

# MPRA

Munich Personal RePEc Archive

## **Flight to Liquidity and Global Equity Returns**

Goyenko, Ruslan and Sarkissian, Sergei

McGill University, McGill University

2010

Online at <https://mpra.ub.uni-muenchen.de/27546/>

MPRA Paper No. 27546, posted 20 Dec 2010 19:34 UTC

# Flight to Liquidity and Global Equity Returns

Ruslan Goyenko and Sergei Sarkissian \*

First draft: November 2007

This draft: June 2010

\* The authors are from the Faculty of Management, McGill University, Montreal, QC H3A1G5, Canada. Goyenko may be reached at [ruslan.goyenko@mcgill.ca](mailto:ruslan.goyenko@mcgill.ca) and Sarkissian may be reached at [sergei.sarkissian@mcgill.ca](mailto:sergei.sarkissian@mcgill.ca). We thank Yakov Amihud, Gurdip Bakshi, Kristin Forbes, Evan Gatev, David Goldreich, Denis Gromb, Andrew Karolyi, Michael Schill, Pedro Santa Clara, Rudi Schadt, and Akiko Watanabe for useful comments. The paper has also benefited from the feedback of participants at the Seventh Darden International Finance Conference, the 2008 European Finance Association Meeting, the 2008 World Bank Conference on Risk Analysis and Management, the Bank of Canada Conference on Financial Market Stability, the 2009 Northern Finance Association Meeting, the 2009 Conference of the Society of Quantitative Analysts, as well as workshops at the ISCTE Business School, Durham University, and Luxembourg School of Finance. We are also grateful to Sam Henkel for providing international stock liquidity data. Goyenko acknowledges financial support from IFM2. Sarkissian acknowledges financial support from IFM2, SSHRC, and the Desmarais Faculty Scholarship.

# Flight-to-Liquidity and Global Equity Returns

## ABSTRACT

Investment practice and academic literature suggest a great degree of interaction between the world's stock markets and most liquid and safe assets, such as U.S. Treasuries. Using data from 46 markets and a 30-year time period, we examine the impact of "flight-to-liquidity" events on global asset valuation. This wide cross-sectional and time-series sample provides a natural setting for analyzing the link between changes in the illiquidity of Treasuries and expected equity returns. Our illiquidity measure is the average percentage bid-ask spread of off-the-run U.S. Treasury bills with maturities of up to one year. We find that this proxy predicts stock market illiquidity and future equity returns in both developed and emerging markets. This predictive relation remains intact after controlling for various world and country-level variables. Asset pricing tests further reveal that Treasury bond illiquidity is a significantly priced factor even in the presence of other conventional risks, such as those of the world stock market, foreign exchange, local equity market variance and illiquidity, as well as the term spread. Our results indicate that flight-to-liquidity risk is an important determinant of returns in global equity markets.

*JEL Classification:* G12; G15

*Keywords:* Cross-asset integration; Flight-to-quality; Illiquidity beta; International asset pricing; Monetary policy

## 1. Introduction

There is a certain linkage between stock and bond markets. Fama and French (1993) show the commonality of default and term spreads in the pricing of bonds and stocks. Fleming, Kirby, and Ostdiek (1998) find strong volatility links between the two markets. Scruggs and Glabadanidis (2003) show that stock returns respond to both stock and bond return shocks. Connolly, Stivers, and Sun (2005) observe that stock market uncertainty has important cross-market pricing effects. Li (2002) shows evidence that stock-bond return correlations are determined primarily by uncertainty about expected inflation. However, the economic forces underlying these linkages are not fully understood: Shiller, and Beltratti (1992), Campbell and Ammer (1993), and Baele, Bekaert, and Inghelbrecht (2010) conclude that the existing levels of co-movement between stock and bond markets cannot be justified by economic fundamentals. More recent research ties stock and bond markets via illiquidity. Chordia, Sarkar, and Subrahmanyam (2005), Goyenko (2006), Goyenko and Ukhov (2009), and Baele, Bekaert, and Inghelbrecht (2010), for example, find that illiquidity has a cross-market effect and that common factors drive illiquidity in both stock and bond markets.

In this paper, we examine the impact of illiquidity of U.S. Treasuries on global equity returns using market-level data from 46 countries over the 30 year period from 1977 to 2006. This wide cross-sectional and time-series sample provides an ideal ground for analyzing the connection between changes in the illiquidity of Treasuries and expected equity returns. If there is an illiquidity premium in asset returns associated with U.S. Treasuries, focusing on equities of both developed and emerging markets should result in particularly powerful tests and valuable cross-market evidence. Our main contribution is the finding of an economically and statistically significant illiquidity premium of U.S. Treasuries in global equity markets.

The choice of the illiquidity of U.S. Treasuries as an additional source of risk in global markets as opposed to that of other government or corporate bonds is natural. First, the Treasuries are typically viewed as the safest and most liquid asset class, with investors from around the

world moving funds into these assets during periods of market uncertainty. For example, on March 13<sup>th</sup>, 2009, the Wall Street Journal writes:

“...Uncle Sam can sleep tight for now. Investors at home and abroad are still buying Treasuries despite a sharp increase in supply. ... Demand from foreign and domestic institutions, including foreign central banks, was hearty at 46.2%, up sharply from 18.2% at the last reopening in November. The robust demand partly reflects investors' preference for highly liquid and low-risk assets at a time of stress in the financial sector and the broader economy...”<sup>1</sup>

Importantly, Longstaff (2004) and Chordia, Sarkar, and Subrahmanyam (2005) show that fund inflows into U.S. Treasury bonds change their illiquidity. Therefore, while we cannot directly track equity fund flows into and out of Treasuries due to unavailability of such data, we attribute changes in the illiquidity of U.S. Treasury bonds to flight-to-liquidity or flight-to-quality events, both of which we refer to as flight-to-liquidity.<sup>2</sup> Second, investors outside of the U.S. hold large and increasing stakes in U.S. Treasuries. While at the end of 1996 foreign they held close to 28% of all marketable Treasury securities outstanding, by the end of 2006 their holdings reached almost 45% (see Figure 1).<sup>3</sup> This means that U.S. Treasuries constitute an increasingly significant portion of foreign investors' portfolios, and as such are subject to active trading and portfolio rebalancing by investors around the world. Third, Beber, Brandt, and Kavajecz (2007) show that during times of economic or stock market distress, investors tend to care more about liquidity

---

<sup>1</sup> The Wall Street Journal, *Investors Still Crave US Treasuries*, by Min Zeng, March 13, 2009, page C.3.

<sup>2</sup> Note that flight-to-liquidity is related to, but distinct from, flight-to-quality. Flight-to-quality is associated with rising default probabilities on risky debt that pushes investors towards holding higher quality instruments with lower credit risk, while flight-to-liquidity usually occurs due to changes in investors' preferences for more liquid assets such as U.S. Treasuries (see Diamond and Dybvig 1983; Bernanke and Gertler, 1995; and Longstaff, 2004). Separating flight to quality and flight-to-liquidity is difficult, however, because credit quality and illiquidity are positively correlated (see Ericsson and Renault, 2006).

<sup>3</sup> Source: The Federal Reserve System, Treasury Bulletin, see <http://www.ustreas.gov/tic/>.

than quality.<sup>4</sup> U.S. Treasury bonds are considered to be the most liquid instruments available, particularly in comparison to the government debt of other countries.

Thus, we assert that the more a risky asset is exposed to flight-to-liquidity, i.e., the higher is the probability that investors will sell it and move their funds into U.S. Treasuries, the higher is its expected return due to the larger Treasury bond illiquidity premium. In our cross-country setting, this implies that markets that are less immune from fund outflows into Treasuries will have higher equity premium.

Our study uses market-level rather than individual security returns for a variety of reasons. During economic uncertainty or market downtrends, which usually witness an increased desire among investors for U.S. Treasuries, correlations across risky assets increase.<sup>5</sup> Yet, the continuing benefits of international diversification, as shown in Ang and Bekaert (2002) and many other papers, imply that this increase in return correlations is larger within a country than across countries (e.g., recall the Asian crisis of 1997, the Russian crisis of 1998, or the Greek crisis of 2010). Besides, dealing with firm returns in a conditional setting such as ours is not feasible from a computational viewpoint. Finally, there are also global data limitation issues: for instance, we cannot obtain reliable measures of stock market illiquidity at the daily or weekly frequencies.

We begin our analysis by looking at the relation between U.S. Treasury bond illiquidity and stock market illiquidity at both the world (aggregate) level and the local (individual country) level. Our proxy for U.S. Treasury bond illiquidity is the average percentage bid-ask spread of off-the-run U.S. Treasury bills with maturities of up to one year. This measure follows Goyenko, Subrahmanyam, and Ukhov (2009), who demonstrate that the illiquidity of these T-bills best represents the illiquidity of the overall U.S. Treasury bond market. To measure individual

---

<sup>4</sup> Note that fund flows in and out of Treasuries are quite frequent. For example, Goetzmann and Massa (2002) find that when investors move funds in and out of the equity market in response to daily market news, these flows affect stock prices. Agnew and Balduzzi (2007) likewise observe that 401(K) plan participants' daily rebalancing between equities and fixed income instruments affect asset prices. Chordia, Sarkar, and Subrahmanyam (2005) observe that daily fund flows impact the illiquidity of both the stock and the bond markets.

<sup>5</sup> See Longin and Solnik, (1995, 2001), De Santis, and Gerard (1997) and Ang and Chen (2002).

countries' or world stock market illiquidity, we follow prior studies on stock market illiquidity in a global setting (e.g., Bekaert, Harvey, and Lundblad, 2007; Lee, 2006) and use the zero-return estimates of Lesmond, Ogden, and Trzcinka (1999).

We find that Treasury bond illiquidity predicts global stock market illiquidity. In particular, an increase in U.S. Treasury bond illiquidity predicts higher stock market illiquidity both at the world and the local levels, even after controlling for various determinants of stock and bond market illiquidity. However, the reverse relation does not hold. These results suggest that financial and/or macroeconomic shocks are first reflected in Treasury bond market illiquidity, and then subsequently transferred into the illiquidity of equity markets around the world (see Goyenko, Subrahmanyam, and Ukhov, 2009). We also find that an increase in stock market volatility forecasts a decrease in bond illiquidity. This result is consistent with flight-to-liquidity: when equity market volatility increases due to higher uncertainty, investors move their funds into U.S. Treasuries, thus lowering bond illiquidity.

Next, we explore the predictive power of Treasury bond illiquidity for global stock returns. Since bond market illiquidity predicts stock market illiquidity, it may predict stock market illiquidity premiums as well. Moreover, if bond illiquidity reflects the change in investors' preferences (i.e., fund outflow from equity markets) earlier than stock market illiquidity, it must have a stronger predictive power for equity returns than stock illiquidity. We find that bond illiquidity significantly negatively predicts stock returns, both for developed and emerging markets and for different sub-periods. This result is robust to the inclusion of other standard predictors of countries' equity returns such as local market returns, local dividend yields, the U.S. term spread, and local and world stock illiquidity. The negative effect of bond illiquidity on equity returns is not surprising. A current-period bond illiquidity shock increases stock illiquidity next period, which causes a contemporaneous decrease in equity returns

(Amihud, 2002). As a result, the current-period bond illiquidity shock leads to lower expected stock market returns next period.<sup>6</sup>

Finally, we present our main tests of four global asset pricing models that account for flight-to-liquidity risk. We first test a benchmark specification – a full-integration international market asset pricing model with two global risk factors: the world market portfolio return and the U.S. Treasury bond illiquidity factor. We then consider global pricing models that include the foreign exchange rate, the local equity market's variance and illiquidity, and the U.S. term spread as additional risk factors. Similar to Bekaert, Harvey, and Lundblad (2007), we conduct our estimation in two steps. In the first step, we use the multivariate GARCH (1,1) methodology and, for each country, compute the conditional return variance and the set of conditional covariances between local stock market returns and the model-specific risk factors. In the second step, we use GMM and estimate prices of risk for both the entire sample of countries and for developed and emerging market subsamples.

The results of our asset pricing tests show a negative and significant price of U.S. Treasury bond illiquidity risk leading to positive bond illiquidity premium. This result holds in the presence of other world and local risk factors considered, for the full sample of countries as well as for the developed and emerging market subsamples. The estimates of the price of bond illiquidity risk are usually larger in magnitude in emerging markets and in such countries as Greece and Portugal, which were classified as developed in the later part of our sample. This is expected as those markets are more exposed to flight-to-liquidity events than well developed countries. In our benchmark model, in economic terms, the average annual premium for flight-to-liquidity risk is between 1.0% and 1.3%. This is comparable in magnitude to the stock illiquidity premium of 1.1% per annum reported by Acharya and Pedersen (2005) for the U.S. equity market. The price of bond illiquidity risk is negative because declining stock prices are

---

<sup>6</sup> This is consistent with Goetzmann and Massa (2002) and Agnew and Balduzzi (2007), who find that people move funds between stock and bond markets instantaneously with respect to daily market news and that these cash flows have an effect on asset prices.



accompanied by increasing illiquidity across all asset classes.<sup>7</sup> This produces negative covariance between bond illiquidity and stock returns. The only other consistently priced factor across all models, not surprisingly, is the world market portfolio return.

Our study is related to two strands of the literature. The first links interest rate factors to equity markets. Merton (1973), Long (1974), and Stone (1974) show theoretically that interest rate factors help explain equity returns. However, subsequent empirical work using U.S. data finds only weak support for the importance of various interest rate-based factors in pricing equity returns.<sup>8</sup> Expanding on this work, Ferson and Harvey (1993) use a set of global risk factors including U.S. bond and T-bill returns and examine equity pricing across countries.<sup>9</sup> We further contribute to this literature by considering Treasury bond illiquidity as a viable alternative to other existing fixed income factors. This paper is also related to research that highlights the importance of illiquidity risk in asset pricing. Prior work focuses solely on the role of stock market illiquidity.<sup>10</sup> We expand this line of work by incorporating bond market illiquidity into a model of global asset pricing.

The rest of the paper is organized as follows. Section 2 describes the data. Section 3 offers initial analysis on the importance of bond illiquidity for global equity markets. In particular, we analyze the relation between U.S. Treasury bond illiquidity and global stock market illiquidity (at the world and local levels) and examine predictive regressions of stock market returns on lagged

---

<sup>7</sup> Note that the illiquidity of U.S. Treasury bills increases as well but to a much lesser degree due to flight-to-liquidity (see Goyenko, Subrahmanyam, and Ukhov, 2009).

<sup>8</sup> Fama and Schwert (1977) show that an unexpected inflation rate factor improves the explanatory power of the CAPM. Similarly, Sweeny and Warga (1986) augment the single-factor model with changes in the long-term interest rate, and Fogler, Kose, and Tipton (1981) relate stock returns to returns on Treasury and corporate bonds. However, Chen, Roll, and Ross (1986) find that default and term spreads are priced in the stock market. Likewise, Fama and French (1993) observe an impact of default and term spreads on stock returns but conclude that risk premiums on these factors are too small. Scruggs (1998) shows that bond returns are important for explaining the intertemporal relation between expected market return and risk.

<sup>9</sup> Most papers on risk-return relations in international markets price equity returns using only global and/or local stock market-based risk factors (see, e.g., Harvey, 1991; Bekaert and Harvey, 1995; Karolyi and Stulz, 1996; De Santis and Gerard, 1997; Fama and French, 1998; Griffin, 2002; and Carrieri, Errunza, and Hogan, 2007). Dumas and Solnik (1995), De Santis and Gerard (1998), and some other studies also account for currency risk.

<sup>10</sup> See Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), Amihud (2002), Pastor and Stambaugh (2003), and Acharya and Pedersen (2005) for the importance of stock market illiquidity in the U.S. Bekaert, Harvey, and Lundblad (2007) and Lee (2006) examine the relation between stock market illiquidity and global equity prices.

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 flight-to-liquidity risk to a set of country-level macroeconomic and financial variables. In Section 6, we offer robustness tests. Section 7 concludes.

## 2. Data

Our data sample consists of 46 countries, 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 U.S. dollars and dividend yields from Datastream (for developed markets) and IFC Global Indices (for emerging markets). We construct excess returns by subtracting the one-month U.S. Treasury bill rate from gross returns. Following Bekaert, Harvey, and Lundblad (2007) and Lee (2006), our proxy for stock market illiquidity in each country is the zero-return measure (Zeros). This measure is motivated by data limitations, which are especially pronounced in emerging markets. In particular, for many countries historical volume data are not sufficiently available to compute Amihud's (2002) return volume-based illiquidity measure.<sup>11</sup> Note, however, that Zeros is directly related to trading volume. More illiquid stocks have less frequent trading and therefore a higher incidence of zero returns.<sup>12</sup> We use the value-weighted proportion of zero daily returns across all firms in a country during a month. World stock market illiquidity is the value-weighted average of country-level aggregate illiquidity series.

Goyenko, Subrahmanyam, and Ukhov (2009) analyze the illiquidity of U.S. Treasuries across all maturities and on-the-run/off-the-run status and find that the illiquidity of off-the-run

---

<sup>11</sup> We nevertheless repeat our main tests, whenever possible, using Amihud's illiquidity measure, but this does not change our conclusions. These results are available upon request.

<sup>12</sup> Fong, Holden, and Trzcinka (2009) find that Zeros efficiently captures the time-series patterns of stock market liquidity compared to effective spread-based benchmarks. They analyze monthly data across 39 countries over the 1996-2007 period.

T-bills with maturities of up to one year best captures the illiquidity of the Treasury market overall. Accordingly, we use the illiquidity of off-the-run T-bills as our proxy for the illiquidity of the U.S. Treasury bond market. More specifically, we use the average percentage bid-ask spread of off-the-run U.S. T-bills with maturities of up to one year to proxy for U.S. Treasury bond market illiquidity. The quoted bid and ask prices come from CRSP's daily Treasury Quotes file. This file includes Treasury fixed income securities of three and six months, as well as 1, 2, 3, 5, 7, 10, 20, and 30 years, to maturity. Under the standard definition, when a new security is issued it is considered to be on-the-run and the older issues are treated as off-the-run. We use the quotes for three-, six-, and 12-month securities. For each month the monthly average spread is first computed for each security as the average proportional daily spread for the month and then equally weighted across short-term assets.<sup>13</sup> These data have also been used by Acharya, Amihud, and Bharath (2009), Baele, Bekaert, and Inghelbrecht (2010), and Goyenko and Ukhov (2009). The primary motivation for using the CRSP data is to have a long enough Treasury bond illiquidity time series to be able to study the connection between economic environment, liquidity conditions, and equity prices across different countries; to our knowledge, CRSP is the only data source that allows for the use of a sufficiently long period to subsume a variety of economic events. However, in robustness tests we use a bond illiquidity measure estimated from high-frequency intraday GovPX data that starts in the 1990s.

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 the equity market returns. Not surprisingly, the average monthly returns and volatilities in emerging markets are higher than those in developed markets. The autocorrelation of dividend yields is very high, in excess of 0.90 in all but five countries. Market illiquidity based on the

---

<sup>13</sup> Our results are similar when non-scaled (raw) quoted spreads are used as an alternative to proportional quoted spreads. This is consistent with Chordia, Sarkar, and Subrahmanyam (2005), who show that the daily correlation between quoted and effective spread changes in the bond market is 0.68 over their nine-year sample period. Thus, quoted spreads are reasonable liquidity proxies.

zero-return measure is also higher on average in emerging markets than developed, as expected. Zeros is highly correlated with transaction costs, but it does not directly indicate the magnitude of illiquidity (see Hasbrouck, 2009; Goyenko, Holden, and Trzcinka, 2009). Rather, this measure gives us only a relative sense of the magnitude of illiquidity. For example, the U.S., which is the most liquid market, has the lowest realization of Zeros at 8.6%, whereas emerging markets, which are perceived to be more illiquid, observe Zeros in the range of 20% and 50%. The world market's illiquidity, which is the value-weighted average illiquidity across all countries, has a value of 19%. The zero-return measure also shows autocorrelation but not to the same extent as dividend yields. The only country with a negative first-order autocorrelation of illiquidity is China.

### **3. Preliminary Analysis**

#### ***3.1. Treasury Bond and Stock Market Illiquidity***

We first investigate the relation between U.S. Treasury bond illiquidity and stock market illiquidity around the world. Our primary goal here is to determine whether there is a liquidity linkage between Treasury bond and stock markets. Flight-to-liquidity, i.e., the inflow of funds into U.S. Treasuries from the stock market, affects the illiquidity of Treasuries (Longstaff, 2004). At the same time, shocks to bond illiquidity associated with monetary policy shifts impact stock market illiquidity (Goyenko and Ukhov, 2009). We posit that if illiquidity of one market (e.g., Treasuries) affects illiquidity of the other market (e.g., equity), it may also forecast the other market's illiquidity premium, that is, illiquidity spillover across markets may also lead to a cross-market spillover of illiquidity premiums. The results are reported in Table 2.

Panel A of Table 2 shows the results of regressing world stock market illiquidity,  $L_{w,t}$ , on lagged Treasury bond illiquidity,  $L_{B,t-1}$ , with and without control variables. We report point estimates and robust t-statistics based on the Newey-West correction for six lags of the standard error. Two lags of  $L_{w,t}$  are included in each regression to control for persistence in the series, but

their coefficients are not reported. Regression (1) shows the base specification between  $L_{B,t-1}$  and  $L_{w,t}$ . We find that the coefficient on bond illiquidity is positive and significant at the 5% level, indicating that a current-period increase in bond illiquidity leads to an increase in world stock market illiquidity next period. This result suggests the presence of illiquidity shock spillover effects between the two markets, with Treasury bond illiquidity picking up global illiquidity shocks first and then transferring these shocks to equity markets. Sudden demand for liquidity, perhaps caused by flight-to-liquidity, may cause bond illiquidity to change first because U.S. Treasuries are among the most liquid assets.

Prior studies suggest that returns and volatility of returns are important drivers of illiquidity (see Amihud and Mendelson, 1986; Benston and Hagerman, 1974). Therefore, in Regression (2) of Panel A, we add to the above specification controls for the world stock market's lagged return,  $r_{w,t-1}$ , and volatility,  $\sigma_{w,t-1}$ .<sup>14</sup> The results show that lagged bond illiquidity remains statistically significant. In contrast, the control variables, which have been shown by Chordia, Roll, and Subrahmanyam (2001) and Chordia, Sarkar, and Subrahmanyam (2005) to predict stock market illiquidity in the U.S., do not appear to affect world stock market illiquidity.

Treasury bond illiquidity captures a substantial portion of monetary policy shocks (see Goyenko, Subrahmanyam, and Ukhov, 2009). In turn, monetary policy can directly affect stock market illiquidity by tightening the inventory constraints of market makers and increasing the borrowing costs of trading (see, e.g., Chordia, Sarkar, and Subrahmanyam, 2005; Hameed, Kang, Viswanathan, 2010). Furthermore, money market fund flows and consumer confidence can impact bond market illiquidity premiums (Longstaff, 2004). Due to the linkages between the bond and stock markets, these variables may also affect stock market illiquidity. Regressions (3) and (4) of Panel A therefore consider two monetary policy controls (the lagged change in the federal funds rate,  $FED_{t-1}$ , and the lagged term spread,  $TERM_{t-1}$ ) and two controls based on Longstaff (2004) (the lagged percentage change in the amount of funds held in money market

---

<sup>14</sup> The monthly stock market volatility for each market in a given month is computed as the standard deviation of daily returns in that market and month. Daily returns are again from Datastream and IFC.

mutual funds,  $MMF_{t-1}$ , and the lagged change in the consumer confidence index,  $CCI_{t-1}$ ), respectively.<sup>15</sup> The results show that current-period bond illiquidity continues to predict next-period world stock market illiquidity at the 10% level or better. Moreover, consistent with Amihud and Mendelson (1986) and Benston and Hagerman (1974), world market volatility has positive and marginally significant power to predict world stock market illiquidity. Note that the slope on  $FED_{t-1}$  is only marginally significant in Regression (3), which suggests that bond illiquidity is more important than monetary policy for stock market illiquidity.

Regression (5) of Panel A includes all control variables above except MMF due to its high correlation with the term spread. The results again show a positive and significant link between lagged bond illiquidity and world stock market illiquidity, and lagged world market volatility is again only marginally significant.

Next, Panel B of Table 2 shows results of regressing individual sample countries' stock market illiquidity on Treasury bond illiquidity. To properly address cross-country correlations and substantial persistence in stock market illiquidity series (see Table 1), we use a structural dynamic panel data estimation technique based on Arellano and Bover (1995) and Blundell and Bond (1998, 2000). This technique is a GMM procedure that allows one to estimate panel data taking into account serial and cross-sectional correlation (via time effects), heteroskedasticity, as well as endogeneity of some explanatory variables. The estimator is based on a system of moment conditions that contain not only original equations but also first-differenced equations.<sup>16</sup> This panel regression model can be written as follows:

$$L_{i,t} = \alpha_0 + \sum_{l=1}^2 \phi_l L_{i,t-l} + \beta X_{it-1} + f_i + d_t + e_{i,t}, \quad (1)$$

---

<sup>15</sup> The term spread is the difference in yields between the 10-year U.S. Treasury note and the one-month T-bill. Data on the amount of funds held in money market mutual funds come from the Federal Reserve Board, and data on the consumer confidence index, which is divided by 100, come from the Conference Board.

<sup>16</sup> Note that Arellano and Bover's (1995) procedure is commonly applied to panel data when it is not possible to run vector autoregression analysis (VAR) due to cross-sectional correlations. Essentially, this procedure gives robust VAR estimates for unbalanced panel data.

where the vector of independent variables,  $X$ , is either a scalar,  $L_B$ , or  $L_B$  augmented by a subset of control variables  $\{r_i, \sigma_i, \text{FED}, \text{TERM}, \text{MMF}, \text{CCI}\}$ , depending on the regression specification,  $f_i$  captures country-specific effects, and  $d_t$  captures calendar effects. Two lags of  $L_{i,t}$  are included in each estimation, but their coefficients are not reported.

In Regression (1) of Panel B we observe that, in line with our results in Panel A, bond illiquidity significantly positively predicts stock illiquidity at the country (i.e., local) level. This relation remains intact after adding various control variables in Regressions (2)-(5). Consistent with the inventory paradigm (see, e.g., Ho and Stoll, 1983; and O'Hara and Oldfield, 1986), we now find that local stock market volatility positively and significantly (at the 10% level or better) predicts local stock market illiquidity in all regression specifications. Changes in the federal funds rate also positively affect local stock market illiquidity, similar to our findings in Panel A. We also find a strong effect of lagged changes in the U.S. consumer confidence index, CCI, on stock market volatility across our sample countries.

Finally, Panel C of Table 2 shows results on the reverse relation, that is, on the predictive effect of world stock market illiquidity on Treasury bond illiquidity. An increase in stock market illiquidity may result in increased flows of funds into Treasuries (flight-to-liquidity), reducing the illiquidity of Treasury bonds. Stock illiquidity may thus have a negative impact on next-period bond illiquidity. Other variables may also have predictive power for Treasury bond illiquidity. In Panel C we include the same control variables as those used in Panel A. Also as in Panel A, two lags of  $L_{B,t}$  are included in each regression (their coefficients are not reported), and we again use t-statistics based on the Newey-West correction for six lags of the standard error. We find that across all specifications (Regressions (1)-(5)), world stock market illiquidity has no significant predictive effect on Treasury bond market illiquidity. Volatility of the world stock market, however, has a negative and marginally significant effect on bond illiquidity, that is, an increase in stock market volatility increases flows of funds into U.S. Treasuries, improving their liquidity. This is consistent with flight-to-liquidity episodes, with flight-to-liquidity in international markets being driven more by stock market volatility than stock market illiquidity as in the U.S. data (see

Goyenko and Ukhov, 2009). We also find that, similar to Goyenko, Subrahmanyam, and Ukhov (2009), changes in the federal funds rate have positive predictive power for bond illiquidity. Taken together, the results suggest that both U.S. monetary policy and world stock market volatility impact U.S. Treasury market illiquidity. However, while the illiquidity of Treasuries increases in response to monetary policy tightening, it decreases in response to fund outflows, or flight-to-liquidity, from world stock markets.

In sum, Table 2 shows that Treasury bond illiquidity has predictive power for stock market illiquidity. In particular, an increase in bond illiquidity predicts an increase in both world and country-specific stock market illiquidity. The reverse relation, however, does not hold. These findings support our hypothesis that illiquidity shocks around the world are reflected first in the illiquidity of the U.S. Treasury market, an important source of immediate liquidity provision.

### ***3.2. Predictive Regressions of Equity Returns***

Given the evidence that the Treasury bond illiquidity predicts global stock market illiquidity, in this section we test whether it has predictive power for global equity returns as well. Since a positive shock to bond illiquidity predicts an increase in world and local stock market illiquidity (see Table 2), and the contemporaneous effect of an increase of stock illiquidity on equity returns is negative (Amihud, 2002), we expect a *negative* relation between bond illiquidity and expected equity returns. The same prediction can be inferred using monetary policy contraction arguments.<sup>17</sup>

Note that both bond illiquidity and stock market illiquidity are persistent. Ferson, Sarkissian, and Simin (2003) warn against using standard statistical inference in regressions of stock returns on lagged instruments when the regressors are autocorrelated. Therefore, to

---

<sup>17</sup> Goyenko, Subrahmanyam, and Ukhov (2009) argue that monetary policy is one of the key determinants of bond illiquidity, and that most of the variation in bond illiquidity is explained by the Federal Reserve's policies. Several studies establish a link between changes in monetary policy and stock returns. Patelis (1997), Thorbecke (1997), and Bernanke and Kuttner (2005) show that a monetary contraction has a large and statistically significant negative effect on both current and subsequent stock values. Therefore, we expect bond illiquidity to have a negative predictive effect on global equity returns.



preclude concerns about spurious regression biases, in the subsequent analysis we follow Pastor and Stambaugh (2003) and Acharya and Pedersen (2005) and use the AR(2) residuals as an illiquidity measure of both the Treasury bond and global stock markets. To reduce the impact of outliers on our estimation results, we winsorize bond and stock market illiquidity shocks at the 1st and 99th percentiles. Table 3 presents test the results of predictive regressions for global and local excess market returns. The two control variables included in all panels are the U.S. term spread and the January dummy; the latter variable is included in every regression.

Panel A of Table 3 reports the results for the world equity market return. In particular, the panel reports point estimates and robust t-statistics based on the Newey-West correction for six lags of the standard error. The regressions include as global stock market controls lagged values of the world market's return, illiquidity, and dividend yield. We conduct our estimation on both the full sample period (columns 1-3) and the three ten-year subperiods of 1977-1986, 1987-1996, and 1997-2006 (columns 4-6). The first three columns show that the slope on bond illiquidity is negative and significant at the 1% level, consistent with our expectations. None of the other variables is significant. The last three columns show that the negative relation observed between lagged bond illiquidity and stock returns is present in each of the subperiods, with its magnitude increasing towards later years of the sample.

The predictive relation between Treasury bond illiquidity and world equity market excess returns is economically important as well. Since one standard deviation of bond illiquidity is 0.002, a one-standard deviation positive shock to bond illiquidity, based, for instance, on Regression (3) output implies a decrease in next-period world market excess returns of -3.091 times 0.002. This amounts to a return decline of 62 basis points per month.

Panel B of Table 3 reports panel regression results for local stock market returns. Our controls now include country-level lagged values of equity market returns, illiquidity, and dividend yields. To account for cross-market correlations and average country-specific characteristics, all regressions include country and year fixed effects, and we cluster standard errors by month. Again, columns 1-3 correspond to full sample period tests, while columns 4-6

correspond to the sub-period tests. The first three regressions show that over the entire sample period, bond illiquidity retains its negative and statistically significant predictive power for local stock returns. Moreover, this relation mostly survives the subperiod tests.<sup>18</sup> Across all regression specifications, the coefficients on  $L_B$  are comparable in magnitude to those in Panel A. Another variable which often shows significance in predictive tests is the local dividend yield. There is no systematic evidence on the importance of lagged stock market illiquidity for equity returns.

In Panel C of Table 3, we split the sample countries into 23 developed and 23 emerging markets and repeat the first three tests of Panel B. Columns 1-3 report the estimation results for the developed markets, while columns 4-6 report the results for the emerging markets. The slope on lagged bond illiquidity is negative and significant at the 5% level or better across all six specifications. However, its magnitude for emerging markets is more than four times larger than that for developed markets. Thus, emerging markets, which tend to be less liquid, experience stronger illiquidity effects. This is consistent with fund flows into U.S. Treasuries during illiquidity shocks to be more pronounced for emerging markets. Dividend yields predict stock returns in developed markets only. Interestingly, lagged local market illiquidity is negative and significant for developed countries, but essentially zero for emerging markets.<sup>19</sup>

Overall, Treasury bond illiquidity predicts global stock returns at both the aggregate world and the individual country levels, over different sub-periods, and across developed versus emerging markets. This result, which is statistically and economically significant, holds after controlling for common predictors of equity returns and stock market illiquidity. In the next section, we investigate the main pricing implications of bond illiquidity for global equity returns.

---

<sup>18</sup> In the last subperiod (1997-2006, column 6) the effect of bond illiquidity is insignificant at conventional significance levels. However, over the 1998-2006 period, which excludes the highly volatile returns of emerging markets during the Asian crisis, the t-statistic associated with  $L_{B,t-1}$  becomes significant again, reaching the value of -2.30.

<sup>19</sup> Bekaert, Harvey, and Lundblad (2007) find a significantly positive (negative) relation between excess returns in closed (open) emerging markets and lagged local stock market illiquidity. This implies a generally flat relation between lagged stock liquidity and excess returns in emerging markets over the full sample period, 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 liberalized economies.

## 4. Conditional Methodology

### 4.1. General Framework

In this section, we test four asset pricing models of global equity returns under full and partial market integration. All of the models use bond illiquidity as a proxy for flight-to-liquidity risk.<sup>20</sup> We assume constant prices of all risk factors.

Model I. If country  $i$  is integrated with the world and purchasing power parity holds across countries, then country  $i$ 's expected return at time  $t$  given the information available at time  $t-1$  is determined by its conditional covariances with the return on the world market portfolio and with Treasury bond illiquidity, that is,

$$E_{t-1}(r_{i,t}) = \lambda_w \text{Cov}_{t-1}(r_{i,t}, r_{w,t}) + \lambda_{LB} \text{Cov}_{t-1}(r_{i,t}, L_{B,t}), \quad (2)$$

where  $\lambda_w$  is the price of world market risk and  $\lambda_{LB}$  is the price of flight-to-liquidity risk. Equation (2) is our benchmark “World CAPM” model with Treasury bond illiquidity risk factor that we call WCAPM-LB. Economically and statistically significant  $\lambda_{LB}$  would suggest that flight-to-liquidity risk is priced in global markets.

Note that during market downturns, when equity returns decrease, illiquidity of all asset classes increases. Therefore, similar to a negative predictive relation, we also expect a *negative* contemporaneous relation between bond illiquidity and global stock returns. This effect, which is similar to that between stock illiquidity and equity returns (see Amihud, 2002), implies negative on average  $\text{Cov}_{t-1}(r_{i,t}, L_{B,t})$  term.<sup>21</sup> Therefore, if bond illiquidity is a systematic risk factor in international equity markets,  $\lambda_{LB}$  must have negative as well. This is our paper's main testable hypothesis.

---

<sup>20</sup> Note that flight-to-liquidity risk is a global factor and therefore cannot be present in fully segmented markets.

<sup>21</sup> Empirical finance literature documents that another financial variable closely related to monetary policy, the short-term interest rate, also has negative predictive and contemporaneous effects on stock prices (e.g., see Breen, Glosten, and Jagannathan, 1989; Fama and Schwert, 1977; Campbell, 1987). However, Bernanke and Kuttner (2005) point out that the reaction of equity prices to monetary policy is not directly related to the policy's impact on the real interest rate.

Model II. If there are deviations in purchasing power parity across countries, then exchange rate risk may also be priced (see Dumas and Solnik, 1995). Model II extends Model I to accommodate this factor as follows:

$$E_{t-1}(r_{i,t}) = \lambda_w \text{Cov}_{t-1}(r_{i,t}, r_{w,t}) + \lambda_{LB} \text{Cov}_{t-1}(r_{i,t}, L_{B,t}) + \lambda_c \text{Cov}_{t-1}(r_{i,t}, r_{c,t}), \quad (3)$$

where  $r_{c,t}$  is the return on the currency basket deposit at time  $t$  and  $\lambda_c$  is the price of currency risk. In our estimations, the return on the currency basket deposit is calculated as the equally weighted average change in exchange rates between the U.S. dollar and four global currencies: the British Pound, Euro, Japanese Yen, and Swiss Franc.<sup>22</sup>

Model III. A country may not be fully integrated with the world. Errunza and Losq (1985) develop a model where expected return on a risky security in such country is determined by a global risk premium and an additional risk premium proportional to the country's conditional market risk. If country  $i$  is fully segmented, its expected return at time  $t$  given the information available at time  $t-1$  is based only on its conditional variance with the market returns, i.e.,  $E_{t-1}(r_{i,t}) = \lambda_i \text{Var}_{t-1}(r_{i,t})$ , where  $\lambda_i$  is the price of country  $i$  risk. We combine this term with Model I, following similar econometric specifications of Chan, Karolyi, and Stulz (1992), Bekaert and Harvey (1995), and De Santis and Gerard (1997), and obtain an asset pricing model of partial world market integration.

$$E_{t-1}(r_{i,t}) = \lambda_w \text{Cov}_{t-1}(r_{i,t}, r_{w,t}) + \lambda_{LB} \text{Cov}_{t-1}(r_{i,t}, L_{B,t}) + \lambda_i \text{Var}_{t-1}(r_{i,t}). \quad (4)$$

In this model, the expected return in country  $i$  is determined based on its conditional covariances with the two global risk factors as well as respective country risk.

Model IV. Recent research shows that stock market illiquidity is an important factor for U.S. stock returns (see, e.g., Amihud, 2002; Pastor and Stambaugh, 2003; Acharya and Pedersen,

---

<sup>22</sup> Across various currency pairs, we observed that only changes in the JPY/USD rate were significantly related to world stock market excess returns. Since the trade- or GDP-weighted approach assigns the JPY/USD rate a weight of less than 15% over the sample period, we account for the JPY/USD rate to the larger degree by using the equally weighted setting (25% for each currency pair). Note, however, that replacing our currency basket with individual exchange rates does not materially impact our test results.

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 (Model III) to include this second country-specific factor. This yields the following model

$$E_{t-1}(r_{i,t}) = \lambda_w Cov_{t-1}(r_{i,t}, r_{w,t}) + \lambda_{LB} Cov_{t-1}(r_{i,t}, L_{B,t}) + \lambda_i Var_{t-1}(r_{i,t}) + \lambda_{Li} Cov_{t-1}(r_{i,t}, L_{i,t}), \quad (5)$$

where  $\lambda_{Li}$  is the price of equity market illiquidity risk in country  $i$ .

We note that it is possible to combine Models II and IV, which would result in a five-factor model, but we do not pursue this setting due to the added estimation difficulties. Following Acharya and Pedersen (2005), one could also consider other stock market illiquidity based covariance risks, such as  $Cov_{t-1}(r_{i,t}, L_{i,t})$ ,  $Cov_{t-1}(L_{w,t}, L_{i,t})$ , and  $Cov_{t-1}(r_{w,t}, L_{i,t})$ . However, these additions will again render our estimation impractical.

#### **4.2. Estimation Details**

Evaluating Models I through IV jointly across 46 countries in a conditional framework with unknown conditional variances and covariances is practically impossible. We therefore estimate our asset pricing models in two steps. While the two-step estimation framework is usually associated with an errors-in-variables problem, it is often the only technique for testing multi-country or multi-asset conditional asset pricing models.<sup>23</sup>

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. 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.

---

<sup>23</sup> For example, Bekaert, Harvey, and Lundblad (2007) model stock market liquidity in emerging countries using a two-step estimation procedure, where the first step is based on the VAR(1) framework and the second on GMM. Engle (2002) examines conditional correlations across multiple assets using a two-step approach with multivariate GARCH models.

The choice of our information variables is determined by previous literature and the results in Tables 2 and 3. First, for the local (world) market return, we use the first lags of the local (world) market return, local (world) dividend yield, U.S. term spread, Treasury bond illiquidity, as well as local (world) stock market illiquidity. We include the lagged bond illiquidity and stock market illiquidity based on our Table 2 and other studies (e.g., Bekaert, Harvey, and Lundblad, 2007), respectively. Including lagged stock market returns is a common practice in conditional asset pricing, although they are often insignificant.<sup>24</sup> Second, for bond illiquidity, the instruments are lagged stock market volatility and the change in the federal funds rate, which come from our Table 2 and Goyenko, Subrahmanyam, and Ukhov (2009). Third, the change in the exchange rate is predicted by the lagged world market return and the one-month Eurodollar deposit rate, following Dumas and Solnik (1995). In unreported results we find that the Eurodollar rate predicts changes in our worldwide exchange rate.<sup>25</sup> Finally, stock market illiquidity is predicted by lagged values of bond illiquidity, stock market return, and volatility. This choice is based on our results in Table 2 as well as extant studies (Chordia, Roll, and Subrahmanyam, 2001; Chordia, Sarkar, and Subrahmanyam, 2005).

Based upon the discussion above, for our Model I (WCAPM-LB) and Model III we initially estimate the following trivariate GARCH (1,1) system for each country:

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

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

$$L_{B,t} = \delta_{30} + \delta_{31}\sigma_{w,t-1} + \delta_{32}FED_{t-1} + e_{LB,t}. \quad (6c)$$

For Model II, we add the relation that governs the dynamics of currency returns,

---

<sup>24</sup> We use the lagged dividend yield and term spread following Fama and French (1989), who observe that these variables predict stock returns. Our results in Table 2, while not showing significance for the term spread, show significant predictive power of dividend yields (at least using the standard statistical inference). We include lagged bond market illiquidity and stock market illiquidity based on our Table 2 and other studies (e.g., Bekaert, Harvey, and Lundblad, 2007), respectively. Including lagged stock market returns is a common practice in conditional asset pricing, although they are often insignificant.

<sup>25</sup> Ideally, we would like to have short-term rates for all the currencies contributing to our currency basket. However, as Dumas and Solnik (1995) note, expanding the instrument set to include several interest rates can quickly worsen the finite-sample properties of estimates due to high auto- and cross-correlations of interest rates.

$$r_{c,t} = \delta_{40} + \delta_{41}r_{w,t-1} + \delta_{42}Euro\$_{t-1} + e_{c,t} , \quad (6d)$$

while for Model IV we add instead the predictive relation for local stock market illiquidity,

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

We also estimate system (6) for the world market portfolio. In this case, equation (6a) is dropped, and, for Model IV, all local market variables in equation (6e) are replaced with their corresponding world market characteristics, that is

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

In the full system of equations 6(a-f), the error term is  $e_t = [e_{i,t}, e_{w,t}, e_{c,t}, e_{LB,t}, e_{Li,t}, e_{Lw,t}]$ . It is assumed to be a multivariate normal distribution with conditional variance-covariance matrix  $H_t$ . The matrix  $H_t$  has the BEKK structure ensuring that it is parsimonious and positive definite (see Engle and Kroner, 1995):

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

where  $C$  is an (MxM) upper triangular matrix and  $A$  and  $B$  are (MxM) diagonal matrices, where  $M$  is the number of equations being estimated under different model specifications. We therefore assume that current-period variance depends only on lagged conditional variance and lagged squared errors, while current-period covariance depends only on lagged covariance and the lagged cross-product of errors. Similar specifications are used in Bekaert and Harvey (1995), DeSantis and Gerard (1997), and other papers. To obtain the parameter estimates, we employ the Berndt, Hall, Hall, and Hausman (BHHH) optimization algorithm. We use conditional covariances between  $r_{i,t}$  on the one side and  $r_{w,t}$ ,  $L_{B,t}$ ,  $r_{c,t}$ , and  $L_{i,t}$  on the other, as well as conditional variances of  $r_{i,t}$  for each country obtained from the system (6) for the second- step GMM estimation.

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

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

where  $\zeta_{i,t}$  and  $\zeta_{w,t}$  are the error terms of the country  $i$  and world market excess return equations at time  $t$ , respectively,  $i=1, \dots, N$ , and  $N$  is the number of countries (46 for the whole sample or 23 for the sub-samples of developed and emerging markets). The “hat” indicator denotes the conditional variances and covariances from the multivariate GARCH (1,1) estimation. At this stage, we compute the following prices of risk:

Model I:  $\lambda_w, \lambda_{LB}$ ;

Model II:  $\lambda_w, \lambda_{LB}, \lambda_c$ ;

Model III:  $\lambda_w, \lambda_{LB}, \lambda_i, i=1, \dots, N$ ;

Model IV:  $\lambda_w, \lambda_{LB}, \lambda_{Lw}, \lambda_i, \lambda_{Li}, i=1, \dots, N$ .

To create orthogonality conditions in an overidentified yet parsimonious system, we use instruments that can be implemented with various asset pricing models. This approach facilitates comparison of test results across models. Our most commonly used instrument vector  $Z$ , which is largely motivated by the predictive regression results in Table 3, includes a constant and three global information variables, namely, the lagged values of Treasury bond illiquidity, the world market portfolio return, and the world dividend yield, that is,

$$Z_{t-1} = [1, L_{B,t-1}, r_{w,t-1}, DY_{w,t-1}]. \quad (8)$$

This gives a total of  $(4N+4)$  orthogonality conditions in the GMM estimation. However, in smaller GMM systems (e.g., the WCAPM-LB specification, Model I), we also use a shorter instrument vector by dropping the world lagged dividend yield from (8), while in the larger systems (e.g., Models II-IV), we also use an alternative instrument set in which the lagged world dividend yield in (8) is replaced with the world stock market illiquidity shocks and the U.S. term spread. This allows us to examine the sensitivity of our results to the instrument choice.



Following the studies of GMM performance in small samples (Andersen and Sørensen, 1996; Ferson and Foerster, 1994), we use Bartlett kernel, Andrews' bandwidth, and iterative updating of both the weighting matrix and the coefficients in all our GMM estimations. Furthermore, to facilitate convergence, we apply the pre-whitening of the weighting matrix as suggested by Andrews and Monahan (1992).<sup>26</sup>

## 5. Empirical Tests

### 5.1. Conditional Treasury Bond Illiquidity Betas

We start by examining the outcome of our multivariate GARCH (1,1) model based on equations (6a-c). In particular, given the estimates of the conditional variance of Treasury bond illiquidity,  $\hat{Var}_{t-1}(L_{B,t})$ , and the conditional covariance of country returns with bond illiquidity,  $\hat{Cov}_{t-1}(r_{i,t}, L_{B,t})$ , we can construct for each country  $i$  the conditional bond illiquidity beta as:

$$Beta_{i,t-1}(L_{B,t}) = \hat{Cov}_{t-1}(r_{i,t}, L_{B,t}) / \hat{Var}_{t-1}(L_{B,t}). \quad (9)$$

In Figure 2, we plot the time series of the conditional Treasury bond illiquidity beta. The figure depicts the average 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 bond illiquidity beta for developed markets is close to but less than zero, while that for emerging markets is much more negative. This result is consistent with the intuition that flight-to-liquidity should be more pronounced in emerging markets, where stock markets are less liquid compared to those in developed markets. This implies a higher sensitivity, in absolute terms, of emerging equity market returns to bond illiquidity.

---

<sup>26</sup> Andersen and Sørensen (1996) find that an estimation using a fixed number of lags in the weighting matrix is inferior to one using an automatic (data-dependent) bandwidth, such as Andrews' bandwidth. They also find that the standard Bartlett kernel estimator is superior to the quadratic one in many model specifications and that pre-whitening can often be helpful in the estimation when the sample size is relatively small. Ferson and Foerster (1994) show that iterated GMM has better finite sample properties than the standard two-stage approach.

We also analyze the cross-sectional properties of bond illiquidity betas. Figure 3 shows the relation between average country-level excess returns and the average conditional betas for the full sample period. We observe that most average bond illiquidity betas are negative and that there is a downward trend between these betas and mean excess returns. The plot implies that the lower in absolute terms is a country's stock market exposure to the illiquidity of U.S. Treasuries, the lower is its expected return. Not surprisingly, the set of observations with negative bond illiquidity betas (the 18 leftmost points) belongs to emerging markets or developed markets that were classified as emerging during a substantial part of our sample period, such as Greece and Portugal. The vast majority of countries with close to zero or positive bond illiquidity risk are associated with developed and therefore more liquid stock markets, which are less exposed to global flight-to-liquidity episodes.

Given the wide dispersion of Treasury bond illiquidity betas across countries, we explore whether any country-specific characteristics can explain the cross-sectional differences in these betas. Table 4 reports results for country-level variables that we believe may affect bond illiquidity betas and therefore impact flight-to-liquidity episodes. CORR is the average country's equity market correlation with the world market portfolio over the entire sample period. Size is the average stock market capitalization to GDP ratio from Djankov et al. (2008). 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. The more developed a country's markets are, the lower their cash outflows should be during illiquidity shocks and hence the lower in absolute terms their bond illiquidity betas. SEG is a market segmentation proxy computed in the spirit of Bekaert et al. (2008) as the average absolute difference between a country's inverse price-to-earning ratio and that of the world market.<sup>27</sup> RATE is the short-term interest rate. The monthly price-to-earning ratios and interest rates are taken from Datastream. These two variables can be regarded as "dynamic indicators," and are easily observable over time at any sampling frequency. The more

---

<sup>27</sup> In Bekaert, et al. (2008), SEG is the weighted sum of local-global industry valuation differentials.

segmented a country is from the world, or the higher is the level of its nominal interest rates, the higher is the probability of flight-to-liquidity episodes from this market, and hence the higher (more negative) its bond illiquidity beta is expected to be. Finally, FREEDOM is the average index of economic freedom in 1995-2006 from the Heritage Foundation,<sup>28</sup> and LAW is the anti-self-dealing index again from Djankov, et al. (2008). These two variables can be thought of as “investor environment” proxies. Countries with better investor protection should have a lower propensity of outflows from their stock markets, and thus should have lower bond illiquidity betas in absolute terms.

Table 5 reports the results of the regression of average conditional bond illiquidity betas across countries (46 data points) on various sets of country characteristics from Table 4. It also shows the R-squared for each regression. In all estimations, the number of foreign listings and short-term rate are taken with logs. Regression (1) includes only one regressor, CORR, which takes a positive and significant coefficient. This implies that the higher is the correlation between the local stock market and the world market the lower is its sensitivity, in absolute value, to flight-to-liquidity. However, when we include the other two “market development” variables, i.e., SIZE and LISTINGS in Regression (2), CORR passes its sign and significance on to the number of overseas listings. Regression (3) presents the test results for the “dynamic indicators.” The coefficients on SEG and RATE are negative, as expected, but only the market segmentation proxy is marginally significant. This implies that less integrated but open countries are generally less immune from bond illiquidity shocks. Regression (4) presents the results for the “investor environment” proxies. Consistent with our expectations, we find a positive and significant relation between FREEDOM and the bond illiquidity beta. This implies that economically, financially, and politically more sound countries have fewer instances of cash outflows to the US Treasury market. However, when we combine the “market development” variables with the “dynamic indicators” and “investor environment” proxies in Regression (5), we find that the only variable that retains its sign and statistical significance at the 5% level is the number of overseas

---

<sup>28</sup> The index can be downloaded from the Foundation’s web site at <http://www.heritage.org/research/features/index/>.

listings. This variable also remains significant in the presence of the emerging market dummy, as shown in Regression (6). Thus, when a country is more integrated with the world market through its foreign listing activity, outflows of funds from its stock market into U.S. Treasuries is less likely, leading to lower absolute value bond illiquidity beta.

## 5.2. Asset Pricing Tests

To further examine the cross-sectional importance of Treasury bond illiquidity for international equity market returns, we turn our attention to the results of the GMM-based asset pricing tests. We first examine the performance of our base two-factor model (Model I), the World CAPM with Treasury bond illiquidity factor WCAPM-LB. Table 6 shows the test results for two different instrument sets across all countries as well as separately for developed and emerging markets. Besides the point estimates of the prices of risk and their t-statistics, for each test the table also reports the degrees of freedom and the GMM J-statistic with its corresponding p-value. The estimation period is 1977-2006 for developed markets and 1987-2006 for emerging markets. In Panel A, the instrument set consists of a constant and the lagged values of the bond illiquidity shock and the world market return, while in Panel B the instrument set is as in (8). The conditional variances and covariances are obtained from the multivariate GARCH (1,1) using equations (6a-c).

Across both panels of Table 6, we observe a positive and significant price of world market portfolio risk,  $\lambda_w$ . Its magnitude is around 4.03 for the full sample of countries, which is in line with similar estimates in prior studies on world market integration (see, e.g., De Santis and Gerard, 1997; Bekaert, Harvey, and Lundblad, 2007). Using the estimates of  $\lambda_w$  and, from the first-stage estimation, the average estimate (across all countries) of the conditional covariance between each country's equity return and the world market return,  $Cov_{t-1}(r_{i,t}, r_{w,t})$ , which is 0.165, we can compute the average expected equity market return for a typical country attributed to the world market risk factor,  $\lambda_w Cov_{t-1}(r_{i,t}, r_{w,t})$ . We find that  $\lambda_w Cov_{t-1}(r_{i,t}, r_{w,t})$  is approximately equal

to 8.0%. This is an economically meaningful number given that the average annual stock market excess return in our sample is 13.2% in Table 1 (1.1% times 12).

More importantly, Table 6 shows that the parameter of primary interest, the price of flight-to-liquidity risk,  $\lambda_{LB}$ , is negative, as expected, and significant at the 5% level or better in every estimation but one, both for the entire sample of countries and for the sub-samples of developed and emerging countries. Note that the decrease in statistical significance of the estimates of  $\lambda_{LB}$  in emerging markets results largely from the shorter sample period. The point estimates of  $\lambda_{LB}$  are between 1.12 and 1.36, in absolute terms, for the whole sample of 46 countries. We can use the values of  $\lambda_{LB}$  and the average conditional covariance  $Cov_{t-1}(r_{i,t}, L_{B,t})$  from the first-stage estimation to compute the average annual equity market premium attributed to bond illiquidity risk,  $\lambda_{LB} Cov_{t-1}(r_{i,t}, L_{B,t})$ . Our evaluation produces a range of values between 1.0% and 1.3%. This magnitude is comparable to that of the U.S. stock illiquidity premium of 1.1% per annum reported by Acharya and Pedersen (2005). We can also observe that on average the point estimates of  $\lambda_{LB}$  in emerging markets are higher than in developed markets (3.7 versus 1.5). This evidence corroborates the results from the predictive regressions in Table 3, where bond illiquidity has a higher predictive impact on stock returns in emerging markets. In economic terms, the average price of risk in emerging markets (3.7 across both panels) implies that in these countries about 3.5% of annual stock market returns arises from exposure to flight-to-liquidity risk. Finally, the J-statistics indicate that we cannot reject our model in which the prices of the world market and bond illiquidity risks are set constant.

While Table 6 shows that the negative and significant price of bond illiquidity risk is a consistent outcome across different estimation settings, one cannot exclude the possibility that this result is due to other world or country-specific risk factors that are omitted from the analysis. In Table 7 we address this issue by estimating three alternative global asset pricing models: Model II, which includes an additional global factor, namely, foreign exchange rate risk, as well as Models III and IV, which consider partial market integration. In Panel A our instrument set is based on (8), while in Panel B the lagged world dividend yield in (8) is replaced with lagged

world stock market illiquidity and the U.S. term spread. Due to the large number of parameters being estimated, we focus only on the full-sample results across all 46 countries.

The first column in both panels of Table 7 present the performance of Model II. The results show that  $\lambda_w$  is significantly positive and  $\lambda_{LB}$  is significantly negative. However, while the magnitude of  $\lambda_{LB}$  is similar to that in Table 6, Model II yields a substantially lower price of world market risk (between 1.77 and 2.32). This decrease in the economic importance of the world market risk factor can be explained by the some prominence of the price of foreign exchange risk. In our tests,  $\lambda_c$  is positive and significant at the 10% level in both panels. Its magnitude is equal to 4.0 on average, which translates into a foreign exchange risk premium of about 0.9% per annum.<sup>29</sup> The J-statistic shows no signs of model misspecification.

The second column of Table 7 shows the performance of Model III, a partial integration model that consists of two global factors (the world market return and bond illiquidity), as well as country-specific variance risk. This model thus has 48 parameters to be estimated. Similar to the earlier results, both  $\lambda_w$  and  $\lambda_{LB}$  are significant with positive and negative signs, respectively. However, the magnitude of  $\lambda_w$  is again lower than that for the base case of Model I in Table 6. This decrease can be explained by the marginal significance of local equity market risks. The average  $\lambda_i$  in Panel B is significant at the 10% level. The average  $\lambda_i$  across both panels is 0.98, which implies an average risk premium (across all 46 countries) associated with local market variance risk,  $\lambda_i Var_{t-1}(r_{i,t})$ , of about 7.7% per annum. The annual premiums associated with world market risk,  $\lambda_w Cov_{t-1}(r_{i,t}, r_{w,t})$ , and bond illiquidity risk,  $\lambda_{LB} Cov_{t-1}(r_{i,t}, L_{B,t})$ , are 4.5% and 0.9% per annum, respectively. Therefore, the implied average expected excess world market return based on Model III is 13.1% per annum, which is very close in magnitude to the average annual excess world market return of 13.2%.

Finally, in column three of Table 7, we test the performance of Model IV, a four-factor partial integration model that, relative to Model III, also includes a second country-specific factor

---

<sup>29</sup> Our estimates of the price of foreign exchange risk using a currency basket are similar in sign and magnitude to the average unconditional estimates across individual currencies in Dumas and Solnik (1995), although their estimates are not significant at the 10% level.

(local stock market illiquidity) and, for the world market return equation, world market illiquidity. This model contains 95 parameters and is thus computationally the most intensive of the four models we consider. The results show that the price of world market portfolio risk remains positive and significant at the 5% level. Bond illiquidity risk retains its economic significance but loses some statistical power, becoming significant at the 10% level in both panels. None of the two local risks (variance and stock market illiquidity) is significant. Likewise, the price of world market illiquidity risk,  $\lambda_{Lw}$ , is insignificant. Importantly, the J-statistic shows that Model IV is rejected at the 1% level in Panel A and at the 5% level in Panel B. This result suggests that our methodology is sufficient to differentiate between the relative validity of various asset pricing models. Notwithstanding, even in a misspecified model bond illiquidity risk is consistently priced.

In sum, Table 7 shows that Treasury bond illiquidity risk is important not only when world market risk is taken into account but also in the presence of other global factors that have been shown in the past, albeit with various success, to have an impact on global equity returns. The table also confirms that other risks such as foreign exchange risk and local market variance risk may enhance the risk-return relation in many countries. However, we are unable to find a systematic effect of stock market illiquidity on equity returns around the world.<sup>30</sup> Finally, our modeling framework allows us to differentiate the suitability of various model specifications, which helps us to identify those models that may work best in an international setting.

## 6. Robustness Tests

### 6.1. *Alternative Interest Rate-Based Risk Factor*

The results in Tables 6 and 7 show the importance of Treasury bond illiquidity for the pricing of global equity returns in the presence of other risk factors. However, one concern with

---

<sup>30</sup> It is possible that in a fully conditional asset pricing setting, that is, when prices of risks are also allowed to vary over time, the importance of various risk factors may be greater than in our study. However, such analysis is beyond the scope of this paper.

the above tests is that they do not include other interest rate-based risk factors besides Treasury bond illiquidity. In other words, the risk factors that we control for are related to stock and foreign exchange markets but not to the bond market. This concern may become relevant if one recalls that Chen, Roll, and Ross (1986) find that the term spread is a risk factor for U.S. stock returns. We therefore test another three-factor model of full market integration, similar to our Model II, but where the currency factor is replaced with the term spread. More specifically:

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

where  $Term_t$  is the term spread at time  $t$  and  $\lambda_{Term}$  is the price of term spread risk. 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 estimations with the same two instrument sets as in Table 7.

The test results are reported in Table 8. As before, the table shows the results across all countries as well as separately for developed and emerging markets. We can see that in spite of the inclusion of the term spread, the price of bond illiquidity risk maintains its negative sign, as well as its economic and statistical significance across all country groups and instrument sets. The price of world market risk is positive and significant across all countries and for the subset of developed markets, but it loses its significance completely in emerging markets. The loss of significance of  $\lambda_w$  in emerging countries and the overall drop in its economic importance appear to be driven by the inclusion of the term spread. The price of term spread risk,  $\lambda_{Term}$ , is negative, but it is significant at the 5% level across all markets only in Panel B. This result is consistent with the sign of term spread risk in Chen, Roll, and Ross (1986).<sup>31</sup> Thus, the impact of illiquidity of U.S. Treasuries on global equity market returns survives the inclusion of an alternative Treasury bond market factor. Moreover, neither of the model specifications is rejected by the J-test.

---

<sup>31</sup> Chen, Roll, and Ross (1986) also report a negative and often significant loading on an unanticipated change in the term spread.



## 6.2. Alternative Treasury Bond Illiquidity Data

In 1996, CRSP switched its data source from the Federal Reserve Bank of New York to GovPX indicative quotes. To determine whether this switch has implications for our analysis, in this subsection we estimate Treasury bond illiquidity using GovPX intraday quotes. We start our sample in 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 off-the-run Treasury bills with up to 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 prices. 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 12-month T-bills for each month. Similar to the previous analysis, we use AR(2) residuals of the estimated series to proxy for aggregate bond illiquidity, which we winsorize as before.

Table 9 shows the estimation results of Model I (WCAPM-LB), with GovPX data for the whole sample of countries as well as for subsamples of developed and emerging markets. As before, the conditional estimates of the variances and covariances are obtained from equations (6a-c) using multivariate GARCH (1,1) model.<sup>32</sup> Due to the short sample period, we use only one instrument set that includes a constant and the lagged values of bond illiquidity and the world market return. We find that using alternative bond illiquidity data does not qualitatively change our results. The price of world market risk is positive and significant, while the price of bond illiquidity risk is negative and significant across all estimations. While the magnitude of  $\lambda_{LB}$  is different from that in Table 6 due to sample size differences, we still observe variation in pricing across country groups:  $\lambda_{LB}$  is about three times higher in emerging markets than in developed

---

<sup>32</sup> The shorter time-series sample that results from using the GovPX data makes the GARCH and GMM estimations less immune to initial value setting. Therefore, in the second-stage estimation we omit the first-stage observations until 1994 for developed markets and 1996 for emerging markets.

markets, similar to the price difference observed in earlier estimations. Thus, Treasury bond illiquidity appears to be priced in global equity markets irrespective of the data used.

## 7. 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 assets such as U.S. Treasuries gives rise to significantly priced “flight-to-liquidity” risk. We proxy for flight-to-liquidity using the percentage bid-ask spread of off-the-run U.S. Treasury bills with maturities of up to one year. Our results show that bond illiquidity has predictive power for both stock market returns and stock market illiquidity around the world. Flight-to-liquidity risk is priced in global equity markets, and it commands an economically and statistically significant premium even after controlling for other conventional factors, such as the world market return, foreign exchange rates, local stock market variance, local stock market illiquidity, and the U.S. term spread. Our results indicate that, *ceteris paribus*, the higher is the sensitivity of an asset to an increase in illiquidity in U.S. Treasuries, or equivalently, the higher is the propensity of funds to flow out of global equity markets into the U.S. Treasury market for liquidity reasons, the larger is the asset’s expected return.

## References:

- Acharya, V., and L. Pedersen, 2005, Asset pricing with liquidity risk, *Journal of Financial Economics* 77, 375-410.
- Acharya, V, Amihud, Y., and S. Bharath, 2009, Liquidity risk of corporate bond returns, NYU working paper.
- Agnew J., and P. Balduzzi, 2007, Transfer activity in 401(k) plans, Working paper, Boston College.
- Amihud, Y., and H. Mendelson, 1986, Asset pricing and the bid-ask spread, *Journal of Financial Economics* 17, 223-249.

- Amihud, Y., 2002, Illiquidity and stock returns: Cross-section and time-series effects, *Journal of Financial Markets* 5, 31–56.
- Andersen, T.G., and B. Sørensen, 1996, GMM estimation of a stochastic volatility model: A Monte Carlo study, *Journal of Business and Economic Statistics* 14, 328-352.
- Andrews, D., and J. Monahan, 1992, An improved heteroskedasticity and autocorrelation consistent covariance matrix estimator, *Econometrica* 60, 953-966.
- Ang, A., and G. Bekaert, 2002, International asset allocation with regime shifts, *Review of Financial Studies* 15, 1137-1187.
- Ang, A., and J. Chen, 2002, Asymmetric correlations of equity portfolios, *Journal of Financial Economics* 63, 443-494.
- Baele, L., G. Bekaert, and K. Inghelbrecht, 2010, The determinants of stock and bond return comovements, *Review of Financial Studies* 23, 2374-2428.
- Beber, A., M. Brandt, and K. Kavajecz, 2007, Flight-to-quality or Flight-to-liquidity? Evidence from the Euro-area bond market. *Review of Financial Studies*, forthcoming
- Bekaert, G., and C. Harvey, 1995, Time-varying world market integration, *Journal of Finance* 50, 403-444.
- Bekaert, G., E. Engstrom, and S. Grenadier, 2005, Stock and bond returns with Moody investors. Working paper, Columbia University.
- Bekaert, G., C. Harvey, and C. Lundblad, 2007, Liquidity and expected returns: Lessons from emerging markets. *Review of Financial Studies* 20, 1783-1832.
- Bekaert, G., C. Harvey, C. Lundblad, and S. Siegel, 2008, What segments equity markets? Working paper, Duke University.
- Benston, G., and R. Hagerman, 1974, Determinants of bid-ask spreads in the over-the-counter market, *Journal of Financial Economics* 1, 353-364.
- Bernanke, B., and M. Gertler, 1995, Inside the black box: The credit channel of monetary policy transmission, *Journal of Economic Perspectives* 9, 27-48.
- Bernanke, B., and K. Kuttner, 2005, What explains the stock market's reaction to Federal Reserve policy? *Journal of Finance* 60, 1221–1257.
- Breen, W., L. Glosten, and R. Jagannathan, 1989, Economic significance of predictable variations in stock index returns, *Journal of Finance* 44, 1177-1190.
- Brennan, M., and A. Subrahmanyam, 1996, Market microstructure and asset pricing: On the compensation for illiquidity in stock returns, *Journal of Financial Economics* 41, 441-464.
- Campbell, J., 1987, Stock returns and the term structure, *Journal of Financial Economics* 18, 373-399.
- Campbell, J., and J. Ammer, 1993, What moves the stock and bond markets? A variance decomposition for long-term asset returns, *Journal of Finance* 48, 3-37.
- Carrieri, F., V. Errunza, and K. Hogan, 2007, Characterizing world market integration through time, *Journal of Financial and Quantitative Analysis* 42, 915-940.

- Chan, K.C., G.A. Karolyi, and R. Stulz, 1992, Global financial markets and the risk premium on U.S. equity, *Journal of Financial Economics* 32, 137-167.
- Chen, N.-F., R. Richard, and S. Ross, 1986, Economic forces and the stock market, *Journal of Business* 59, 383-403.
- Chordia, T., R. Roll, and A. Subrahmanyam, 2001, Market liquidity and trading activity, *Journal of Finance* 56, 501-530.
- Chordia, T., A. Sarkar, and A. Subrahmanyam, 2005, An empirical analysis of stock and bond market liquidity, *Review of Financial Studies* 18, 85-129.
- Connolly, R., C. Stivers, and L. Sun, 2005, Stock market uncertainty and the stock-bond return relation, *Journal of Financial and Quantitative Analysis* 40, 161-194.
- De Santis, G., and B. Gerard, 1997, International asset pricing and portfolio diversification with time-varying risk, *Journal of Finance* 52, 1881-1912.
- Diamond, D., and P. Dybvig, 1983, Bank runs, deposit insurance, and liquidity, *Journal of Political Economy* 91, 401-419.
- Djankov, S., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer, 2008, The law and economics of self-dealing, *Journal of Financial Economics* 88, 430-465.
- Dumas, B., and B. Solnik, 1995. The world price of foreign exchange risk, *Journal of Finance* 50, 445-479.
- Engle, R., 2002, Dynamic conditional correlation - a simple class of multivariate GARCH models, *Journal of Business and Economic Statistics* 20, 339-350.
- Engle, R., and K. Kroner, 1995, Multivariate simultaneous generalized ARCH. *Econometric Theory* 11, 122-150.
- Ericson, J., and O. Renault, 2006, Liquidity and credit risk, *Journal of Finance* 61, 2219-2250.
- Errunza, V., and E. Losq, 1985, International asset pricing under mild segmentation: Theory and test, *Journal of Finance* 40, 105-124.
- Fama, E., and G.W. Schwert, 1977, Asset returns and inflation, *Journal of Financial Economics* 5, 115-146.
- Fama, E., and K.R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3-56.
- Fama, E., and K.R. French, 1998, 1998, Value versus growth: The international evidence, *Journal of Finance* 53, 1975-1999.
- Ferson W., and S. Foerster, 1994, Finite sample properties of the generalized method of Moments in tests of conditional asset pricing models, *Journal of Financial Economics* 36, 29-55.
- Ferson, W. and C.R. Harvey, 1993, The risk and predictability of international equity returns, *Review of Financial Studies* 6, 527-566.
- Ferson, W., S. Sarkissian, and T. Simin, 2003, Spurious regressions in financial economics? *Journal of Finance* 58, 1393-1413.

- Fleming, J., Kirby, C., Ostdiek, B., 1998, Information and volatility linkages in the stock, bond and money markets, *Journal of Financial Economics* 49, 111-137.
- Fogler, H., J. Kose, and J. Tipton, 1981, Three factors, interest rate differentials and stock groups, *Journal of Finance* 36, 323-335.
- Goetzmann, W.N., and M. Massa, 2002, Daily momentum and contrarian behavior of index fund investors, *Journal of Financial and Quantitative Analysis* 37, 375-389.
- Goyenko, R., 2006, Stock and bond pricing with liquidity Risk. Working paper, McGill University.
- Goyenko, R., C. Holden, and C. Trzcinka, 2009, Do liquidity measures measure liquidity?, *Journal of Financial Economics* 92, 153-181.
- Goyenko, R., and A. Ukhov, 2009, Stock and bond market liquidity: A long-run empirical analysis, *Journal of Financial and Quantitative Analysis* 44, 189-212.
- Goyenko, R., A. Subrahmanyam, and A. Ukhov, 2009, The term structure of bond market liquidity, *Journal of Financial and Quantitative Analysis*, forthcoming.
- Griffin, J., 2002, Are the Fama French factors global or country specific, *Review of Financial Studies* 15, 1121-1152.
- Hameed, A., W. Kang, and S. Viswanathan, 2010, Stock market declines and liquidity, *Journal of Finance* 65, 257-293.
- Harvey, C., 1991. The world price of covariance risk, *Journal of Finance* 46, 111-157.
- Hasbrouck, J., 2009, Trading costs and returns for US equities: Estimating effective costs from daily data, *Journal of Finance* 64, 1445-1477.
- Ho, T., and H. Stoll, 1983, The dynamics of dealer markets under competition, *Journal of Finance* 38, 1053-1074.
- Karolyi, G.A., and R. Stulz, 1996, Why do markets move together? An investigation of U.S.-Japan stock return comovements, *Journal of Finance* 51, 951-986.
- Lee, K-H., 2006, The world price of liquidity risk, Working paper, Rutgers University.
- Lesmond, D., J. Ogden, and C. Trzcinka, 1999, A new estimate of transactions costs. *Review of Financial Studies* 12, 1113-1141.
- Li, L., 2002, Macroeconomic factors and the correlation of stock and bond returns. Working paper, Yale University.
- Long, J., 1974, Stock prices, inflation and the term structure of interest rates, *Journal of Financial Economics* 1, 131-170.
- Longin, F., and B. Solnik, 1995, Is the correlation in international equity returns constant: 1960-1990?, *Journal of International Money and Finance*, 14, 1, 3-26.
- Longin, F. and B. Solnik, 2001, Extreme correlation of international equity markets, *Journal of Finance* 56, 651-678.
- Longstaff, F., 2004, The flight-to-liquidity premium in U.S. Treasury bond prices, *Journal of Business* 77, 511-526.

- Merton, R., 1973, An intertemporal capital asset pricing model. *Econometrica* 41, 867-887.
- O'Hara, M., and G. Oldfield, 1986, The microeconomics of market making, *Journal of Financial and Quantitative Analysis* 21, 361-376.
- Pastor, L., and R. Stambaugh, 2003, Liquidity risk and expected stock returns, *Journal of Political Economy* 111, 642-685.
- Patelis, A., 1997. Stock return predictability and the role of monetary policy, *Journal of Finance* 52, 1951-1972.
- Sarkissian, S., and M. Schill, 2004, The overseas listing decision: New evidence of proximity preference, *Review of Financial Studies* 17, 769-809.
- Scruggs, J., 1998, Resolving the puzzling intertemporal relation between the market risk premium and conditional market variance: A two-factor approach, *Journal of Finance* 53, 575-603.
- Scruggs, J., and P. Glabadanidis, 2003, Risk premia and the dynamic covariance between stock and bond returns, *Journal of Financial and Quantitative Analysis* 38, 295-316.
- Shiller, R., and A. Beltratti, 1992, Stock-prices and bond yields – can their comovements be explained in terms of present value models, *Journal of Monetary Economics* 30, 25-46.
- Stone, B., 1974. Systematic interest-rate risk in a two-index model of returns, *Journal of Financial and Quantitative Analysis* 9, 709-721.
- Sweeny, R. and Warga, A., 1986, The pricing of interest rate risk: Evidence from the stock Market, *Journal of Finance* 41, 393-410.
- Thorbecke, W., 1997, On stock market returns and monetary policy, *Journal of Finance* 52, 635-654.

**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 for 23 developed and 23 emerging countries (top and bottom halves of the table). The sample period is 1977:01-2006:12. 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 value-weighted average proportion of zero daily returns in a month for each market.

Country	Obs	Market return			Dividend yield			Market illiquidity		
		Mean	$\sigma$	$\rho$	Mean	$\sigma$	$\rho$	Mean	$\sigma$	$\rho$
Australia	360	0.009	0.070	-0.002	0.334	0.077	0.948	0.252	0.092	0.756
Austria	360	0.008	0.062	0.213***	0.153	0.037	0.961	0.546	0.223	0.927
Belgium	360	0.008	0.055	0.081	0.315	0.124	0.988	0.311	0.100	0.715
Canada	360	0.006	0.052	0.039	0.256	0.091	0.985	0.205	0.093	0.851
Denmark	360	0.009	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	0.010	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	0.012	0.103	0.082*	0.314	0.108	0.945	0.304	0.110	0.649
Ireland	360	0.012	0.070	0.104**	0.346	0.186	0.986	0.570	0.226	0.895
Italy	360	0.009	0.075	0.069	0.217	0.069	0.969	0.126	0.068	0.423
Japan	360	0.005	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	0.007	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	0.008	0.051	0.097*	0.178	0.058	0.988	0.308	0.098	0.744
United Kingdom	360	0.009	0.065	0.092*	0.362	0.104	0.961	0.493	0.229	0.974
United States	360	0.006	0.044	0.012	0.267	0.121	0.994	0.086	0.047	0.965
Argentina	360	0.025	0.235	0.057	0.183	0.151	0.850	0.283	0.166	0.761
Brazil	360	0.017	0.152	0.027	0.321	0.228	0.871	0.527	0.285	0.913
Chile	360	0.016	0.097	0.203***	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	0.009	0.080	0.127*	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	0.016	0.113	0.259***	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	0.011	0.042	0.081	0.240	0.088	0.993	0.194	0.037	0.774

**Table 2****Determinants of stock market and Treasury bond illiquidity**

This table shows the relation between U.S. Treasury bond illiquidity and illiquidity of the world and local stock markets. The sample has 46 countries and covers a period from 1977:01 to 2006:12. Panels A and B present the results from the regression of world and local stock market illiquidity, respectively, on the lagged value of Treasury bond illiquidity and other global and local predictors. Panel C presents the results from the regression of Treasury bond illiquidity on the lagged value of world market illiquidity and other global predictors. Treasury bond illiquidity,  $L_B$ , is off-the-run illiquidity of Treasury bills computed from the quoted spreads available at CRSP daily Treasury files. The variables  $L_w$ ,  $r_w$ , and  $\sigma_w$  denote the world measures of stock market illiquidity, excess equity return, and volatility, respectively. The variables  $L_i$ ,  $r_i$ , and  $\sigma_i$  denote the local measures of stock market illiquidity, excess equity return, and volatility, respectively. For each market and month, illiquidity is based on the value-weighted average proportion of zero returns of all firms in a given market and month. World stock market illiquidity is the value-weighted average of countries' illiquidity. Monthly stock market volatility for each market in a given month is computed as standard deviation of daily returns in that market and month. Daily return data are from Datastream and IFC. The variables FED, TERM, MMF, and CCI denote the U.S.-based measures: change in the federal funds rate, term spread, percentage change in the amount of funds held in money market mutual funds, and change in the consumer confidence index, respectively. The term spread is the difference in yields between the 10-year U.S. Treasury note and the one-month T-bill. The data on the amount of funds held in money market mutual funds are from the Federal Reserve Board. The consumer confidence index, which is divided by 100, is from the Conference Board. The two lags of the dependent variable are included in each regression, but their coefficients are not reported. The robust t-statistics are shown in parentheses. The estimation of  $L_w$  in Panel A and  $L_B$  in Panel C are performed with the Newey-West correction for six lags of the standard error. The estimation of  $L_i$  in Panel B is performed with the Arellano-Bover/Blundell-Bond estimator and accounts for unobserved country and time effects. Significance at the 10%, 5% and 1% levels is denoted by \*, \*\*, and \*\*\*, respectively.

Panel A: Dependent variable: World stock market illiquidity

	(1)	(2)	(3)	(4)	(5)
Constant	0.032*** (4.04)	0.024** (2.30)	0.020* (1.84)	0.023** (2.17)	0.019* (1.78)
$L_{B,t-1}$	0.119** (2.15)	0.123** (2.18)	0.160** (2.31)	0.109* (1.65)	0.161** (2.31)
$r_{w,t-1}$		-0.001 (-0.01)	0.004 (0.14)	0.001 (0.04)	0.003 (0.11)
$\sigma_{w,t-1}$		0.606 (1.42)	0.675* (1.68)	0.711* (1.74)	0.734* (1.89)
FED <sub>t-1</sub>			0.254* (1.71)		0.336 (1.60)
TERM <sub>t-1</sub>			0.018 (1.50)		0.017 (1.40)
MMF <sub>t-1</sub>				0.020 (0.77)	
CCI <sub>t-1</sub>				0.025 (1.13)	0.015 (0.70)



**Table 2 (continued)**

Panel B: Dependent variable: Local stock market illiquidity

	(1)	(2)	(3)	(4)	(5)
Constant	0.078*** (5.64)	0.094*** (4.81)	0.096*** (5.09)	0.092*** (4.70)	0.095*** (5.07)
$L_{B,t-1}$	0.674*** (4.16)	0.661*** (3.58)	0.598*** (3.20)	0.678*** (3.57)	0.625*** (3.28)
$r_{i,t-1}$		0.012 (0.76)	0.014 (0.88)	0.009 (0.60)	0.011 (0.69)
$\sigma_{i,t-1}$		0.396* (1.79)	0.406* (1.83)	0.468** (2.09)	0.476** (2.14)
$FED_{t-1}$			0.272* (1.87)		0.185 (1.22)
$TERM_{t-1}$			-0.016 (-0.85)		-0.025 (-1.31)
$MMF_{t-1}$				0.032 (0.91)	
$CCI_{t-1}$				0.063*** (4.59)	0.062*** (4.49)
Country Effects	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes

Panel C: Dependent variable: Treasury bond market illiquidity

	(1)	(2)	(3)	(4)	(5)
Constant	<-0.001 (-0.27)	0.001* (1.83)	0.001 (1.57)	0.001* (1.73)	0.001 (1.48)
$L_{w,t-1}$	0.001 (0.89)	-0.002 (-0.84)	-0.001 (-0.57)	-0.003 (-1.02)	-0.001 (-0.48)
$r_{w,t-1}$		-0.001 (-0.24)	<0.001 (0.12)	-0.001 (-0.09)	<0.001 (0.02)
$\sigma_{w,t-1}$		-0.105** (-2.70)	-0.080* (-1.94)	-0.040** (-2.22)	-0.063* (-1.70)
$FED_{t-1}$			0.072* (1.82)		0.065* (1.66)
$TERM_{t-1}$			-0.001 (-0.57)		-0.001 (-0.76)
$MMF_{t-1}$				0.018 (1.17)	
$CCI_{t-1}$				0.005* (1.79)	0.004 (1.47)

**Table 3****Predictive regressions of country equity returns**

This table presents the output of predictive regressions of country excess equity returns ( $r_i$ ) on the lagged Treasury bond illiquidity shocks,  $L_B$ , as well as other lagged instruments.  $L_w$  and  $L_i$  are the world and country-level stock market illiquidity shocks, respectively. For each market and month, illiquidity is based on the value-weighted average proportion of zero returns of all firms in a given market and month. World stock market illiquidity is the value-weighted average of countries' illiquidity. Illiquidity shocks are the AR(2) residuals of the corresponding series.  $DY_w$  and  $DY_i$  are the world market and local country dividend yields, respectively. TERM is the U.S. term spread. JanD is the January dummy. Regressions in Panel B include country and year fixed effects but their coefficients are not reported. Stock market illiquidity and bond illiquidity shocks are winsorized at 1% and 99%. The t-statistics in Panel A are based on the Newey-West standard errors with six lags, while in Panel B on standard errors clustered by time. 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: Dependent variable: World stock market return

	Full sample period			Sub-periods		
	(1)	(2)	(3)	1977-1986	1987-1996	1997-2006
Constant	0.005** (2.26)	0.015 (1.18)	0.008 (0.54)	0.048 (1.57)	-0.040 (-1.20)	-0.103** (-2.74)
$L_{B,t-1}$	-3.054*** (-4.24)	-3.082*** (-4.24)	-3.091*** (-4.15)	-2.593*** (-3.10)	-8.678*** (-3.84)	-19.949* (-1.94)
$r_{w,t-1}$		0.030 (0.56)	0.028 (0.53)	0.003 (0.03)	-0.016 (-0.16)	0.069 (1.06)
$L_{w,t-1}$		-0.049 (-0.83)	-0.070 (-1.19)	-0.363* (-1.87)	-0.094 (-0.68)	0.159 (1.28)
$DY_{w,t-1}$			0.003 (1.46)	0.007 (0.84)	0.031* (1.71)	0.043*** (3.17)
$TERM_{t-1}$			0.022 (1.12)	0.033 (1.32)	-0.032 (-0.55)	-0.050 (-1.26)
JanD	0.001 (0.17)	0.003 (0.41)	0.004 (0.52)	0.006 (0.48)	0.016 (1.16)	0.005 (0.40)

**Table 3 (continued)**

Panel B: Dependent variable: Local stock market returns

	Full sample period			Sub-periods		
	(1)	(2)	(3)	1977-1986	1987-1996	1997-2006
Constant	0.028* (1.74)	0.044*** (2.71)	0.028 (1.60)	0.014 (0.60)	0.075** (2.54)	0.017 (0.51)
$L_{B,t-1}$	-3.997*** (-2.88)	-3.697*** (-2.63)	-3.725*** (-2.77)	-2.484* (-1.80)	-8.267** (-2.47)	-17.515 (-1.53)
$r_{i,t-1}$		0.016 (0.61)	0.020 (0.73)	-0.003 (-0.08)	-0.003 (-0.06)	0.028 (0.78)
$L_{i,t-1}$		-0.004 (-0.42)	-0.006 (-0.64)	-0.046** (-2.90)	-0.027 (0.95)	-0.005 (-0.28)
$DY_{i,t-1}$			0.314*** (2.69)	0.007*** (3.26)	0.003 (1.13)	0.006*** (2.92)
$TERM_{t-1}$			-0.041 (-0.81)	0.019 (0.38)	-0.199** (-2.20)	-0.008 (-0.07)
JanD	0.012 (1.43)	0.009 (1.14)	0.009 (1.13)	0.005 (0.60)	0.018 (0.96)	0.012 (0.83)
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes

Panel C: Developed and Emerging markets sub-samples

	Developed markets			Emerging markets		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.009 (1.38)	0.021** (2.34)	0.016 (1.05)	0.052** (2.40)	0.029 (1.08)	0.035 (1.13)
$L_{B,t-1}$	-3.191*** (-2.33)	-3.233** (-2.39)	-3.255** (-2.47)	-13.580*** (-2.64)	-14.132** (-2.02)	-13.798** (-1.97)
$r_{i,t-1}$		-0.001 (-0.01)	0.007 (0.26)		0.011 (0.30)	0.012 (0.34)
$L_{i,t-1}$		-0.015*** (-2.75)	-0.017*** (-2.98)		0.006 (0.35)	0.003 (0.17)
$DY_{i,t-1}$			0.004*** (3.02)			0.003 (1.62)
$TERM_{t-1}$			-0.022 (-0.49)			-0.093 (-0.87)
JanD	0.004 (0.72)	0.005 (0.89)	0.005 (0.83)	0.025* (1.67)	0.020 (1.25)	0.020 (1.28)
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Effects	Yes	Yes	Yes	Yes	Yes	Yes

**Table 4****Summary of macroeconomic and financial variables**

This table shows the averages of several country-level financial and macroeconomic 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 listings from a given country placed on foreign exchanges at the end of 1998 from Sarkissian and Schill (2004). SEG and RATE are the market segmentation proxy and short-term interest rate, respectively. SEG is computed, following Bekaert, et al. (2008), as the average absolute difference between the country's inverse price-to-earning ratio and that of the world market. The monthly price-to-earning ratios and interest rates are from Datastream. 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. (2008).

**Table 4 (continued)**

Country	CORR	SIZE	LISTINGS	SEG	RATE	FREEDOM	LAW
Argentina	0.07	0.58	19	8.73	16.5	66.3	0.34
Australia	0.58	1.02	96	1.45	7.9	76.7	0.76
Austria	0.38	0.16	12	1.84	4.2	70.0	0.21
Belgium	0.61	0.67	27	2.26	4.9	69.3	0.54
Brazil	0.26	0.38	27	6.29	24.4	55.8	0.27
Canada	0.72	1.06	266	1.52	7.2	73.2	0.64
Chile	0.20	0.89	22	5.08	0.7	76.0	0.63
China	0.16	0.43	15	1.41	6.1	52.6	0.76
Colombia	0.18	0.14	4	4.69	7.1	62.2	0.57
Czech Republic	0.39	0.20	5	3.93	7.5	69.6	0.33
Denmark	0.52	0.58	9	2.01	5.9	71.6	0.46
Finland	0.59	1.77	12	3.33	4.2	70.8	0.46
France	0.67	0.89	69	2.16	5.5	63.1	0.38
Germany	0.65	0.54	112	1.36	4.4	68.6	0.28
Greece	0.31	0.91	9	2.48	8.2	57.9	0.22
Hong Kong	0.49	3.61	19	2.65	5.1	90.1	0.96
Hungary	0.53	0.24	11	2.30	13.6	62.4	0.58
India	0.16	0.33	65	1.80	6.8	49.1	0.58
Indonesia	0.35	0.24	7	5.05	15.4	54.8	0.65
Ireland	0.62	0.67	72	3.51	7.1	76.6	0.79
Israel	0.48	0.53	65	2.69	9.2	63.9	0.73
Italy	0.49	0.52	27	1.06	5.2	64.6	0.42
Japan	0.71	0.69	206	3.27	2.2	70.6	0.50
Jordan	0.11	0.77	1	2.63	4.7	64.0	0.16
Korea	0.39	0.54	29	1.84	9.2	69.5	0.47
Malaysia	0.41	1.48	7	1.83	4.6	64.3	0.95
Mexico	0.37	0.21	30	4.09	26.2	61.4	0.17
Netherlands	0.78	1.31	105	3.09	3.2	73.3	0.20
New Zealand	0.53	0.40	22	2.31	9.9	81.0	0.95
Norway	0.59	0.39	19	4.42	7.6	67.4	0.42
Pakistan	0.12	0.14	0	4.61	9.2	55.9	0.41
Philippines	0.39	0.48	7	2.33	12.2	58.7	0.22
Poland	0.50	0.16	8	4.15	16.0	60.3	0.29
Portugal	0.54	0.46	7	1.77	4.4	65.0	0.44
Russia	0.54	0.33	6	7.45	31.0	49.9	0.44
Singapore	0.59	1.64	5	2.09	3.0	88.4	1.00
South Africa	0.60	1.55	88	2.91	13.0	62.8	0.81
Spain	0.73	0.79	24	2.34	5.6	66.4	0.37
Sweden	0.69	1.12	47	1.57	4.7	69.0	0.33
Switzerland	0.69	2.49	28	1.79	3.4	77.8	0.27
Taiwan	0.36	1.01	27	1.58	4.4	72.5	0.56
Thailand	0.36	0.44	3	6.28	7.4	67.8	0.81
Turkey	0.29	0.35	7	4.02	64.9	58.8	0.43
United Kingdom	0.70	1.57	176	2.30	8.9	78.4	0.95
United States	0.83	1.42	436	1.10	5.9	78.3	0.65
Venezuela	0.09	0.05	4	5.47	10.5	50.3	0.09
Average	0.46	0.79	49.17	3.11	9.77	66.89	0.51

**Table 5****Relation between Treasury bond illiquidity betas and macroeconomic and financial factors**

This table shows the results of regression of countries' average conditional Treasury 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 listings from a given country placed on foreign exchanges at the end of 1998 from Sarkissian and Schill (2004). SEG and RATE are the market segmentation proxy and short-term interest rate, respectively. SEG is computed, following Bekaert, et al. (2008), as the average absolute difference between the country's inverse price-to-earning ratio and that of the world market. The monthly price-to-earning ratios and interest rates are from Datastream. 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. (2008). D(Emerging) is the emerging market dummy. The number of foreign listings and the short rate are taken with logs. The table also reports the adjusted R-squared for each regression. The t-statistics are shown in parenthesis. Significance at the 10%, 5% and 1% levels is denoted by \*, \*\*, and \*\*\*, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-23.33*** (-4.16)	-30.517*** (-5.32)	1.718 (0.27)	-58.993*** (-3.67)	-36.254 (-1.53)	-23.301 (-0.88)
CORR	24.550** (2.21)	-5.456 (-0.39)			-15.891 (-1.05)	-25.481 (-1.45)
SIZE		5.705* (1.68)			3.192 (0.78)	3.259 (0.80)
LISTINGS		5.381*** (2.58)			5.340*** (2.57)	5.383*** (2.59)
SEG			-8.431* (-1.77)		-1.397 (-0.98)	-1.082 (-0.75)
RATE			-5.631 (-1.49)		-1.964 (-0.58)	-1.304 (-0.38)
FREEDOM				0.780*** (2.97)	0.411 (1.16)	0.280 (0.74)
LAW				-10.161 (-1.01)	-13.000 (-1.35)	-9.910 (-0.99)
D(Emerging)						-7.514 (-1.07)
Adj R <sup>2</sup>	0.100	0.220	0.077	0.134	0.244	0.247

**Table 6****Tests of the World CAPM with the world market return and Treasury bond illiquidity factors**

This table shows the estimation results of the global asset pricing model with the world market portfolios return and Treasury bond illiquidity factors (Model I, WCAPM-LB) for various instruments sets. The sample period is 1977:01(1987:01)-2006:12 for developed (emerging) markets.  $\lambda_w$  is the price of world market risk and  $\lambda_{LB}$  is the price of bond illiquidity risk. The estimates of conditional variances and covariances are from the multivariate GARCH (1,1) model based on equations (6a-c). The instrument set consists of a constant, C, and the lagged values of the AR(2) residual of bond illiquidity,  $L_B$ , the world market return,  $r_w$ , and the world dividend yield,  $DY_w$ . The robust t-statistics are shown in parenthesis. The table also shows the degrees of freedom and J-statistic with its corresponding p-value (in squared brackets). Significance at the 10%, 5% and 1% levels is denoted by \*, \*\*, and \*\*\*, respectively.

Panel A: Instrument set - {C,  $L_B$ ,  $r_w$ }

	All countries	Developed	Emerging
$\lambda_w$	4.031*** (3.83)	3.213*** (2.66)	3.682** (2.54)
$\lambda_{LB}$	-1.126*** (-2.83)	-1.367*** (-3.02)	-3.321* (-1.69)
df	139	70	70
J-stat	116.85	76.947	55.917
p-value	[0.913]	[0.266]	[0.889]

Panel B: Instrument set - {C,  $L_B$ ,  $r_w$ ,  $DY_w$ }

	All countries	Developed	Emerging
$\lambda_w$	4.026*** (4.93)	3.780*** (3.92)	3.078** (2.42)
$\lambda_{LB}$	-1.358*** (-4.32)	-1.632*** (-4.59)	-4.049** (-2.08)
df	186	94	94
J-stat	165.67	105.64	78.66
p-value	[0.855]	[0.194]	[0.872]

**Table 7****Tests of alternative global asset pricing models**

This table shows the estimation results of three global asset pricing models. The sample period is 1977:01(1987:01)-2006:12 for developed (emerging) markets.  $\lambda_w$ ,  $\lambda_{Lw}$ ,  $\lambda_{LB}$ , and  $\lambda_c$  are the prices of world market risk, world market illiquidity risk, Treasury bond illiquidity risk, and currency risk, respectively. Ave  $\lambda_i$  and Ave  $\lambda_{Li}$  are the average prices of local market variance risk and local market illiquidity risk, respectively, both across 46 countries. The return on the currency basket deposit is calculated as the equally weighted average change in exchange rates between the U.S. dollar and four global currencies: the British Pound, Euro, Japanese Yen, and Swiss Franc. The instrument set consists of a constant, C, and the lagged values of AR(2) residual of bond illiquidity,  $L_B$ , world market return,  $r_w$ , world dividend yield,  $DY_w$ , AR(2) residual of global stock market illiquidity,  $L_w$ , and the U.S. term spread, TERM. The robust t-statistics are shown in parenthesis. The table also shows the degrees of freedom and J-statistic with its corresponding p-value (in squared brackets). Significance at the 10%, 5% and 1% levels is denoted by \*, \*\*, and \*\*\*, respectively.

Panel A: Instrument set - {C,  $L_B$ ,  $r_w$ ,  $DY_w$ }

	Model II	Model III	Model IV
$\lambda_w$	1.769** (2.08)	3.721*** (3.61)	3.499** (2.46)
$\lambda_{LB}$	-1.051*** (-3.39)	-1.636*** (-4.47)	-1.240* (-1.70)
$\lambda_c$	3.948* (1.86)		
$\lambda_{Lw}$			-0.020 (-0.07)
Ave $\lambda_i$		0.567 (0.91)	-0.299 (-0.05)
Ave $\lambda_{Li}$			0.623 (0.55)
df	185	140	93
J-stat	156.48	130.97	142.15***
p-value	[0.937]	[0.695]	[0.001]

Panel B: Instrument set - {C,  $L_B$ ,  $r_w$ ,  $L_w$ , TERM}

	(1)	(2)	(3)
$\lambda_w$	2.315*** (2.81)	2.096* (1.93)	2.819** (2.00)
$\lambda_{LB}$	-1.137*** (-5.14)	-1.736*** (-4.08)	-1.480* (-1.74)
$\lambda_c$	4.027* (1.95)		
$\lambda_{Lw}$			0.285 (0.66)
Ave $\lambda_i$		1.122* (1.89)	2.739 (0.32)
Ave $\lambda_{Li}$			-0.785 (-0.51)
df	232	187	140
J-stat	204.31	173.96	167.84*
p-value	[0.905]	[0.743]	[0.054]



**Table 8****Global asset pricing model with the world market return, Treasury bond illiquidity, and term spread factors**

This table shows the estimation results of an asset pricing model with three global factors and various instrument sets. The sample period is 1977:01(1987:01)-2006:12 for developed (emerging) markets. Here,  $\lambda_w$ ,  $\lambda_{LB}$ , and  $\lambda_{Term}$  are the prices of world market risk, Treasury bond illiquidity risk, and term spread risk, respectively. The estimates of conditional variances and covariances are from the multivariate GARCH (1,1) model using equations (6a-c) and the AR(1) equation for the U.S. term spread,  $TERM_t = \phi_0 + \phi_1 TERM_{t-1} + e_{TERM,t}$ . The instrument set consists of a constant, C, and the lagged values of AR(2) residual of bond illiquidity,  $L_B$ , world market return,  $r_w$ , and world dividend yield,  $DY_w$ . The robust t-statistics are shown in parenthesis. The table also shows the degrees of freedom and J-statistic with its corresponding p-value (in squared brackets). Significance at the 10%, 5% and 1% levels is denoted by \*, \*\*, and \*\*\*, respectively.

Panel A: Instrument set - {C,  $L_B$ ,  $r_w$ }

	All countries	Developed	Emerging
$\lambda_w$	1.585** (2.33)	2.211** (2.55)	1.083 (0.80)
$\lambda_{LB}$	-1.549*** (-3.01)	-1.425** (-2.50)	-2.078** (-2.29)
$\lambda_{Term}$	-6.364 (-1.61)	-3.494 (-0.78)	-8.675 (-0.65)
df	138	69	69
J-stat	126.54	68.44	64.52
p-value	[0.748]	[0.496]	[0.630]

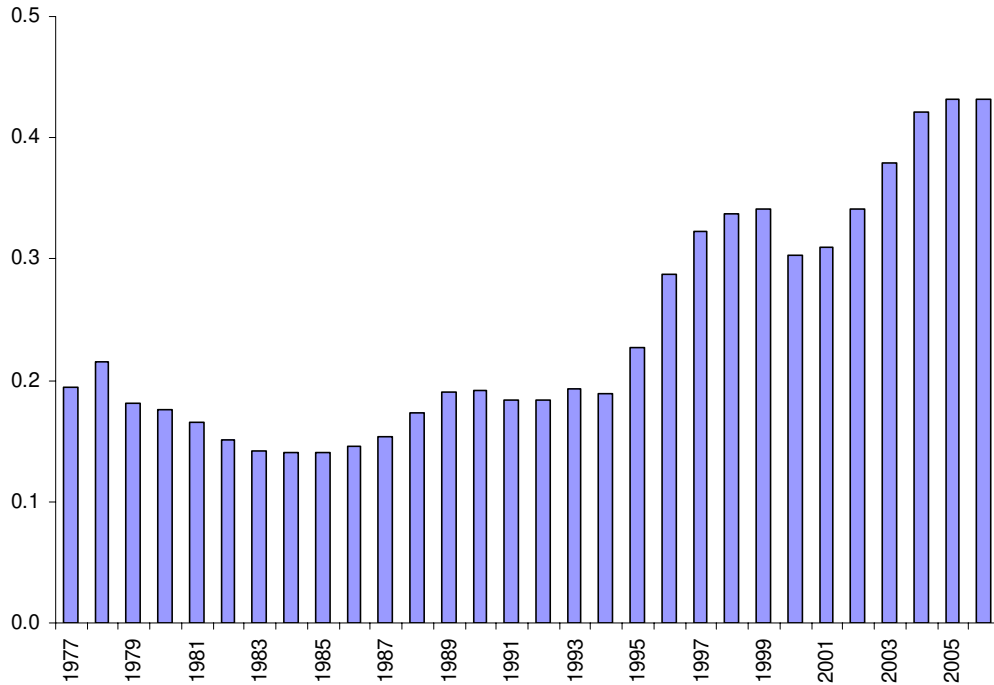
Panel B: Instrument set - {C,  $L_B$ ,  $r_w$ ,  $DY_w$ }

	All countries	Developed	Emerging
$\lambda_w$	1.553*** (2.72)	1.832** (2.50)	1.025 (0.86)
$\lambda_{LB}$	-1.958*** (-4.41)	-1.747*** (-3.55)	-2.606* (-1.72)
$\lambda_{Term}$	-7.710*** (-2.72)	-5.334* (-1.71)	-11.032 (-1.05)
df	185	93	93
J-stat	159.29	89.71	92.39
p-value	[0.915]	[0.577]	[0.498]

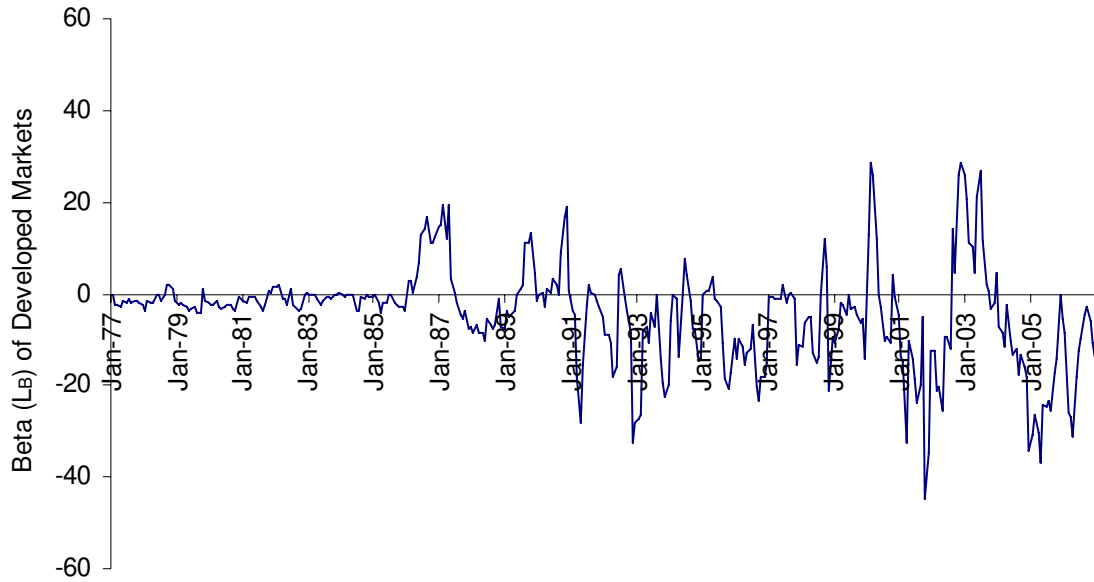
**Table 9****Tests of the WCAPM-LB with Treasury bond illiquidity based on the GovPX data**

This table shows the estimation results of the two-factor global asset pricing model (WCAPM-LB) with the world market and Treasury bond illiquidity risk using GovPX data. The sample period is 1994:01-2006:12 for developed markets and 1996:01-2006:12 for emerging.  $\lambda_w$  is the price of world market risk, and  $\lambda_{LB(GovPX)}$  is the price of Treasury bond illiquidity risk. The estimates of conditional variances and covariances are from the multivariate GARCH (1,1) using equations (6a-c). The instrument set consists of a constant, C, and the lagged values of AR(2) residual of bond illiquidity,  $L_B$ , and world market return,  $r_w$ . The robust t-statistics are shown in parenthesis. The table also shows the degrees of freedom and J-statistic with its corresponding p-value (in squared brackets). Significance at the 10%, 5% and 1% levels is denoted by \*, \*\*, and \*\*\*, respectively.

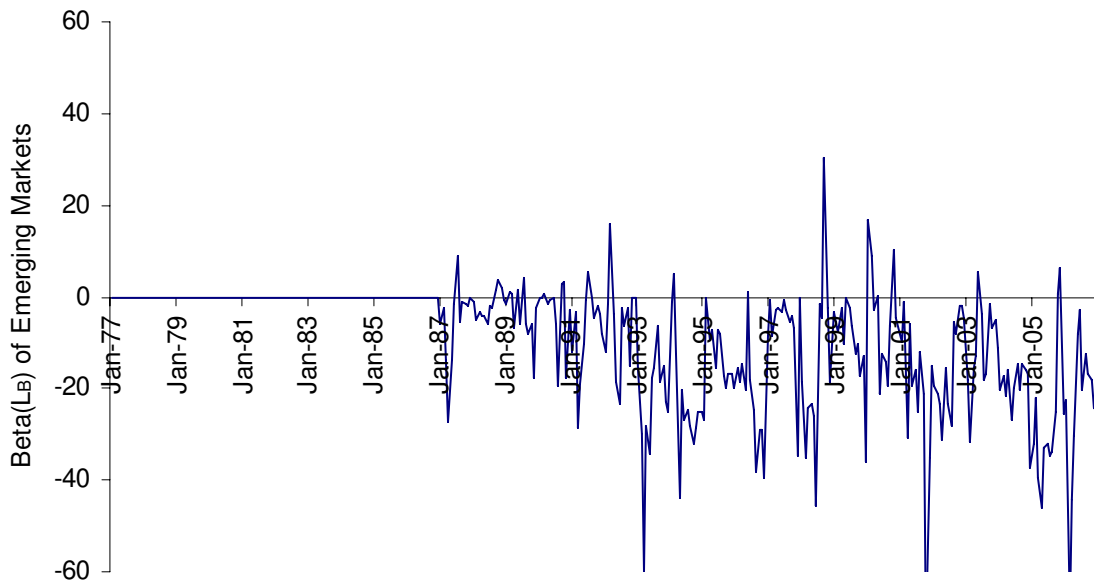
	All countries	Developed	Emerging
$\lambda_w$	2.457*** (5.98)	3.227*** (3.38)	3.309** (2.52)
$\lambda_{LB(GovPX)}$	-0.404*** (-4.52)	-0.377** (-2.00)	-1.193*** (-3.64)
df	139	70	70
J-stat	127.38	72.95	64.94
p-value	[0.750]	[0.381]	[0.681]



**Figure 1. Proportion of US debt held by foreigners.** The figure shows the proportion of all U.S. Federal debt held by foreign and international investors. The source is the Federal Reserve System, Treasury Bulletin.

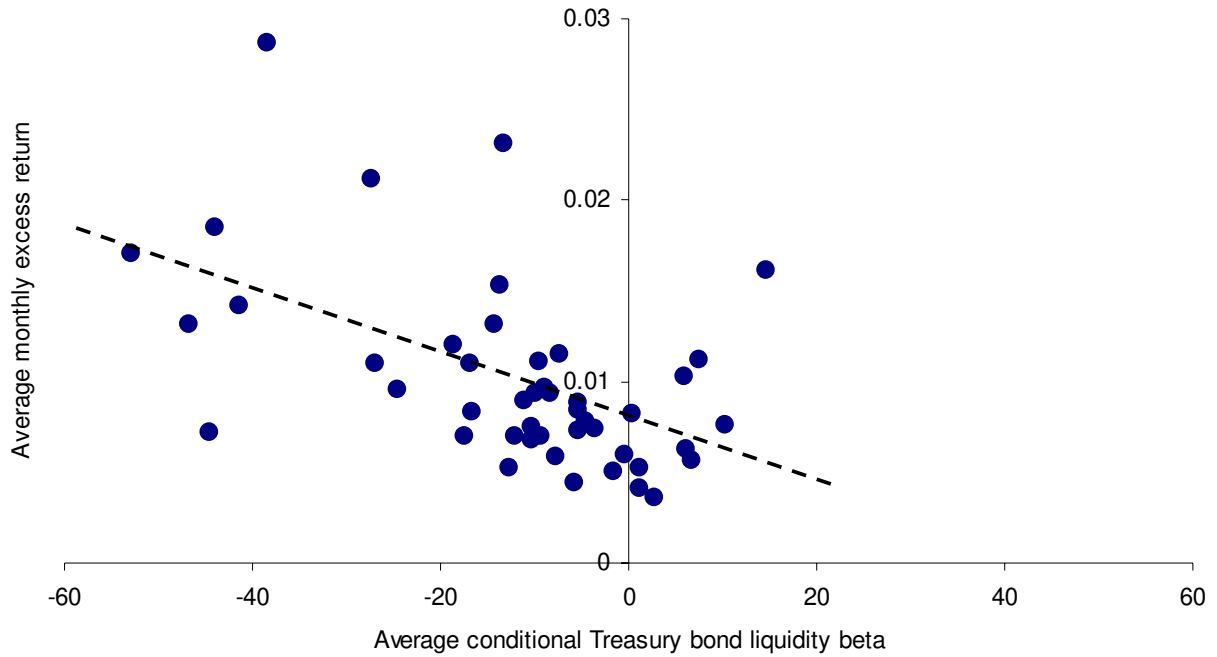


A



B

**Figure 2. Conditional Treasury bond illiquidity beta.** The figure shows average conditional Treasury bond illiquidity betas for 23 developed markets (Plot A) and 23 emerging markets (Plot B). The sample period is 1977:01(1987:01)-2006:12 for developed (emerging) markets. The conditional beta in each market is the ratio of the conditional covariance of country's excess returns with bond illiquidity risk over the conditional variance of bond illiquidity.



**Figure 3. Country equity returns and Treasury bond illiquidity betas.** The plot shows the relation between the mean country excess equity returns and their respective average conditional Treasury bond illiquidity betas. The sample period is 1977:01(1987:01)-2006:12 for developed (emerging) markets. The conditional beta in each market is the ratio of conditional covariance of country’s excess returns with bond illiquidity risk over conditional variance of bond illiquidity. Each conditional beta is averaged over the respective sample period. The regression line is shown with a dashed line.