302***			**0.7894***		
	(3.99)			(5.87)		
Δ(Bid-Ask)		**1.5759***			**2.3387†**	
		(3.89)			(1.96)	
Δ(%Zero)			0.0022			**0.0482***
			(0.88)			(2.92)
Δ(Credit Rating)	0.0016	0.0018	0.0017	0.0216*	0.0160†	0.0218*
	(1.01)	(0.95)	(1.11)	(3.85)	(2.19)	(3.46)
Δ(TBill)	-2.3084*	-2.2792*	-1.9906*	-2.6071*	-3.0665†	-1.9192
	(7.28)	(6.04)	(6.12)	(2.53)	(2.14)	(1.60)
Δ(Delta)	-5.4856*	-5.4163*	-4.3577*	-5.6601†	-5.2777	-2.4279
	(6.81)	(5.58)	(5.36)	(2.32)	(1.70)	(0.84)
Δ(Euro)	-0.0934*	-0.1043*	-0.0748*	-0.0861	-0.0519	-0.0171
	(5.89)	(5.30)	(4.88)	(1.84)	(0.82)	(0.30)
Δ(Political Risk)	-0.0005*	-0.0008*	-0.0007*	-0.0021*	-0.0028*	-0.0023*
	(3.48)	(3.72)	(4.59)	(4.27)	(4.31)	(4.29)
Δ(Inflation)	-0.0304†	-0.0220	-0.0396*	-0.0807*	-0.0532	-0.0923*
	(2.15)	(1.29)	(3.45)	(3.34)	(1.72)	(2.95)
Δ(Unemployment)				0.0038	0.0019	0.0014
				(1.87)	(1.25)	(0.99)
Δ(External Balances)	0.0006	-0.0000	0.0002	-0.0012	-0.0011	-0.0010
	(0.19)	(0.01)	(0.97)	(1.84)	(1.46)	(1.24)
Δ(Total Reserves/GDP)	-0.0322	-0.0337	0.0140	-0.1347	-0.0354	-0.1308
	(1.21)	(1.01)	(0.52)	(1.67)	(0.32)	(1.21)
Δ(Total Reserves/Total Exports)	-0.0002	-0.0001	-0.0007	-0.0005†	-0.0009*	-0.0006*
	(1.24)	(0.53)	(1.70)	(2.13)	(2.79)	(2.95)
Δ(Total Trade/GDP)	-0.0001	-0.0001	0.0001	-0.0001	-0.0051	-0.0004
	(1.16)	(0.70)	(0.69)	(0.09)	(1.56)	(0.87)
Sample Size	264	358	540	304	330	389
χ^2	109.14*	339.39*	91.05*	161.31*	90.37*	136.13*