Flight-to-Liquidity and Global Equity Returns

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ABSTRACT

Investment practice and academic literature document a great degree of interaction between stock markets around the world and most liquid and safest assets such as the US Treasury bonds. Using data from 46 markets, we examine the joint impact of the "flight-to-liquidity" and "flight-to-quality" on global asset valuation. Our proxy for the flight-to-liquidity/quality is the illiquidity of US short-term Treasury bonds. We find that it is a leading indicator of the stock market illiquidity, and that it is also a strong predictor of future equity returns in both developed and emerging markets. This predictive relation remains intact after controlling for other global and local variables, including the lagged US term spread, dividend yields, equity market returns, as well as global and local stock market illiquidity. Subsequent tests reveal that the bond illiquidity is significantly correlated with contemporaneous stock market returns, and that it is a priced factor even in the presence of other conventional risk factors, such as the world stock market return, exchange rate, stock market illiquidity, and the term spread. Our results indicate that the flight-to-liquidity/quality risk is an important determinant of returns in global equity markets.

JEL Classification: G12; G15

1. Introduction

The existing literature generally agrees that stock and bond markets are interlinked, although its economic reasons are not fully understood.[1] It has also been shown that these markets are integrated via illiquidity. Chordia, Sarkar, and Subrahmanyam (2005), Goyenko (2006), Goyenko and Ukhov (2007), and Baele, Bekaert, and Inghelbrecht (2007) find that illiquidity has a cross-market effect and that common factors drive illiquidity and volatility in stock and bond markets.

In this paper, we develop and test an international asset pricing model with global US Treasury bonds based illiquidity factor. In our framework, we consider it as a viable proxy for a joint "flight-to-liquidity" and "flight-to-quality" risk around the world. It is well known that in market downturns, investors chase safest and most liquid securities such as US Treasures which improves its liquidity (see Longstaff, 2004). For instance, on the aftermath of the LTCM crisis in 1998, the *Financial Times* wrote:

> "LTCM … was heavily invested in the Russian market, most of its exposure was in the US, Europe and Japan, in markets about as far removed from Indonesian bonds or Brazilian stocks as you can get. Yet its balance sheet was wiped out … any reduction in US interest rates would probably, in itself, not be enough to stop the global "flight to quality"."[2]

This means that the illiquidity of the world's safest assets changes over time in response to asset allocation shifts from and to more risky securities.[3] As a result, the more an asset is exposed to the flight-to-quality (or flight-to-liquidity), the higher should be its expected return, i.e., investors should be receiving a premium for not switching from illiquid stocks into Treasuries.

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[1] Fleming, Kirby, and Ostdiek (1998) find strong volatility linkages between stock and bond markets. Scruggs and Glabadanidis (2003) show that stock but not bond returns respond to both stock and bond return shocks. Connolly, Stivers, and Sun (2005) find that stock market uncertainty has important cross-market pricing. Li (2002) provides some evidence that stock-bond correlations are determined primarily by uncertainty about expected inflation. However, Shiller, and Beltratti (1992), Campbell and Ammer (1993) and Baele, Bekaert, and Inghelbrecht (2007) conclude that the existing levels of co-movement cannot be justified by economic fundamentals.

[2] "Liquidity crunch threatens", *Financial Times*, London (UK): Sep 28, 1998, pg. 27.

[3] The allocation of funds to or from equity markets is not limited to the times of financial crises. Goetzmann and Massa (2002) find that investors move funds in and out of the equity market in response to daily market news and changes in risk.

Very few studies account for interest rate based risk factors in general to price equity returns. Chen, Roll and Ross (1986) find that default and term spreads are priced in the stock market. Scruggs (1998) shows that bond returns are important for explaining the intertemporal relation between expected market return and risk. Ferson and Harvey (1993) use an ad-hoc set of global risk factors that includes US bond and Treasury bill returns and examine equity pricing across countries.[4] Further, numerous studies, although focusing on the stock market illiquidity only, show its significant impact on the time-series and cross-section of expected stock returns in the US.[5] In international setting, the role of liquidity is less precise largely due to the difficulty of constructing stock-based liquidity measures for different countries. Predictably, few studies in this area yield somewhat contradicting results. For instance, Bekaert, Harvey, and Lundblad (2007) find that models with local liquidity factors outperform standard CAPM in emerging markets. Lee (2006) shows however that global liquidity risk is priced and that the U.S. market liquidity is the main driver of this risk.

We study the importance of flight-to-liquidity/quality for global equity returns using data from 46 countries over the 30 year period from 1977 to 2006. We start with the analysis of the relation between the US Treasury bond market illiquidity and stock market illiquidity around the world. Our proxy for the bond illiquidity is the average percentage bid-ask spread of off-the-run US Treasury bonds with maturities of up to one year. Goyenko, Subrahmanyam, and Ukhov (2007) demonstrate that the illiquidity of short-term off-the-run issues is the main determinant of illiquidity premium in the US Treasury bond market. Our proxy for the stock market illiquidity in each country is the value-weighted proportion of daily zero returns in a given month as in Bekaert, Harvey, and Lundblad (2007) and Lee (2006). The vector-autoregression analysis shows that bond illiquidity predicts stock market illiquidity, both at the country level and worldwide, but

[4] Most of the papers on international equity returns effectively assume segmentation of the stock and bond markets, and therefore price equity returns using solely global and/or local stock market based risk factors (e.g., see Harvey, 1991; Bekaert and Harvey, 1995; Karolyi and Stulz, 1996; De Santis and Gerard, 1997; and Carrieri et al., 2006). Dumas and Solnik (1995), De Santis and Gerard (1998) and some other studies also account for currency risk.

[5] See Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), Amihud (2002), Pastor and Stambaugh (2003), and Acharya and Pedrsen (2005) among others.

not vice-versa. This is consistent with flight-to-liquidity/quality episodes occurring not only in the US (see Goyenko and Ukhov, 2007) but also in other countries. Furthermore, bond illiquidity retains its predictive power for stock market illiquidity in the presence of world and local equity market returns and volatilities. We also observe that, unlike stock market illiquidity, global equity market volatility and the US federal funds rate predict the variation in the bond illiquidity.

Next, we run regressions of stock returns on the lagged bond illiquidity and other lagged variables to determine the importance of bond illiquidity in predicting global asset returns. The tests show that the slope on the bond illiquidity is significant and negative across both developed and emerging markets, implying that the current increase in the bid-ask spread in the US Treasury market decreases next period stock market returns around the world. This result is robust to the inclusion of other standard local and global predictors of countries' equity market returns such as the lagged local market returns, dividend yields, the US term spread, as well as local and world stock market liquidity measures.

The negative effect of bond illiquidity on future equity returns can be explained as follows. Goyenko, Subrahmanyam and Ukhov (2007) show that bond spreads increase under monetary policy tightening, which often reflects the worsening of economic conditions. In these conditions, when both stock and bond markets are down, Treasuries decrease less in value than stocks and the flight-to-liquidity/quality from the stock market occurs. Bond spreads, reacting first to the increase in real rates, forecast increase in stock market illiquidity (see Goyenko and Ukhov, 2007). An increase in stock market illiquidity has a negative impact on contemporaneous equity returns (e.g., see Amihud, 2002). Therefore, an increase in the bond illiquidity, which predicts increase in illiquidity in the stock market, should also have a negative effect on expected stock returns.

Third, we examine the asset pricing implications of the flight-to-liquidity/quality risk by considering two nested models of full market integration and two nested models of partial market integration. The main full integration model includes the world market risk, the bond illiquidity risk, as well as the exchange rate risk factors. The main partial integration model, besides the world market and bond illiquidity risk, also accounts for the local market variance and stock illiquidity risk. We conduct our estimation in two steps. In the first step, using the multivariate GARCH (1,1) methodology, for each country we compute its conditional return variance and the set of conditional covariances between local market equity returns and each of the risk factors present in a specific asset pricing model. In the second step, we use GMM and estimate prices of risk on the entire sample of countries as well as separately for the sub-samples of developed and emerging markets. We also use conditional estimates to compute conditional bond illiquidity betas for each country and relate them to the set of country-level macroeconomic and financial variables.

The results of our asset pricing tests show a negative and significant price of the bond illiquidity risk in the presence of all other global and local factors. This holds across the whole sample of countries as well as for the groups of developed and emerging markets. The price of bond illiquidity risk is negative because, in contrast to stock market illiquidity, the covariance between the bond illiquidity and returns is negative on average. An increase in stock market illiquidity increases expected equity returns (Amihud, 2002) and causes cash outflow into the bond market (Agnew and Balduzzi, 2007). This cash outflow decreases bond illiquidity, thus producing a negative covariance between bond illiquidity and stock returns. This implies that the higher is the country's stock market sensitivity to the increase in the percentage bid-ask spread of US Treasury bonds, the higher is a propensity of flight-to-liquidity and the higher is its expected return.

The point estimates of the price of the bond illiquidity risk are between –0.25 and –0.60 for the entire sample of countries depending on model specification. In economic terms, this translates into an average annual premium attributed to the flight-to-liquidity risk to be between 0.35% and 0.75%. It is comparable in magnitude to the stock illiquidity premium of 1.1% per annum reported by Acharya and Pedersen (2005) in the US equity market. The estimates of the bond illiquidity price of risk are larger in magnitude in emerging markets, as one would expect given more occurrences of flight-to-liquidity/quality from those countries. The only other consistently priced factor, not surprisingly, is the world market portfolio return, which yields the price of risk between 2.50 and 5.50. This estimation range is in line with that from many other previous studies.

The rest of the paper is organized as follows. Section 2 highlights the economic intuition for the existence of the Treasury bond illiquidity premium in stock markets around the world. Section 3 describes the data, and offers initial analysis on the importance of bond illiquidity. In particular, we analyze the relation between bond illiquidity and global and local stock market illiquidity and examine predictive regressions of stock market returns on the lagged values of bond illiquidity and other variables. In Section 4, we develop our conditional asset pricing methodology. Section 5 presents results from the asset pricing tests. In this section, we also relate our estimates of the flight-to-liquidity risk to the set of country-level macroeconomic and financial variables. Section 6 concludes.

2. Economic Motivation

There are several reasons to expect the existence of the Treasury bonds illiquidity premium in the international equity markets. First, US Treasury securities constitute one of the largest markets and are traded around-the-clock in the three largest financial centers of Tokyo, London, and New York. The daily trading volume in the secondary market for Treasuries averaged $125 billion in 1995 compared to $491.39 billion in the end of 2006.[6] Given this market structure, the Treasury illiquidity can immediately react to economic announcements and other developments around the world.

Second, investors outside of the US hold large stakes in US Treasuries. In particular, foreign official accounts held $1.3 trillion of Treasury securities at the end of 2005, or about 30 percent of all marketable Treasury securities outstanding (see Fleming, 2007). In fact, the

[6] Source: Federal Reserve System, Treasury Bulletin.

holdings of Treasuries by foreigners have increased rapidly during the last decade. At the end of 1996 foreign investors held close to 28% of all marketable Treasury securities outstanding but by the end of 2006 their holdings reached almost 45%.[7] The evidence shows a very active trading of Treasury securities by international investors.

Third, the flight-to-quality and -liquidity takes place not only domestically but also internationally (e.g., see Longstaff, 2004). Therefore, an illiquidity shock in the stock market of the US or worldwide causes fund outflow from equity market into the US Treasury bond market. Since the funds flow between the markets affects illiquidity (see Chordia, Sarkar, and Subrahmanyam, 2005; and Goyenko and Ukhov, 2007), it should also impact security prices. Indeed, Goetzmann and Massa (2002) find that when investors move funds in and out of the equity market in response to daily market news, these fund flows affect equity prices. Agnew and Balduzzi (2007) observe that 401(K) plan participants' daily rebalancing between equities and fixed-income instruments affect asset prices. Therefore, changes in the bond illiquidity, which first reflects changes in the current economic environment, are accompanied by fund flows between the international stock and the US Treasury bond markets, and therefore must have an impact on equity returns across countries.

Finally, note that US Treasuries have a comparative advantage over sovereign debt of other countries. In particular, Beber, Brandt, and Kavajecz (2007) find that in general, while rebalancing towards less risky and more liquid assets such as fixed income securities, investors care both about credit quality and liquidity. However, during economic or stock market distress they care the most about liquidity. US Treasuries, being of the highest credit quality, are also considered as the most liquid among government debt instruments of other countries. Around-the-clock availability and around-the-world trading makes them the source of international demand for liquidity.

Given many plausible reasons for a non-trivial impact of US Treasury bond illiquidity on equity markets around the world, our next goal is to determine the expected signs of this effect on

[7] Source: Federal Reserve System, Treasury Bulletin.

stock returns in both contemporaneous and predictive settings. Note that during market downturns illiquidity of all asset classes increases. However, the illiquidity of short-term US Treasuries increases less partly due to fund inflow from the stock market (flight-to-quality or liquidity). For example, Goyenko, Subrahmanyam, and Ukhov (2007) report that the percentage bid-ask spread difference between long- and short-term US Treasuries is 12 basis points during economic expansions, but it increases to more than 18 basis points in recessions. Therefore, we expect a *negative contemporaneous* relation between Treasury bond illiquidity and global stock returns.

To understand the predictive sign of the impact of bond illiquidity on equity returns it is important to establish other important causes of illiquidity. In this respect, Goyenko, Subrahmanyam, and Ukhov (2007) argue that monetary policy is one of the main determinants of bond illiquidity. They show that bond illiquidity increases not only contemporaneously but also with a lag in response to monetary policy contraction. Thus, bond illiquidity can be viewed as a financial variable which directly captures information about changes in the U.S. monetary policy. In addition, several studies establish a link between changes in monetary policy and stock returns. Patelis (1997), Thorbecke (1997), and more recently, Bernarke and Kuttner (2005) demonstrate that monetary policy contraction has large and statistically significant negative effect on current and subsequent stock values. These authors suggest that tighter monetary conditions reduce firms' access to credit and negatively impact future cash flows. Therefore, we expect bond illiquidity to also have a *negative predictive* relation to global equity returns.[8]

3. Data and Initial Analysis

3.1. Data

[8] Empirical finance literature documents that another financial variable closely related to monetary policy, short-term interest rate, also has negative predictive and contemporaneous effect on stock prices (e.g., see Breen, Glosten, and Jagannathan (1989), Fama and Schwert (1977), Campbell (1987)). However, Bernarke and Kuttner (2005) point out that the reaction of equity prices to monetary policy is not directly related to policy's impact on the real interest rate.

Our data sample consists of 46 countries, out of which 23 are classified as developed and 23 as emerging. The sample covers the 30-year period from January 1977 to December 2006, although for many countries the time series data start significantly later than 1977. For each country, we collect monthly local equity market returns in US dollars and dividend yields from Datastream (for developed market) and IFC Global Indices (for emerging markets). We construct excess returns by subtracting the one-month US Treasury bill rate from gross returns. Following Bekaert, Harvey, and Lundblad (2007) and Lee (2006), our proxy for the stock market illiquidity in each country is the value-weighted proportion of zero daily returns across all firms in that country during a month. The world stock market illiquidity is the value-weighted average of countries' aggregate illiquidity. Our proxy for the flight-to-liquidity/quality is the US Treasury bond illiquidity which we compute as the average percentage bid-ask spread of off-the-run US T-bills with maturities of up to one year. Once issued, the security is considered as on-the-run and the older issues are off-the-run. The quoted bid and ask prices are from CRSP daily Treasury Quotes file.

Table 1 shows the number of observations, means, volatilities, and first-order autocorrelations of monthly excess equity returns, dividend yields, and the stock liquidity measure for each country and for the world market. The number of observations corresponds to those for equity market returns. As expected, the average monthly returns and volatilities in emerging markets are higher than those in developed markets. The autocorrelation of dividend yield is very high, in excess of 0.90 in all but five countries. The market illiquidity is higher on average in emerging markets than developed. It is also an autocorrelated variable although not as much as the dividend yield. The only country with negative first-order autocorrelation in illiquidity is China.

3.2. Treasury Bond and Stock Market Illiquidity

We first investigate the relation between the US Treasury bond illiquidity and stock market illiquidity around the world. Our primary goal here is to determine whether there is an illiquidity linkage between the markets. For example, funds inflow into the US Treasuries from the stock market caused by flight-to-liquidity would affect bond illiquidity (Longstaff, 2004). Fund movements between the markets may impact illiquidity and cause illiquidity spillover (Goyenko and Ukhov, 2007). Subsequently, if illiquidity of one market affects illiquidity of the other market, it may also forecast illiquidity premium in the other market, i.e. illiquidity spillover across markets may also lead to the cross-market spillover of illiquidity premium.

The results of this analysis are reported in Table 2. Panel A shows the outcomes from VAR(1) models for the bond illiquidity, L_B, with either the world market illiquidity, L_w, or the local market illiquidity, L_i. We observe that the bond illiquidity predicts both the world and local stock market illiquidity, but the reverse is not true. The coefficient on the lagged L_B is positive in both estimations and significant at the 10% level for the world market illiquidity and 1% level for the local market illiquidity. This implies that the current increase in the illiquidity of the US Treasury bond market leads to an increase in the stock market illiquidity next period globally and across different countries.

Earlier studies suggest that returns and volatility of returns are important drivers of illiquidity (see Amihud and Mendelson, 1986; and Benston and Hagerman, 1974). More recent studies such as Chordia, Roll, and Subrahmanyam (2001), and Chordia, Sarkar, and Subrahmanyam (2005) find that returns are important determinants of illiquidity in the stock market. Furthermore, Goyenko, Subrahmanyam, and Ukhov (2007) show that monetary policy affects bond market illiquidity. Monetary policy can also affect stock market illiquidity by tightening inventory constraints of market makers and increasing borrowing costs of trading (e.g., Chordia, Sarkar, and Subrahmanyam, 2005), Therefore, in Panel B of Table 2 we show the estimates from VAR(1) models involving, besides the bond and stock market illiquidity, global and local stock market excess returns and volatilities, as well as the changes in the US federal funds rate, FED, and the US term spread, TERM. As before, we observe a significant and positive impact of the lagged bond illiquidity on both the world (columns one and two) and local (columns three and four) stock market illiquidity. Furthermore, consistent with inventory paradigm (e.g., see Ho and Stoll, 1983; and O'Hara and Oldfield, 1986), we find that local market volatility is an important determinant of local stock market illiquidity: the slope coefficient on volatility is positive and significant at the 1% level. Finally, shifts in the US federal funds rate seem to forecast local stock market illiquidity but not the global stock illiquidity.

Thus, while the stock market illiquidity is predicted by the bond illiquidity, the variables that can potentially predict bond illiquidity are not related to stock market illiquidity. Table 3 reports the VAR(1) results for the bond illiquidity. As in the case of stock market illiquidity, we consider the world stock market return and volatility, the changes in the US federal funds rate, and the US term spread. We also use the world dividend yield, DY_w, as an alternative to the term spread to proxy general market conditions. For consistency, in all estimations, we retain the lagged world stock market illiquidity measure.

Regression (1) shows that the slope on the lagged world market volatility is negative and significant at the 10% level. However, after accounting for changes in the federal funds rate and either the term spread or the world dividend yield, in Regressions (2) and (3) respectively, the coefficient on the lagged volatility losses its significance. Instead, we find a positive and significant at the 1% level coefficient on the federal funds rate in both of these estimations. Therefore, consistent with the previous literature, monetary policy tightening increases illiquidity in the bond market. In Regression (3), we also observe a significant coefficient on the world dividend yield. However, taking into account an extreme persistency of the dividend yield (the autocorrelation is 0.99), we rerun the VAR(1) system of Regression (3) on the 1987-2006 sub-sample in Regression (4). We observe that the world dividend yield completely looses its significance. In this sub-sample, the lagged changes in the federal funds rate are still significant at the 5% level. In addition, the world market volatility regains and even improves its significance compared to Regressions (2) and (3). Thus, it appears that both the US monetary policy and global stock market volatility have an impact on the illiquidity of Treasury bond market. However, stock market illiquidity does not affect bond illiquidity. The effect of volatility on bond illiquidity is consistent with the flight-to-liquidity or flight-to-quality effects. An increase in the stock market volatility causes funds inflow into the bond market and improves bond liquidity.

In sum, bond illiquidity has predictive power over stock illiquidity but not vice versa. An increase in bond illiquidity, which is associated with monetary policy tightening in the US, predicts an increase in stock illiquidity around the world. In addition, stock market affects bond illiquidity via volatility. An increase in stock market volatility, which is a characterization of worsening of illiquidity conditions, causes flight-to-liquidity and decreases bond illiquidity.

3.3. Predictive Regressions

Given strong predictive power of bond illiquidity for the world and local stock market illiquidity, we now examine whether it has similar predictive ability for the world and local equity market returns. If bond illiquidity predicts stock illiquidity it might as well predict stock market illiquidity premium. Note that bond illiquidity, similar to stock market illiquidity, is a persistent variable. Ferson, Sarkissian, and Simin (2003) warn against using standard statistical inference in regression of stock returns on lagged instruments when regressors are autocorrelated. Therefore, to preclude any concerns for spurious regression bias, in the subsequent analysis, as in the studies on stock market illiquidity (e.g., see Pastor and Stambaugh, 2003; and Acharya and Pedersen, 2005), we use the AR(2) residuals as a measure of bond illiquidity rather than the level.

Table 4 presents several specifications of predictive regressions. We estimate all models for the entire sample of data as well as for the sub-samples of 23 developed and 23 emerging markets. In all models, we follow Bekaert, Harvey, and Lundblad (2007) and control for the lagged world market return and country fixed effects, but their coefficients are not reported.[9] To correct for the effects of heteroskedasticity and autocorrelation in residuals, we use the Newey-West robust standard errors with six lags. Panel A reports the full sample results. Regression 1

[9] In their setting, Bekaert, Harvey, and Lundblad (2007) control for the lagged US return as a global market return proxy.

includes only bond illiquidity as an independent variable. We observe that the slope coefficient has negative sign and it is significant at the 1% level for all country samples.

Regressions 2 and 3, besides bond illiquidity, include the lagged local market return as well as either the world or the local stock market illiquidity, respectively. In spite of these additions, the slope coefficient on bond illiquidity is similar to that in Regression 1: it is negative and still significant at the 1% level. The lagged stock market return is also positive across all estimations, but, similar to many studies, mostly insignificant, indicating the existence of only some short-term return predictability. However, there is no consistent evidence of the importance of the lagged stock market illiquidity for expected equity returns. When the lagged world market illiquidity is used as a proxy for stock market illiquidity, its slope coefficient is negative and significant only on the entire sample of countries but not separately for the developed and emerging market groups. When the local market illiquidity is used as a predictive variable, its slope is significantly negative only for developed countries.[10]

Finally, Regressions 4 and 5 control for some of the usual variables that are believed to predict stock returns, such as local dividend yields and the US term spread. The coefficient on bond illiquidity retains its negative sign and high significance across all estimations. The lagged local market return also comes up prominently with a positive sign and strong statistical significance at the 5% level in all estimations but one for emerging markets in Regression 4. The stock market illiquidity again shows no consistent outcome across countries, both in terms of sign and statistical significance. The lagged local dividend yield is positive and highly significant. The term spread is also positive, as expected, but its significance is not as strong across all estimations as that for the dividend yield. However, the statistical importance of predictability of these two variables, especially the dividend yield, must be taken with a caution given their highly autocorrelated nature.

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[10] Bekaert, Harvey, and Lundblad (2007) observe a significantly positive (negative) relation between excess returns in open emerging markets and lagged liquidity (illiquidity). This implies a generally flat relation between lagged stock liquidity and excess returns in emerging markets, similar to our result. Also note that their relation between stock market liquidity and excess returns in open emerging markets resembles ours in developed markets, as one would expect from well-liberalized economies.

Panel B of Table 4 shows the sub-sample results based on the Regression 5 specification. The entire time period is divided in two sub-periods, so the two sub-samples across all countries and developed markets group are 1977-1991 and 1992-2006, while those for emerging markets – 1987-1996 and 1997-2006, respectively. The two most important observations from this panel is that the slope coefficient on the lagged bond illiquidity (i) retains its negative and significant sign in all estimations, and (ii) strengthens in magnitude and statistical significance in the second sub-period. These results show a stable impact of bond illiquidity on global stock returns, and are consistent with the increasing holdings of US Treasuries by foreign investors over time. Unlike bond illiquidity, neither the local dividend yield nor the US term spread show a stable relation to future stock returns. Finally, the lagged stock market liquidity is again significant but negative only for developed markets.

To summarize, the Table 4 shows that our proxy for the flight-to-liquidity/quality has a strong predictive ability for stock returns around the world. The negative effect of bond illiquidity on future equity returns has the following intuition. An increase in bond spreads can be attributed to monetary policy tightening which reflects the worsening of economic conditions when both stock and bond markets are down (see Goyenko, Subrahmanyam, and Ukhov, 2007). Under these conditions, Treasury bonds decrease less in value than stocks and the flight-to-liquidity/quality from the stock market takes places. As Goyenko and Ukhov (2007) show, bond illiquidity, by immediately reacting to changes in monetary policy, is able to forecast changes in the stock market illiquidity. Unexpected increase in stock market illiquidity has a negative impact on contemporaneous equity returns (Amihud, 2002). Therefore, an increase in the bond illiquidity, which predicts an increase in stock illiquidity (and subsequent flight-to-liquidity) also has a negative effect on expected stock returns. Our results demonstrate that changes in bond illiquidity have global impact on equity prices.

4. Conditional Methodology

4.1. General framework

In this section, we test asset pricing models of global equity returns under full and partial market integration all of which account for the flight-to-liquidity/quality risk.[11] We assume constant prices of all risk factors.

If country *i* is integrated with the world and purchasing power parity holds across countries, then its expected return at time *t* given the information at time *t*-1 is determined based on its conditional covariance with the return on the world market portfolio, and the bond illiquidity factor, namely:

$$E_{t-1}\left(r_{i,t}\right) = \lambda_w \,\mathrm{Cov}_{t-1}\left(r_{i,t}, r_{w,t}\right) + \lambda_{LB} \,\mathrm{Cov}_{t-1}\left(r_{i,t}, L_{B,t}\right), \tag{1}$$

where λ_w is the price of the world market risk and λ_{LB} is the price of the flight-to-liquidity/quality risk. However, if there are deviations in the purchasing power parity across countries (see Dumas and Solnik, 1995), then the exchange rate risk maybe a priced factor too, and equation (1) must be extended to accommodate its impact as follows:

$$E_{t-1}\left(r_{i,t}\right) = \lambda_w \,\mathrm{Cov}_{t-1}\left(r_{i,t}, r_{w,t}\right) + \lambda_{LB} \,\mathrm{Cov}_{t-1}\left(r_{i,t}, L_{B,t}\right) + \lambda_c \,\mathrm{Cov}_{t-1}\left(r_{i,t}, r_{c,t}\right), \tag{2}$$

where $r_{c,t}$ is the return on the currency basket deposit at time *t* and λ_c is the price of currency risk.

If country *i* is partially integrated with the world (see Errunza and Losq, 1985), then its expected return at time *t* given the information at time *t*-1 is also determined by the variance of its own market return, that is,

$$E_{t-1}\left(r_{i,t}\right) = \lambda_w \,\mathrm{Cov}_{t-1}\left(r_{i,t}, r_{w,t}\right) + \lambda_{LB} \,\mathrm{Cov}_{t-1}\left(r_{i,t}, L_{B,t}\right) + \lambda_i \,\mathrm{Var}_{t-1}\left(r_{i,t}\right), \tag{3}$$

where λ_i is the price of country *i* risk. After accounting for the exchange rate risk, equation (3) is extended to:

$$E_{t-1}\left(r_{i,t}\right) = \lambda_w \,\mathrm{Cov}_{t-1}\left(r_{i,t}, r_{w,t}\right) + \lambda_{LB} \,\mathrm{Cov}_{t-1}\left(r_{i,t}, L_{B,t}\right) + \lambda_c \,\mathrm{Cov}_{t-1}\left(r_{i,t}, r_{c,t}\right) + \lambda_i \,\mathrm{Var}_{t-1}\left(r_{i,t}\right). \tag{4}$$

[11] Note that the flight-to-liquidity/quality risk is a global risk factor and therefore cannot be present in fully segmented markets.

To test whether the flight-to-liquidity/quality risk is priced in global markets we need to determine whether there exists a risk premium associated with the bond illiquidity.

Recent research shows that stock market illiquidity is an important factor for US stock returns (e.g., see Amihud, 2002, Pastor and Stambaugh, 2003, Acharya and Pedersen, 2005). There is some evidence that stock market illiquidity is also important in global markets (e.g., Bekaert, Harvey, and Lundblad, 2007; Lee, 2006). To control for stock market illiquidity, we further extend the partial integration model (4) to accommodate for the second country-specific factor, its market illiquidity. This yields the following model,

$$\begin{aligned} E_{t-1}(r_{i,t}) = {} & \lambda_w \operatorname{Cov}_{t-1}(r_{i,t}, r_{w,t}) + \lambda_{LB} \operatorname{Cov}_{t-1}(r_{i,t}, L_{B,t}) + \lambda_c \operatorname{Cov}_{t-1}(r_{i,t}, r_{c,t}) + \\ & + \lambda_i \operatorname{Var}_{t-1}(r_{i,t}) + \lambda_{Li} \operatorname{Cov}_{t-1}(r_{i,t}, L_{i,t}) \end{aligned}, \qquad (5)$$

where λ_{Li} is the price of equity market illiquidity risk in country *i*.

4.2. Practical Considerations

Evaluating models from (1) through (5) jointly across 46 countries in a conditional framework with unknown conditional variances and covariances is practically impossible. Therefore, we estimate asset pricing models in two steps. In the first step, we estimate the conditional variances of equity market returns and their covariances with all risk factors depending on the model specification. We obtain these estimates separately for each country within a multivariate GARCH (1,1) setting that includes return and risk factor dynamics. Here we follow Harvey (1991), Ferson and Harvey (1993), and many others and model country equity returns and risk factors as linear functions of global and local information variables.

Our choice of information variables is largely determined by the results in Tables 2, 3, and 4. For local (world) market return, we use the lag of the following variables: local (world) market return, local (world) dividend yield, the US term spread, the bond illiquidity, as well as the local (world) stock market illiquidity. The change in the exchange rate is predicted by the return on the currency basket deposit and the change in the US federal funds rate. In our estimations, the return on the currency basket deposit at time *t* is computed as the equally weighted average of exchange rate changes with the US dollar of four global currencies: the British Pound, Euro, Japanese Yen, and Swiss Franc. The bond illiquidity is predicted by the world stock market volatility and the changes in the US federal funds rate (see Table 3). Finally, the stock market illiquidity is predicted by its own value as well as the market return, volatility, and bond illiquidity. More specifically, for example, for the most computationally complicated model (5) we estimate the following multivariate GARCH (1,1) system for each country:

$$r_{i,t} = \delta_{10} + \delta_{11} r_{i,t-1} + \delta_{12} DY_{i,t-1} + \delta_{13} TERM_{t-1} + \delta_{14} L_{B,t-1} + \delta_{15} L_{i,t-1} + e_{i,t} \quad (6a)$$

$$r_{w,t} = \delta_{20} + \delta_{21} r_{wi,t-1} + \delta_{22} DY_{w,t-1} + \delta_{23} TERM_{t-1} + \delta_{24} L_{B,t-1} + \delta_{25} L_{w,t-1} + e_{w,t} \quad (6b)$$

$$L_{B,t} = \delta_{40} + \delta_{41} \sigma_{w,t-1} + \delta_{42} FED_{t-1} + e_{LB,t} \quad (6c)$$

$$r_{c,t} = \delta_{30} + \delta_{31} r_{c,t-1} + \delta_{32} FED_{t-1} + e_{c,t} \quad (6d)$$

$$L_{i,t} = \delta_{50} + \delta_{51} L_{i,t-1} + \delta_{52} L_{B,t-1} + \delta_{53} r_{i,t-1} + \delta_{54} \sigma_{i,t-1} + e_{Li,t} \quad (6e)$$

We also estimate system (6) for the world market portfolio. In this case, the system is reduced to four equations: equations (6b-d) and all local market variables in equation (6e) are replaced with the corresponding world market characteristics, namely:

$$L_{w,t} = \delta_{50} + \delta_{51} L_{w,t-1} + \delta_{52} L_{B,t-1} + \delta_{53} r_{w,t-1} + \delta_{54} \sigma_{w,t-1} + e_{Lw,t} . \quad (6f)$$

In system (6a-e), the error term, $e_t = [e_{i,t}, e_{w,t}, e_{c,t}, e_{LB,t}, e_{Li,t}]$ is assumed to be a multivariate normal distribution with conditional variance-covariance matrix H_t. Matrix H_t has the following structure:

$$H_t = C'C + A' e_{t-1} e'_{t-1} A + B' H_{t-1} B ,$$

where C is a (5x5) upper triangular matrix, A, and B are (5x5) diagonal matrices. That is, we assume that the current variance depends only on the lagged conditional variance and lagged squared errors, while the current covariance depends only on the lagged covariance and lagged cross-product of errors. To obtain the parameter estimates, we employ the Berndt, Hall, Hall and

Hausman (BHHH) optimization algorithm. While system (6) yields the estimates of pairwise covariances between all variables, for each country we are interested only in the conditional covariances between $r_{i,t}$ on the one side and $r_{w,t}$, $r_{c,t}$, $L_{B,t}$, and $L_{i,t}$ on the other.

In the second step, we use panel GMM and estimate pricing moments across all countries (or country groups) and the world market. For example, the moments for model (5) are:

$$\begin{aligned} \zeta_{i,t} &= r_{i,t} - \lambda_w \hat{\mathrm{C}}\mathrm{ov}_{t-1}(r_{i,t}, r_{w,t}) - \lambda_{LB} \hat{\mathrm{C}}\mathrm{ov}_{t-1}(r_{i,t}, L_{B,t}) - \lambda_c \hat{\mathrm{C}}\mathrm{ov}_{t-1}(r_{i,t}, r_{c,t}) - \\ &\quad - \lambda_i \hat{\mathrm{V}}\mathrm{ar}_{t-1}(r_{i,t}) - \lambda_{Li} \hat{\mathrm{C}}\mathrm{ov}_{t-1}(r_{i,t}, L_{i,t}) \\ \zeta_{w,t} &= r_{w,t} - \lambda_w \hat{\mathrm{V}}\mathrm{ar}_{t-1}(r_{w,t}) - \lambda_{LB} \hat{\mathrm{C}}\mathrm{ov}_{t-1}(r_{i,t}, L_{B,t}) - \lambda_c \hat{\mathrm{C}}\mathrm{ov}_{t-1}(r_{i,t}, r_{c,t}) - \\ &\quad - \lambda_{Lw} \hat{\mathrm{C}}\mathrm{ov}_{t-1}(r_{i,t}, L_{w,t}) \end{aligned} \quad , \qquad (7)$$

where $\zeta_{i,t}$ and $\zeta_{w,t}$ are the error terms of country *i* and world market excess return equations at time *t*, respectively, while the "hat" denotes the conditional variances and covariances from the multivariate GARCH (1,1) estimation.

At this stage, we estimate the following prices of risk [$\lambda_w, \lambda_{LB}, \lambda_{Lw}, \lambda_c, \lambda_i, \lambda_{Li}$], i.e., (2N+4) parameters, where N is the number of countries used. To create the orthogonality conditions in an over-identified, yet parsimonious system, we use an instrument vector *Z* which, besides the constant, includes only two global information variables: the lagged return on the world market portfolio and the lagged value of bond illiquidity, that is, Z_{t-1} = [$1, r_{w,t-1}, L_{B,t-1}$]. This gives a total of (3N+3) orthogonality conditions in the GMM estimation. However, in a large estimation system like (7), a small instrument set may lead to difficulties in convergence. Therefore, the alternative instrument set that we use includes three additional variables: the lagged values of the return on the currency basket deposit, world dividend yield, and US term spread, that is, Z_{t-1}^{alt} = [$1, r_{w,t-1}, L_{B,t-1}, r_{e,t-1}, DY_{w,t-1}, TERM_{t-1}$], which yields (6N+6) orthogonality conditions. Finally, taking into account a comprehensive study of GMM performance in small samples by Andersen and Sørensen (1996), in all our GMM estimations, we use Bartlett Kernel, Andrews Bandwidth, and iterative updating of both the weighting matrix and coefficients.

5. Empirical Tests

5.1. Conditional Treasury Bond Illiquidity Betas

We begin with examining the outcome of our multivariate GARCH (1,1) estimations. In particular, given the estimates of the conditional variance of the bond illiquidity, $\hat{\mathrm{V}}\mathrm{ar}_{t-1}\left(L_{B,t}\right)$, and the conditional covariance of country returns with the bond illiquidity, $\hat{\mathrm{C}}\mathrm{ov}_{t-1}\left(r_{i,t}, L_{B,t}\right)$, we can construct for each country *i* the conditional bond illiquidity beta as:

$$Beta_{i,t-1}\left(L_{B,t}\right) = \hat{\mathrm{C}}\mathrm{ov}_{t-1}\left(r_{i,t}, L_{B,t}\right) \Big/ \hat{\mathrm{V}}\mathrm{ar}_{t-1}\left(L_{B,t}\right). \tag{8}$$

We plot the time-series of the conditional bond illiquidity beta in Figure 1. It shows the betas for developed markets (Plot A) and emerging markets (Plot B). These betas are averaged for each month across 23 developed and 23 emerging markets, respectively. We can see that the betas for both country groups are highly volatile, especially after 1987. The average conditional beta for developed markets is close to but below zero, while that for emerging markets is much more negative. This result is consistent with economic intuition since the average flight-to-liquidity risk or the effect of bond illiquidity on equity returns should be more pronounced for emerging markets.

The negative covariance between stock returns and bond illiquidity contrasts with the positive covariance between stock returns and stock market illiquidity documented in many other studies (e.g., Amihud, 2002; Pastor and Stambaugh, 2003; Bekaert, Harvey, and Lundblad, 2007). This effect can be explained as follows. When the stock market becomes illiquid, funds flow into more liquid and less risky Treasury bond market. For example, Longstaff (2004) reports a large liquidity premium in the US Treasury bonds and finds strong evidence that this premium, among other things, is related to changes in flows into equity and money market mutual funds. The outflow of funds from equity markets leads to improvements in bond liquidity and appreciation in bond prices. Recent studies also show that fund outflows from equity markets are persistent (see Agnew and Balduzzi 2005), and that they affect stock prices (Goetzmann and

Massa, 2002). Therefore, a positive illiquidity shock in the stock market causes expected equity returns to increase because of increases in both stock market illiquidity and cash outflow into the bond market. Thus, lower bond bid-ask spreads correspond to higher returns in the stock market, implying a negative covariance between stock returns and bond illiquidity. The more negative is this covariance, the more illiquid is the country's equity market, and so one should expect more cash outflow from this market into liquid Treasury bonds in unfavorable market conditions.

We also analyze cross-sectional properties of the bond illiquidity betas. Figure 2 shows the relation between average country excess returns and the average conditional betas. We observe that most average bond illiquidity betas are negative and that there is a downward trend between betas and mean returns. The plot implies that the lower is the country's stock market exposure to the increase in the bid-ask spread of the US Treasury bond (i.e., the increase in the bond illiquidity) in absolute value, the lower is its expected return. Not surprisingly, most of the points on the plot with the largest in magnitude but negative average conditional bond illiquidity betas belong to emerging markets. The countries with close to zero or positive bond illiquidity risk maybe regarded as markets which have relatively more liquid stock markets and less exposed to the worldwide flight-to-liquidity/quality episodes.

Given a wide dispersion of bond illiquidity betas across countries, we explore if there are any countrywide characteristics that can explain the cross-sectional differences in these betas. Table 5 reports the set of some average country-level variables. CORR is the average country's equity market correlation with the world market portfolio over the entire sample period. Size is the average ratio of market capitalization to GDP from Djankov et al. (2007). LISTINGS is the number of all overseas listings traded on various world stock exchanges at the end of 1998 from Sarkissian and Schill (2004). We can think of these three variables as "market development" proxies. PE and RATE are from Datastream and correspond to the average country's P/E ratio and its short-term interest rate over the entire sample period. These two variables maybe regarded as "dynamic indicators" since they are easily observable over time at any sampling frequency. FREEDOM is the average index of economic freedom in 1995-2006 from the Heritage

Foundation.[12] LAW is the anti-self-dealing index again from Djankov et al. (2007). This last set of country characteristics can be thought of as an "investor environment."

Table 6 reports the results of the regression of average conditional bond illiquidity betas across countries on various sets of country characteristics from Table 5. We also show the root mean squared error for each regression model. In estimations, the number of foreign listings and the short rate are taken with logs. Regression 1 includes only one regressor, CORR, and it yields positive and significant result. This implies that the higher is the correlation of the local stock market with the world, the lower is its sensitivity to the flight-to-quality risk. However, when we include the other two "market development" variables, i.e., the SIZE and LISTINGS in Regression 2, CORR passes its sign and significance to the number of overseas listings. Regression 3 deals with "dynamic indicators." The P/E ratio comes up positive and weakly significant, while short-term rate negative and significant. Regression 4 shows the regression results with the "investor environment" proxies and we observe a positive and significant relation between economic freedom and the bond illiquidity beta. However, when we combine "market development" variables with "dynamic indicators" in Regression 5 and, in addition, with "investor environment" proxies in Regression 6, we find that the only variable that retains statistical significance at the 5% level and economically meaningful sign is the number of overseas listings. Thus, it appears that the more integrated a country is with the world market in terms of the size of its foreign listing activity, the less concerns the investors will have with that market's flight-to-liquidity risk.

5.2. Asset Pricing Test Results

To further examine the cross-sectional importance of the bond illiquidity risk for international equity market returns, we turn our attention to the results of the GMM tests. Note that the conditional covariance of country returns with bond illiquidity is negative on average. Therefore,

[12] The index can be downloaded from the Foundation's web site at http://www.heritage.org/research/features/index/.

if the bond illiquidity is a systematic factor in international equity markets, it must have a negative price of risk.

We group our tests based on the degree of integration. Table 7 shows the results of GMM estimation for two full integration (FI) models based on equations (1) and (2) across the entire country sample as well as separately for developed and emerging markets. The estimation period is 1977-2006 for developed markets and 1987-2006 for emerging. The conditional estimates of the variances and covariances are obtained from the multivariate GARCH (1,1) using equations (6a-c) for Model 1FI and (6a-d) for Model 2FI. The instrument set that we use in these estimations is our parsimonious set Z that includes a constant, the lagged world market return, and the lagged values of bond illiquidity.

Across all model specifications, we observe a positive and significant price of the world market portfolio risk λ_w. It economic terms, its magnitude is between 2.5 and 5.0, which is very consistent with numerous studies on the world market integration (e.g., see De Santis and Gerard, 1997; Bekaert, Harvey, and Lundblad, 2007). In contrast, in Model 2FI the price of risk associated with changes in the currency basket, λ_c, is insignificant for all country samples. More importantly, the parameter of our primary interest, the flight-to-liquidity price of risk, λ_{LB}, is negative, as expected, and significant at the standard 5% level or less in all six estimations across both models. The point estimates of λ_{LB} are around 0.25 for the entire sample of countries. Due to the absence of country-specific parameters, all GMM systems corresponding to the full integration models are substantially over-identified. The J-statistics indicate that we cannot reject the hypothesis that the prices of world market and bond illiquidity risks are constant.

While Table 7 shows that the negative significance of the bond illiquidity price of risk is a very consistent outcome across different estimations, one cannot exclude the possibility that this result is due to the omission of country-specific risk factors. Therefore, in the GMM estimations in Table 8 we consider two partial integration (PI) models by accounting for local market variance risk and local market volatility risk. The estimation period is again 1977-2006 for developed markets and 1987-2006 for emerging markets. Model 1PI is based on equation (4), and

Model 2PI is based on equation (5). The conditional estimates of the variances and covariances are obtained from the multivariate GARCH (1,1) using equations (6a-e). The instrument set for Model 1PI includes a constant, the lagged world market return, and the lagged values of bond illiquidity. In Model 2PI, the instrument set also includes the lagged values of the world dividend yield, the US term spread, and the return on the currency basket deposit. Finally, to reduce the dimensionality of the system and facilitate the convergence of the GMM optimization algorithm, we omitted the foreign exchange risk factor. This simplification to models (4) and (5) does not sacrifice any economic intuition in estimating our two partial integration models, since the foreign exchange price of risk, λ_c, turned out to be unimportant in the full integration models 1FI and 2FI.

As before, we again observe a positive and significant risk premium coefficient λ_w on the world stock market portfolio across all estimations. Note that in spite of the differences in model specifications and the instruments set (for Model 2PI), the slope coefficients are still consistently within 2.5 and 5.0 range in the magnitude. Also, similar to our earlier results in Table 7, we find once again that the price of flight-to-liquidity risk, λ_{LB}, is negative and significant at the standard 5% level in all estimation and it is again larger for emerging markets. Its magnitude is slightly larger at about 0.60 across all countries. Based on the J-statistics, we again cannot reject the hypothesis that the prices of world market, bond illiquidity, and local risks are constant. Thus, the flight-to-liquidity risk is consistently priced under various models of full and partial integration. This implies that changes in the US Treasury bond illiquidity have an important impact on global equity returns. In economic terms, the average annual premium attributed to the flight-to-liquidity risk, $\lambda_{LB}\,\mathrm{Cov}_{t-1}\left(r_{i,t}, L_{B,t}\right)$, lies between 0.35% and 0.75% across all countries depending on the model specification.

6. Robustness Tests

6.1. Alternative Interest Based Risk Factor

The results in Tables 7 and 8 show the importance of bond illiquidity for the pricing of global equity returns even in the presence of other risk factors. However, one concern with all previous asset pricing tests is that they do not include any other interest rate based risk factor but bond illiquidity. In other words, risk factors that we control for are related to stock and foreign exchange markets but not to the bond market. This concern becomes especially relevant if one recalls the Chen, Roll and Ross (1986) argument that the term spread is a risk factor for US stock returns, as well as our results in Table 4 showing some predictive power of the US term spread for global stock returns. Therefore, we also test a model of full integration, similar to our model (2) where the currency risk is replaced with the term spread risk, namely:

$$E_{t-1}(r_{i,t}) = \lambda_w Cov_{t-1}(r_{i,t}, r_{w,t}) + \lambda_{LB} Cov_{t-1}(r_{i,t}, L_{B,t}) + \lambda_{Term} Cov_{t-1}(r_{i,t}, Term_t), \quad (9)$$

where $Term_t$ is the term spread at time t and λ_{Term} is the price of term spread. In the first-stage GARCH(1,1) estimation, the term spread is modeled as an AR(1) process. In the second stage, we use GMM estimation with the instrument set composed of the constant and the lagged values of the world market return, AR(2) residual of the bond illiquidity, and the term spread.

We report the test results in Table 9. We can see that in spite of the inclusion of the term spread, the prices of bond illiquidity risk, λ_{LB}, maintains its correct sign and statistical significance across all country groups. The price of the world market risk, λ_w, is again positive and significant in the estimation with all countries and in the sub-set of emerging markets. For developed markets λ_w is positive but not significant. The lost of significance of the market price of risk for developed countries appears to be driven by the inclusion of the term spread. The term spread price of risk, λ_{Term}, is negative but it is significant at the standard 5% level only for developed markets. This result is consistent both with the sign of term spread risk in Chen, Roll and Ross (1986) and our results on predictive regressions in Table 4.[13] Thus, even with the

[13] Chen, Roll and Ross (1986) also report a negative and often significant loading on an unanticipated change in the term spread.

inclusion of an alternative global interest rate risk based factor, bond illiquidity not only maintains its importance for global equity pricing in general but also retains its pricing value for stock returns in countries with different level of development.

6.2. Alternative Source of Treasury Bond Illiquidity (GovPX Data)

In 1996 CRSP switched its data source from the Federal Reserve Bank of New York to GovPX indicative quotes. To address this issue, in this sub-section we estimate bond illiquidity using GovPX intraday quotes. We start our sample from 1992 – the first full year with available GovPX data. The bond liquidity measure is based on intraday data from New York trading hours (7:30AM to 5:00PM EST). As before, we use trading data for the off-the-run Treasury bills with less than or one year to maturity. The monthly time-weighted average quoted bid-ask spread is calculated as the difference between the best bid and best ask per $100 par value. In order to obtain reliable estimates of the bid-ask spread, the following filters are used: (i) bid or offer quotes with a zero value are deleted, and (ii) a quoted bid-ask spread that is negative or more than 50 cents per $100 par value (a multiple of about 12–15 times the sample average) is deleted. Monthly estimates of illiquidity based on quoted intraday bid-ask spreads are averaged across three, six and twelve-month T-bills for each month. Similar to the pervious analysis, we use AR(2) residuals of the estimated series to proxy for the aggregate bond illiquidity.

Table 10 shows the estimation results of asset pricing model with two global risk factors, similar to Model 1FI in Table 7. As before, the conditional estimates of the variances and covariances are obtained from the multivariate GARCH (1,1) using equations (6a-c).[14] The instrument set includes a constant, the lagged world market return, and the lagged AR(2) residual of US Treasury bond illiquidity. We see that using an alternative bond illiquidity data does not qualitatively change our earlier results and conclusions. The price of the world market risk is positive and significant, while the price of the bond illiquidity risk is negative and significant

[14] The shorter time-series sample that results from using the GovPX data makes the GARCH and GMM estimations less immune to initial values setting. Therefore, in the second stage estimation, we omit the first-stage observations until 1994 for both developed and emerging markets.

across all estimations. Thus, bond illiquidity appears to be priced in global equity markets irrespective of the data used.

6. Conclusion

In this paper, we offer a novel look at global equity market pricing. The existence of large shifts in asset allocation strategies from less liquid assets around the world to more liquid and safe ones such as US Treasury bonds gives the rise to a significant price of the "flight-to-liquidity/quality" risk. We proxy the flight-to-liquidity by the percentage bid-ask spread of off-the-run US Treasuries with maturities of up to one year. Our results show that the Treasury bond illiquidity has strong predictive power for both local stock market returns as well as stock market illiquidity. The flight-to-liquidity risk is priced in global equity markets, and so it commands an economically and statistically significant premium across both developed and emerging countries even after controlling for the world market, exchange rate, US term spread, and local risks, including stock market illiquidity. Our results indicate that, *ceteris paribus*, the higher is the sensitivity of an asset to the increase in the US Treasury bond illiquidity the larger is its expected return.

Another, not least important implication of our findings is that in global markets it is much easier to account for the flight-to-liquidity/quality risk than the stock market illiquidity risk. Unlike stock market illiquidity that has numerous alternative measures (e.g., the proportion of zero returns during a month, the bid-ask spread, share turnover, etc.), all of which are difficult to measure both at the local and global levels, the flight-to-liquidity/quality risk is measured by a variable which is easily observable and is very precise.

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Table 1
Summary Statistics

This table presents the means, volatilities, and first-order autocorrelations of monthly excess equity returns, dividend yields, and stock market illiquidity measures for 23 developed and 23 emerging countries (top and bottom halves of the table). The number of observations corresponds to the number of monthly returns. The data are from Datastream and IFC. The returns are in US dollars in excess of the one-month US T-bill rate. Market illiquidity is the average proportion of zero daily returns in a month for each market. The sample period is 1977:01-2006:12.

		Market return			Dividend yield			Market illiquidity		
Country	Obs	Mean	Vol	ρ	Mean	Vol	ρ	Mean	Vol	ρ
Australia	360	0.007	0.070	-0.002	0.334	0.077	0.948	0.252	0.092	0.756
Austria	360	0.007	0.062	0.213	0.153	0.037	0.961	0.546	0.223	0.927
Belgium	360	0.007	0.055	0.081	0.315	0.124	0.988	0.311	0.100	0.715
Canada	360	0.005	0.052	0.039	0.256	0.091	0.985	0.205	0.093	0.851
Denmark	360	0.008	0.056	0.075	0.170	0.071	0.985	0.424	0.307	0.978
Finland	225	0.010	0.086	0.174	0.202	0.083	0.966	0.217	0.120	0.831
France	360	0.008	0.066	0.074	0.313	0.117	0.980	0.217	0.092	0.556
Germany	360	0.006	0.057	0.011	0.216	0.077	0.987	0.162	0.069	0.554
Greece	203	0.013	0.099	0.075	0.232	0.097	0.972	0.142	0.080	0.473
Hong Kong	360	0.011	0.103	0.082	0.314	0.108	0.945	0.304	0.110	0.649
Ireland	360	0.009	0.070	0.104	0.346	0.186	0.986	0.570	0.226	0.895
Italy	360	0.006	0.075	0.069	0.217	0.069	0.969	0.126	0.068	0.423
Japan	360	0.004	0.064	0.095	0.101	0.052	0.995	0.265	0.058	0.571
Netherlands	360	0.008	0.049	0.015	0.360	0.129	0.988	0.249	0.146	0.572
New Zealand	227	0.007	0.063	-0.050	0.393	0.073	0.927	0.219	0.071	0.466
Norway	323	0.009	0.075	0.086	0.211	0.072	0.940	0.249	0.089	0.683
Portugal	203	0.005	0.054	0.138	0.238	0.087	0.611	0.303	0.176	0.752
Singapore	360	0.006	0.085	0.091	0.214	0.069	0.949	0.290	0.075	0.486
Spain	237	0.009	0.059	0.041	0.253	0.086	0.979	0.294	0.196	0.867
Sweden	299	0.011	0.070	0.079	0.206	0.062	0.949	0.212	0.105	0.783
Switzerland	360	0.007	0.051	0.097	0.178	0.058	0.988	0.308	0.098	0.744
UK	360	0.007	0.065	0.092	0.362	0.104	0.961	0.493	0.229	0.974
US	360	0.005	0.044	0.012	0.267	0.121	0.994	0.086	0.047	0.965
Argentina	360	0.033	0.235	0.057	0.183	0.151	0.850	0.283	0.166	0.761
Brazil	360	0.016	0.152	0.027	0.321	0.228	0.871	0.527	0.285	0.913
Chile	360	0.017	0.097	0.167	0.381	0.179	0.962	0.369	0.071	0.680
China	158	0.010	0.114	-0.021	0.125	0.061	0.934	0.120	0.121	-0.054
Colombia	264	0.019	0.089	0.365	0.390	0.217	0.984	0.485	0.126	0.738
Czech Republic	156	0.009	0.085	0.200	0.264	0.198	0.910	0.235	0.154	0.798
Hungary	156	0.015	0.104	-0.038	0.128	0.052	0.863	0.135	0.097	0.670
India	360	0.010	0.080	0.094	0.151	0.059	0.929	0.283	0.198	0.802
Indonesia	204	0.006	0.131	0.199	0.165	0.093	0.947	0.359	0.153	0.803
Israel	119	0.007	0.069	-0.026	0.164	0.066	0.952	0.148	0.082	0.256
Jordan	347	0.007	0.056	0.092	0.26	0.146	0.919	0.520	0.110	0.392
Korea	360	0.011	0.108	0.034	0.162	0.104	0.925	0.174	0.083	0.444
Malaysia	264	0.005	0.092	0.091	0.204	0.080	0.947	0.309	0.084	0.598
Mexico	360	0.015	0.113	0.219	0.187	0.110	0.942	0.327	0.131	0.862
Pakistan	264	0.012	0.095	0.060	0.465	0.262	0.940	0.310	0.174	0.715
Philippines	264	0.014	0.101	0.275	0.132	0.100	0.970	0.438	0.178	0.791
Poland	156	0.010	0.116	-0.081	0.131	0.067	0.910	0.209	0.112	0.770
Russia	119	0.031	0.164	0.143	0.095	0.062	0.898	0.291	0.131	0.379
South Africa	155	0.011	0.079	0.048	0.265	0.074	0.936	0.189	0.175	0.963
Taiwan	264	0.013	0.121	0.064	0.104	0.075	0.975	0.165	0.080	0.106
Thailand	360	0.008	0.100	0.098	0.275	0.191	0.943	0.273	0.066	0.351
Turkey	240	0.026	0.187	0.067	0.273	0.180	0.876	0.269	0.199	0.659
Venezuela	264	0.014	0.133	0.032	0.351	0.323	0.948	0.330	0.168	0.867
World	360	0.005	0.042	0.081	0.240	0.088	0.993	0.194	0.037	0.774

Table 2
VAR Analysis: Treasury Bond and Stock Market Illiquidity

This table shows the output from vector-autoregression models between the Treasury bond illiquidity, L_B, and the world, L_w, or local, L_i, stock illiquidity. For each market and month, stock illiquidity is based on the value-weighted average proportion of zero returns of all firms in a given market. The world stock market illiquidity is the value-weighted average of countries' illiquidity. Panel A shows the VAR(1) model of stock market illiquidity and bond illiquidity. Panel B shows the VAR(1) model of stock market illiquidity, bond illiquidity, alongside with the stock market and monetary policy control variables. Here r_w, r_i, σ_w, and σ_i stand for world and local equity market excess returns and market volatility, respectively. Also, FED is the US federal funds rate and TERM is the US term spread. Monthly stock market volatility for each market in a given month is computed as standard deviation of the daily returns in that market and month. The daily return data are from Datastream and IFC. The sample has 46 countries and covers the period from 1977:01 to 2006:12. The robust t-statistics are shown in parentheses. Significance at the 10%, 5% and 1% levels is denoted by *, **, and ***, respectively.

Panel A: Stock market illiquidity and Treasury bond illiquidity

	$L_{w,t}$	$L_{w,t-1}$	$L_{i,t}$	$L_{i,t-1}$
$L_{B,t-1}$	0.1325* (1.77)		0.2680*** (4.73)	
$L_{B,t}$		0.0007 (0.16)		0.0001 (0.29)

Panel B: Stock market illiquidity and Treasury bond illiquidity controlling for stock market and monetary policy variables

	$L_{w,t}$	$L_{w,t}$	$L_{i,t}$	$L_{i,t}$
$L_{B,t-1}$	0.4822* (1.81)	0.1714** (2.17)	0.3094*** (5.35)	0.3107 (5.34)
$r_{w,t-1}$	-0.0060 (-0.19)	-0.0028 (-0.09)		
$\sigma_{w,t-1}$	0.5923 (1.30)	0.6497 (1.41)		
$r_{i,t-1}$			-0.0010 (-0.11)	0.0001 (0.01)
$\sigma_{i,t-1}$			0.2911*** (3.19)	0.3107*** (3.38)
FED_{t-1}		0.2194 (1.10)		0.3659** (2.28)
$TERM_{t-1}$		0.0177 (1.45)		0.0071 (0.89)

Table 3

VAR Analysis: Treasury Bond Illiquidity, Global Stock Market, and Monetary Policy Variables

This table shows the results from the regression of the Treasury bond illiquidity on its two lagged values as well as other lagged global predictors. The variables L_w, FED, TERM, and DY_w denote the world stock market illiquidity, the US federal funds rate, the US term spread, and the world market dividend yield, respectively. The term spread is the difference in long-term US bond and the one-month US T-bond rates. Monthly stock market volatility for each market in a given month is computed as standard deviation of the daily returns in that market and month. The daily return data are from Datastream and IFC. The sample has 46 countries and covers the period from 1977:01 to 2006:12 in Regressions (1-3) and 1987:01 to 2006:12 in Regression (4). The robust t-statistics are shown in parentheses. Significance at the 10%, 5% and 1% levels is denoted by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)
$L_{w,t-1}$	-0.0027	-0.0015	-0.0020	-0.0001
	(-0.58)	(-0.35)	(-0.45)	(-0.05)
$r_{w,t-1}$	-0.0031	-0.0004	-0.0001	-0.0001
	(-0.82)	(-0.11)	(-0.04)	(-0.02)
$\sigma_{w,t-1}$	-0.1032*	-0.0729	-0.0516	-0.0338**
	(-1.85)	(-1.32)	(-0.92)	(-2.06)
FED_{t-1}		0.0914***	0.0784***	0.0411*
		(3.82)	(4.26)	(1.82)
$TERM_{t-1}$		-0.0009		
		(-0.64)		
$DY_{w,t-1}$			0.0007**	0.0001
			(2.00)	(0.03)

Table 4
Predictive Regressions of Country Excess Equity Returns

This table presents the output of predictive regressions of country excess equity returns (r_i) on the lagged T-bond illiquidity, L_B, as well as other lagged instruments. L_w and L_i are the world and country-level stock market illiquidity. For each market and month, illiquidity is based on the value-weighted average proportion of zero returns of all firms in a given market. The world stock market illiquidity is the value-weighted average of countries' illiquidity. DY_w and DY_i denote the world market and local country dividend yields, respectively. TERM is the US term spread. The estimation of all regression models controls for the lagged world market return, country fixed effects, and uses the Newey-West robust standard errors with 6 lags. The whole sample period is 1977-2006 but it is 1987-2006 for emerging markets. Significance at the 10%, 5% and 1% levels is denoted by *, **, and ***, respectively.

Panel A: Full sample estimation

Regression model	All countries	Developed	Emerging
Regression 1			
$L_{B,t-1}$	-1.212***	-1.014***	-9.622***
	(-3.47)	(-3.32)	(-2.84)
Regression 2			
$r_{i,t-1}$	0.071**	0.035*	0.041
	(2.05)	(1.68)	(1.60)
$L_{B,t-1}$	-1.174***	-0.986***	-9.135***
	(-3.38)	(-3.22)	(-2.69)
$L_{w,t-1}$	-0.052**	-0.024	-0.079**
	(-2.54)	(-1.39)	(-2.15)
Regression 3			
$r_{i,t-1}$	0.027	0.034	0.022
	(1.34)	(1.60)	(0.82)
$L_{B,t-1}$	-1.093***	-0.964***	-10.842***
	(-3.30)	(-3.15)	(-3.35)
$L_{i,t-1}$	-0.004	-0.013***	0.012
	(-0.65)	(-2.78)	(0.74)
Regression 4			
$r_{i,t-1}$	0.039**	0.041*	0.036
	(1.96)	(1.91)	(1.42)
$DY_{i,t-1}$	3.514***	2.450***	4.012***
	(3.88)	(2.66)	(2.91)
$TERM_{t-1}$	0.020***	0.013	0.042**
	(2.56)	(1.62)	(2.44)
$L_{B,t-1}$	-1.152***	-0.958***	-10.222***
	(-3.27)	(-3.10)	(-3.16)
$L_{w,t-1}$	-0.045**	-0.037**	-0.051
	(-2.24)	(-2.04)	(-1.18)
Regression 5			
$r_{i,t-1}$	0.030	0.038*	0.024
	(1.50)	(1.84)	(0.91)
$DY_{i,t-1}$	3.778***	2.807***	4.531***
	(3.75)	(3.01)	(2.88)
$TERM_{t-1}$	0.018**	0.013	0.033*
	(2.26)	(1.62)	(1.74)
$L_{B,t-1}$	-1.045***	-0.934***	-10.544***
	(-3.13)	(-3.02)	(-3.29)
$L_{i,t-1}$	-0.008	-0.018***	0.011
	(-1.16)	(-3.66)	(0.63)

Table 4 (continued)

Panel B: Sub-sample estimations

	All countries		Developed		Emerging	
	1977-1991	1992-2006	1977-1991	1992-2006	1987-1996	1997-2006
$r_{i,t-1}$	0.005	0.024	0.037	0.042	0.024	0.024
	(0.11)	(1.21)	(1.23)	(1.47)	(0.49)	(0.29)
$DY_{i,t-1}$	1.798	6.340***	2.384	9.082***	3.985	4.531***
	(0.91)	(4.70)	(1.60)	(4.37)	(1.07)	(3.21)
$TERM_{t-1}$	0.011	0.022**	0.017	-0.006	-0.056	0.033***
	(0.79)	(2.30)	(1.39)	(-0.61)	(-1.17)	(2.96)
$L_{B,t-1}$	-0.995***	-9.903***	-0.806**	-6.318***	-7.741**	-15.759***
	(-2.92)	(-3.63)	(-2.53)	(-2.66)	(-2.12)	(-3.29)
$L_{i,t-1}$	-0.011	-0.005	-0.022*	-0.014**	0.036	0.006
	(-0.68)	(-0.53)	(-1.93)	(-2.17)	(1.05)	(0.22)

Table 5
Summary of Macroeconomic and Financial Variables

This table shows the set of average country-level variables. CORR is the country's equity market correlation with the world market portfolio. SIZE is the average ratio of market capitalization to GDP. LISTINGS is the number of all foreign listings at the end of 1998 from Sarkissian and Schill (2004). PE and RATE are from Datastream and correspond to the average P/E ratio and short-term interest rate. FREEDOM is the average index of economic freedom in 1995-2006 from the Heritage Foundation. LAW is the anti-self-dealing index in Djankov et al. (2007).

Country	CORR	SIZE	LISTINGS	PE	RATE	FREEDOM	LAW
Argentina	0.07	0.58	19	22	16.5	66.3	0.34
Australia	0.58	1.02	96	15	7.9	76.7	0.76
Austria	0.38	0.16	12	17	4.2	70.0	0.21
Belgium	0.61	0.67	27	13	4.9	69.3	0.54
Brazil	0.26	0.38	27	17	24.4	55.8	0.27
Canada	0.72	1.06	266	15	7.2	73.2	0.64
Chile	0.20	0.89	22	16	0.7	76.0	0.63
China	0.16	0.43	15	30	6.1	52.6	0.76
Colombia	0.18	0.14	4	9	7.1	62.2	0.57
Czech Republic	0.39	0.20	5	11	7.5	69.6	0.33
Denmark	0.52	0.58	9	17	5.9	71.6	0.46
Finland	0.59	1.77	12	16	4.2	70.8	0.46
France	0.67	0.89	69	13	5.5	63.1	0.38
Germany	0.65	0.54	112	15	4.4	68.6	0.28
Greece	0.31	0.91	9	17	8.2	57.9	0.22
Hong Kong	0.49	3.61	19	15	5.1	90.1	0.96
Hungary	0.53	0.24	11	30	13.6	62.4	0.58
India	0.16	0.33	65	19	6.8	49.1	0.58
Indonesia	0.35	0.24	7	15	15.4	54.8	0.65
Ireland	0.62	0.67	72	12	7.1	76.6	0.79
Israel	0.48	0.53	65	51	9.2	63.9	0.73
Italy	0.49	0.52	27	19	5.2	64.6	0.42
Japan	0.71	0.69	206	39	2.2	70.6	0.50
Jordan	0.11	0.77	1	18	4.7	64.0	0.16
Korea	0.39	0.54	29	18	9.2	69.5	0.47
Malaysia	0.41	1.48	7	28	4.6	64.3	0.95
Mexico	0.37	0.21	30	13	26.2	61.4	0.17
Netherlands	0.78	1.31	105	13	3.2	73.3	0.20
New Zealand	0.53	0.40	22	15	9.9	81.0	0.95
Norway	0.59	0.39	19	12	7.6	67.4	0.42
Pakistan	0.12	0.14	0	9	9.2	55.9	0.41
Philippines	0.39	0.48	7	20	12.2	58.7	0.22
Poland	0.50	0.16	8	2	16.0	60.3	0.29
Portugal	0.54	0.46	7	18	4.4	65.0	0.44
Russia	0.54	0.33	6	9	31.0	49.9	0.44
Singapore	0.59	1.64	5	20	3.0	88.4	1.00
South Africa	0.60	1.55	88	14	13.0	62.8	0.81
Spain	0.73	0.79	24	15	5.6	66.4	0.37
Sweden	0.69	1.12	47	18	4.7	69.0	0.33
Switzerland	0.69	2.49	28	14	3.4	77.8	0.27
Taiwan	0.36	1.01	27	29	4.4	72.5	0.56
Thailand	0.36	0.44	3	11	7.4	67.8	0.81
Turkey	0.29	0.35	7	18	64.9	58.8	0.43
UK	0.70	1.57	176	13	8.9	78.4	0.95
US	0.83	1.42	436	16	5.9	78.3	0.65
Venezuela	0.09	0.05	4	12	10.5	50.3	0.09
Average	0.46	0.79	49.17	17.35	9.77	66.89	0.51

Table 6

Relation between Conditional Treasury Bond Illiquidity Betas and Macroeconomic and Other Factors

This table shows the results of regression of countries' average conditional bond illiquidity betas on the set of country-level macroeconomic and financial variables. CORR is the country's equity market correlation with the world market portfolio. SIZE is the average ratio of market capitalization to GDP. LISTINGS is the number of all foreign listings at the end of 1998 from Sarkissian and Schill (2004). PE and RATE are from Datastream and correspond to the average P/E ratio and short-term interest rate. FREEDOM is the average index of economic freedom in 1995-2006 from the Heritage Foundation. LAW is the anti-self-dealing index from Djankov et al. (2007). The number of foreign listings and the short rate are taken with logs. The robust t-statistics are shown in parenthesis. RMSE is the root mean squared error. Significance at the 10%, 5% and 1% levels is denoted by *, **, and ***, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
CORR	21.727**	-7.924				
	(2.31)	(-0.62)				
SIZE		6.233*			4.018	3.455
		(1.67)			(1.41)	(0.89)
LISTINGS		11.776***			8.392***	7.957***
		(3.90)			(3.16)	(2.72)
PE			23.997*		19.021	21.619*
			(1.91)		(1.57)	(1.77)
RATE			-17.721**		-7.530	-5.100
			(-2.29)		(-1.50)	(-0.98)
FREEDOM				0.633***		0.237
				(2.62)		(0.68)
LAW				-2.882		-8.142
				(-0.28)		(-0.91)
RMSE	14.24	12.93	13.24	13.95	12.17	12.30

Table 7
Asset Pricing Tests: Full Integration Models

This table shows the result of the GMM estimation of the two models of full market integration. The estimation period is 1977:01-2006:12 for developed markets and 1987:01-2006:12 for emerging markets. Here, λ_w is the price of the world market risk, λ_{LB} is the price of the bond illiquidity risk, λ_c is the price of currency basket risk. The return on the currency basket deposit is computed as the equally weighted average of exchange rate changes with the US dollar of four global currencies: the British Pound, Euro, Japanese Yen, and Swiss Franc. Model 1FI is based on equation (1), and Model 2FI is based on equation (2). The conditional estimates of the variances and covariances are obtained from the multivariate GARCH (1,1) using equations (6a-c) for Model 1FI and (10a-d) for Model 2FI. The GMM estimation uses Bartlett Kernel, Andrews Bandwidth, and iterative updating of the weighting matrix and coefficients. The instrument set includes a constant, the lagged world market return, and the lagged AR(2) residual of US Treasury bond illiquidity. The robust t-statistics and p-values are shown in parenthesis. Significance at the 10%, 5% and 1% levels is denoted by *, **, and ***, respectively.

	All Countries	Developed	Emerging
Model 1FI			
λ_w	4.361***	3.435***	3.682***
	(5.09)	(3.36)	(3.10)
λ_{LB}	-0.269**	-0.296**	-7.235***
	(-2.14)	(-2.16)	(-3.48)
J-stat	76.32	56.52	42.72
p-value	[>0.999]	[0.877]	[>0.999]
Model 2FI			
λ_w	3.195***	2.557**	3.146**
	(3.58)	(2.38)	(2.23)
λ_{LB}	-0.294**	-0.329**	-8.401***
	(-2.02)	(-2.09)	(-3.29)
λ_c	-2.082	-0.764	4.034
	(-1.02)	(-0.32)	(0.86)
J-stat	89.28	61.56	49.92
p-value	[>0.999]	[0.725]	[0.959]

Table 8
Asset Pricing Tests: Partial Integration Models

This table shows the result of the GMM estimation of the two models of partial market integration. The estimation period is 1977:01-2006:12 for developed markets and 1987:01-2006:12 for emerging markets. Here, λ_w is the price of the world market risk, λ_{LB} is the price of the bond illiquidity risk, Ave λ_i is the average price of local market risk, while Ave λ_{Li} is the average price of the local equity market illiquidity. Model 1PI is based on equation (4), and Model 2PI is based on equation (5). The conditional estimates of the variances and covariances are obtained from the multivariate GARCH (1,1) using equations (6a-c) for Model 1PI and (6a-c,e) for Model 2PI. The GMM estimation uses Bartlett Kernel, Andrews Bandwidth, and iterative updating of the weighting matrix and coefficients. The instrument set for Model 1PI includes a constant, the lagged world market return, and the lagged AR(2) residual of US Treasury bond illiquidity. In Model 2PI, the instrument set also includes the lagged values of the world dividend yield, the US term spread, and the return on the currency basket deposit. The robust t-statistics and p-values are shown in parenthesis. Significance at the 10%, 5% and 1% levels is denoted by *, **, and ***, respectively.

	All Countries	Developed	Emerging
Model 1PI			
λ_w	4.067***	3.419***	4.113**
	(3.98)	(3.06)	(2.25)
λ_{LB}	-0.467***	-0.469**	-5.095**
	(-2.60)	(-2.54)	(-2.13)
Ave λ_i	0.805	0.834	0.833
	(1.43)	(1.39)	(1.23)
J-stat	60.84	38.16	34.32
p-value	[0.996]	[0.817]	[0.915]
Model 2PI			
λ_w	2.858***	2.966***	4.554***
	(3.00)	(2.82)	(2.52)
λ_{LB}	-0.571***	-0.437**	-0.783
	(-2.76)	(-2.02)	(-2.09)
Ave λ_i	3.771	0.571	-0.053
	(0.39)	(0.53)	(-0.01)
Ave λ_{Li}	-0.613	-0.380	-0.168
	(-0.26)	(-0.14)	(-0.57)
J-stat	123.48	75.60	73.20
p-value	[>0.999]	[0.928]	[0.952]

Table 9

Full Integration Asset Pricing Model with Bond Illiquidity and the Term Spread

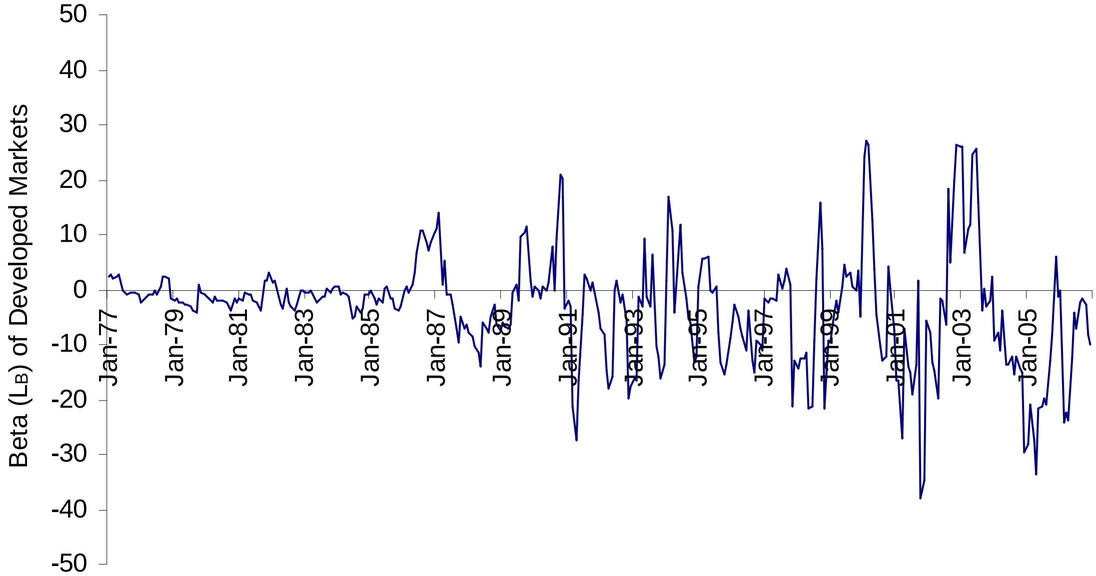
This table shows the result of the GMM estimation of the of a full integration model with three global factors. The estimation period is 1977:01-2006:12 for developed markets and 1987:01-2006:12 for emerging markets. Here, λ_w is the price of the world market risk, λ_{LB} is the price of the bond illiquidity risk, λ_{Term} is the price of the term spread risk. The conditional estimates of the variances and covariances are obtained from the multivariate GARCH (1,1) using equations (6a-c). The GMM estimation uses Bartlett Kernel, Andrews Bandwidth, and iterative updating of the weighting matrix and coefficients. The instrument set includes a constant, the lagged world market return, the lagged AR(2) residual of US Treasury bond illiquidity, and the lagged term spread. For convergence facilitation, the GMM estimation is performed with the pre-whitening of variables. The robust t-statistics and p-values are shown in parenthesis. Significance at the 10%, 5% and 1% levels is denoted by *, **, and ***, respectively.

	All Countries	Developed	Emerging
λ_w	2.529***	0.858	3.653***
	(3.34)	(0.93)	(3.16)
λ_{LB}	-0.600***	-0.886***	-3.682**
	(-3.23)	(-3.81)	(-2.29)
λ_{Term}	-7.894*	-12.026**	-0.114
	(-1.87)	(-2.32)	(-0.01)
J-stat	168.50	95.38	84.31
p-value	[0.787]	[0.384]	[0.703]

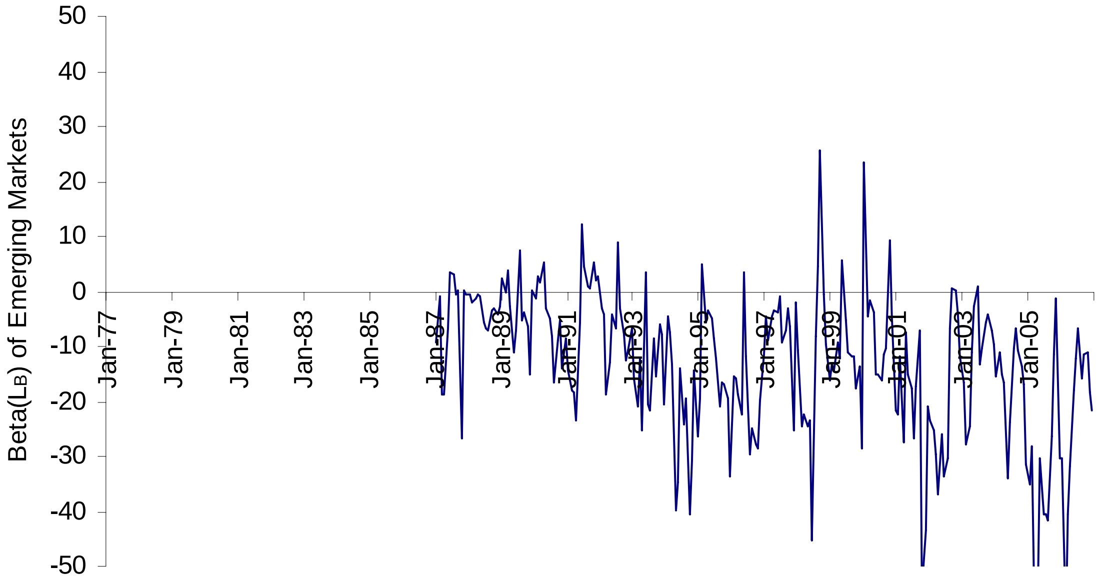
Table 10
A Two-Factor Full Integration Model with GovPX data

This table shows the result of the GMM estimation of the of a full integration model with two global factors. The estimation period is 1992:04-2006:12. Here, λ_w is the price of the world market risk, and $\lambda_{LB(GovPX)}$ is the price of the bond illiquidity risk based on the GovPX data. The conditional estimates of the variances and covariances are obtained from the multivariate GARCH (1,1) using equations (6a-c). The GMM estimation uses Bartlett Kernel, Andrews Bandwidth, and iterative updating of the weighting matrix and coefficients. The instrument set includes a constant, the lagged world market return, and the lagged AR(2) residual of US Treasury bond illiquidity. The robust t-statistics and p-values are shown in parenthesis. Significance at the 10%, 5% and 1% levels is denoted by *, **, and ***, respectively.

	All Countries	Developed	Emerging
λ_w	6.606***	6.137***	4.997***
	(5.89)	(4.73)	(3.03)
$\lambda_{LB\ (GovPX)}$	-1.339***	-1.248***	-0.581*
	(-6.79)	(-4.64)	(-1.77)
J-stat	110.84	62.63	62.35
p-value	[0.956]	[0.692]	[0.701]



A



B

Figure 1. Conditional Treasury Bond Illiquidity Beta. The figure shows the conditional bond illiquidity beta for developed markets (Plot A) and emerging markets (Plot B). Conditional beta in each market is the ratio of the conditional covariance of the country's excess returns with the bond illiquidity risk over the conditional variance of the bond illiquidity risk. The betas then are averaged for each month across 23 developed and 23 emerging markets.

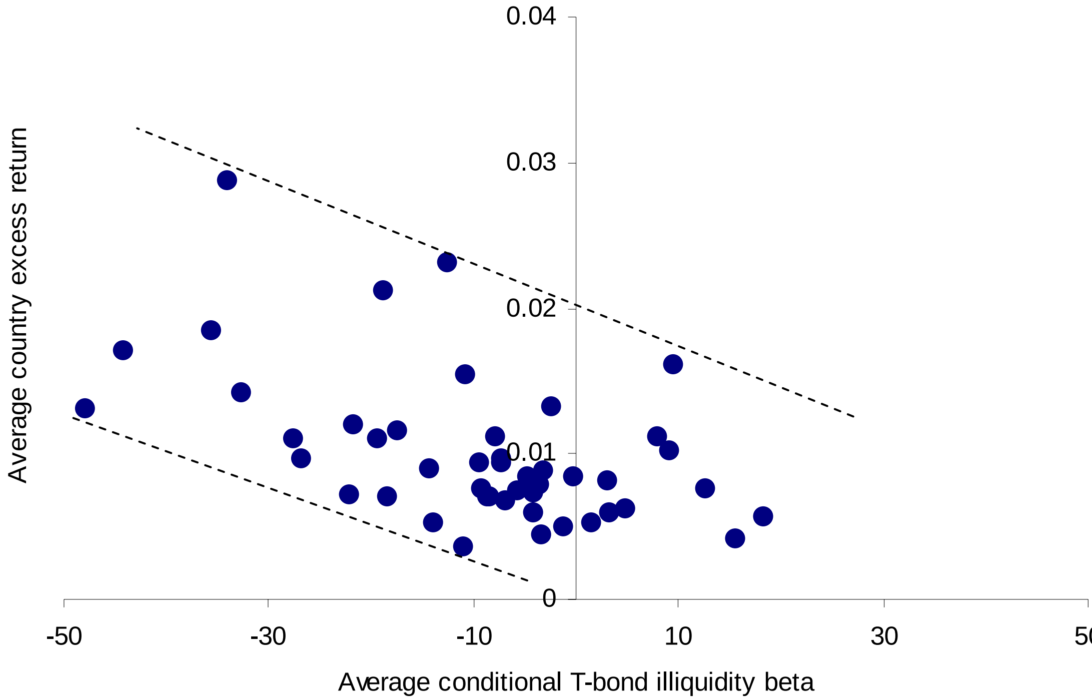


Figure 2. Country Returns and Treasury Bond Illiquidity Betas. The plot shows the relation between mean country excess returns and their respective average conditional T-bond illiquidity betas. The conditional betas are computed as the ratio of conditional covariance of country excess returns with the bond illiquidity risk over the conditional variance of the bond illiquidity risk. The estimates of betas for each emerging market are computed for country's the post-liberalization period.