

The World Price of Liquidity Risk

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Abstract

This paper specifies and tests an equilibrium asset pricing model with liquidity risk at the global level. The analysis encompasses 25,000 individual stocks from 48 developed and emerging countries around the world from 1988 to 2004. Though we cannot find evidence that the liquidity-adjusted capital asset pricing model of Acharya and Pedersen (2005) holds in international financial markets, cross-sectional as well as time-series tests show that liquidity risks arising from the covariances of individual stocks' return and liquidity with local and global market factors are priced. Furthermore, we show that the US market is an important driving force of world-market liquidity risk. We interpret our evidence as consistent with an intertemporal capital asset pricing model (Merton (1973)) in which stochastic shocks to global liquidity serve as a priced state variable.

1 Introduction

In classical asset pricing models, perfect financial markets without frictions, especially no trading costs, are assumed and thus the diverse features of liquidity are ignored.¹ However, considering liquidity in investment is important since liquidity affects portfolio investment performance (Holthausen, Leftwich, and Mayers (1991), Keim (2003), Lesmond, Schill, and Zhou (2004), Korajczyk and Sadka (2005)) and it has a significant implication for portfolio diversification strategies (Domowitz and Wang (2002), Harford and Kaul (2004)). In addition, it has been shown that liquidity affects the cross-sectional differences of asset returns as a characteristic (Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), Amihud (2002)) or as a risk factor (Pastor and Stambaugh (2003), Sadka (2004), Acharya and Pedersen (2005)).

To date, the potential importance of liquidity for international asset pricing has not been explored systematically. We seek to remedy this situation by investigating an equilibrium asset pricing relationship with liquidity both as a characteristic and as a risk factor in international financial markets using 25,000 stocks from 48 countries from January 1988 to December 2004. To our knowledge, this is the first paper that assesses multiple forms of liquidity risks as well as market risk similar to Acharya and Pedersen (2005)'s liquidity-adjusted capital asset pricing model (LCAPM) for international financial markets and that encompasses stocks from both emerging and developed markets in an individual stock-level analysis of world market liquidity.

The research on the implications of liquidity for international asset pricing is small relative to that for the US market. Rouwenhorst (1999) investigates the cross-sectional relation between asset returns and liquidity measured by turnover in 20 countries from emerging markets. For 19 emerging markets, Bekaert, Harvey, and Lundblad (2003) show that the covariance of country-portfolio returns with local market liquidity predicts future returns, but they could not find evidence that global liquidity risk is priced. In contrast, Stahel (2004b) and Liang and Wei (2005) investigate the implication of liquidity risks in 3 and 23 developed markets, respectively.

While these papers are pioneering efforts, they share common limitations. First, the *only*

¹Liquidity is a concept used to capture the various explicit and implicit trading costs and it has many, and potentially overlapping dimensions arising from adverse selection (Kyle (1985), Glosten and Milgrom (1985)), inventory control (Stoll (1978), Grossman and Miller (1988), Ho and Stoll (1981)) and needs for immediate trading (Grossman and Miller (1988)). Broadly, it is used to describe the ease of trading a large amount of shares in a given amount of time without a significant impact on prices.

liquidity risk considered in the previous literature is the one that arises from the sensitivity of individual stock returns with market-wide liquidity which is shown in Pastor and Stambaugh (2003) to be priced for the US market. However, none of these studies deal with the pricing of liquidity risks arising from the covariance of individual stock liquidity with market-wide liquidity (commonality in liquidity) and that arising from the covariance of individual stock liquidity with market returns. Acharya and Pedersen (2005) show these liquidity risks to be important for US markets. Second, all of these studies have focused on either emerging markets or developed markets separately, and thus their measured global market liquidity intrinsically reflects only *part* of the world. Third, except for Rouwenhorst (1999), all of these studies employ a portfolio-level analysis rather than the analysis at the individual-stock level to investigate the asset pricing implication of liquidity. This is important because it can significantly increase the power of the tests.

We employ a variety of test methods. In Fama-MacBeth cross-sectional tests where we compute predicted betas and in the time-series tests, we evaluate the unconditional version of LCAPM extended to international financial markets. Though we reject the overidentifying restrictions of the LCAPM of Acharya and Pedersen (2005), we find that a security's required return depends on the covariances of its own return (liquidity) with local and global market liquidity (returns). Interestingly, we find global liquidity risks subsume local liquidity risks and a trading strategy based on non-traded global liquidity risks is shown to produce annualized excess return of 10.6 percent. We interpret our evidence as consistent with an intertemporal capital asset pricing model (Merton (1973)) in which stochastic shocks to global liquidity serve as a priced state variable.

We also find that the US market is an important driving force of global liquidity risks by showing that stocks from around the world are significantly influenced by US market returns. Specifically, the global liquidity risk arising from the covariance of individual stock liquidity with the US market returns is priced in both emerging and developed markets, while the covariance with the world market portfolio return formed by excluding the US market is not priced in these markets.

One challenge in a study of liquidity at a global level is to find a satisfactory liquidity proxy. In international financial markets, intra-day data is seldom available and trading volume data

is also rare. Hence, a liquidity proxy based *only* on returns may be valuable. We employ the zero-return measure suggested by Lesmond, Ogden, and Trzcinka (1999) in this study. The zero-return measure is the ratio of the number of zero-return days to the total number of trading days in a given month. The intuition behind this measure is that informed traders would not trade on a day, thus leading to a zero-return day, when the trading cost is high enough to offset the gains from informed trading. The validity of this measure is established in the US market (Lesmond, Ogden, and Trzcinka (1999)) and in world markets (Bekaert, Harvey, and Lundblad (2003), Lesmond (2005)) by demonstrating its high correlation the bid-ask spreads. While the above studies deal with annual or quarterly frequency zero-return measures, we add more evidence of the validity of this measure at the *monthly* frequency. We find that monthly zero-return measures are highly correlated with daily quoted spreads obtained from TAQ/ISSM in the US market for January 1983 to December 2003. Monthly zero-return measures have a correlation of 90% with proportional quoted spreads (defined as quoted spread divided by quote midpoint) in the US market.

The rest of this paper is organized as follows. In the next section, we briefly survey the previous literature related to liquidity in international financial markets. In section 3, we review the liquidity-adjusted capital asset pricing model of Acharya and Pedersen (2005). Section 4 describes the data, the sample screening procedure and the construction and the validity of our liquidity measure. The test methodology is introduced in section 5 and the empirical results are reported in section 6. In section 7, we explore the robustness of the test results and we conclude in section 8.

2 Related literature

While we have a relatively large number of studies about US market liquidity (Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), Amihud (2002), Pastor and Stambaugh (2003), Sadka (2004), Acharya and Pedersen (2005)), studies of liquidity outside of the US market are rare. However, a few recent papers extend research on liquidity to emerging markets (Rouwenhorst (1999), Bekaert, Harvey, and Lundblad (2003), Lesmond (2005)), to developed markets (Liang and Wei (2005), Stahel (2004b)) and to both emerging and developed markets (Stahel (2004a)). Among these, Bekaert, Harvey, and Lundblad (2003), Stahel (2004b) and

Liang and Wei (2005) investigate the asset pricing implication of liquidity in terms of liquidity *risk* rather than or as well as liquidity as a characteristic.

Rouwenhorst (1999) investigates the cross-sectional relation between asset returns and liquidity in 20 countries from emerging markets and finds that small stocks or value stocks have *higher* average turnover than large or growth stocks, a finding he acknowledges to be hard to justify by existing liquidity theories.

Viewing market liquidity as an undiversifiable risk factor, Pastor and Stambaugh (2003) investigate the relation between an asset's price and its covariance with market-wide liquidity. The stocks whose returns are more sensitive to unexpected market-wide liquidity fluctuations would require higher expected return as a compensation for bearing liquidity risk. A trading strategy of buying stocks with high liquidity risk and selling those with low liquidity risk is shown to produce 7.5% annual profits. Sadka (2004) adds similar evidence using a different liquidity measure theoretically derived from an equilibrium where the competitive risk-neutral market maker's expected value of the security is linearly related to orderflow.

Bekaert, Harvey, and Lundblad (2003) extend the studies to international financial markets. For 19 emerging markets, they show that liquidity risk arising from the covariance between individual stock returns and local market liquidity predicts future returns, while the liquidity risk with respect to world market does not. However, their test assets are country portfolios rather than individual stocks as in this study and, more importantly, by restricting their sample only to emerging markets, their global market factors are actually emerging market factors, which represent only *part* of the world markets. By contrast, a recent paper by Liang and Wei (2005) investigates the liquidity risks of only developed markets through 23 country portfolios as test assets. They find some evidence that the liquidity risk arising from return sensitivity to global market-wide liquidity fluctuations is priced in developed markets. However, this study also regards developed market liquidity as world market liquidity, although it is again only a part of global liquidity.² Stahel (2004b) investigates the commonality in liquidity and the asset pricing implication of liquidity risk in three developed countries of Japan, UK and US. He finds that global and industry-wide cross-country liquidity is more important than local market

²Including both emerging and developed markets for global market liquidity is important especially when we consider the growing importance of emerging markets (Harvey (1995), Lesmond (2005))

liquidity in asset pricing for these countries.

While these previous studies shed light on the effect of global liquidity risk on asset price, none of these studies deal with liquidity risks arising from the covariances other than those of individual stock returns with market liquidity. Acharya and Pedersen (2005) propose a theoretical asset pricing model that includes various liquidity risks: liquidity risk arising from the covariance of individual stock liquidity with market-wide liquidity (commonality in liquidity), from the covariance of individual stock returns with market liquidity, and from the covariance of individual stock liquidity with market returns. This simple but all-encompassing model is derived from a standard CAPM that considers trading-cost-adjusted prices rather than prices in a market with no trading costs. The liquidity risk studied in the previous literature is nested in the liquidity-adjusted capital asset pricing model of Acharya and Pedersen (2005). They show that these various liquidity risks are priced in US markets but the empirical results are somewhat sensitive to the test assets used and to econometric specifications. To the best of our knowledge, there is no paper that has investigated these multiple liquidity risks in international financial markets. In the next section, we will review the liquidity-adjusted capital asset pricing model proposed by Acharya and Pedersen (2005).

3 Liquidity-adjusted capital asset pricing model

As discussed in section 2, it has been empirically shown that liquidity is a priced factor both as a characteristic and as a systematic risk factor. However, a theoretical asset pricing model that includes both of these aspects of liquidity was proposed only recently. The liquidity-adjusted capital asset pricing model (LCAPM, henceforth) of Acharya and Pedersen (2005) is derived from a framework similar to CAPM in that risk-averse investors maximize their expected utility under wealth constraint, but by replacing the cost-free stock price, $P_{i,t}$, with a *trading-cost-adjusted* stock price, $P_{i,t} - \Psi_{i,t}$, where $\Psi_{i,t}$ is a trading cost in absolute amount, in an overlapping generation economy. The LCAPM is in equation (1).

$$E_t(R_{i,t+1} - C_{i,t+1}) = R_f + \lambda_t \frac{Cov_t(R_{i,t+1} - C_{i,t+1}, R_{t+1}^D - C_{t+1}^D)}{Var_t(R_{t+1}^D - C_{t+1}^D)} \quad (1)$$

where R_i is a gross return of stock i , R_f is a gross risk-free rate and $C_{i,t}$ is a trading cost per price at time t ($C_{i,t} \equiv \Psi_{i,t}/P_{i,t-1}$). Subscript t for expectation, covariance, and variance denotes

that these operators are conditional on the information set available up to time t . Superscript D denotes that the variable is defined in terms of the local market portfolio (D from ‘domestic’).

As a result of the study of the liquidity-adjusted price, LCAPM has three additional covariance terms related to stochastic trading costs other than the traditional market risk component. It is clear that without trading cost terms of C^D and C_i , the LCAPM in (1) is equivalent to the traditional CAPM.

By assuming constant conditional variance or constant premia, the unconditional version of the model is derived as:

$$E(R_{i,t} - R_{f,t}) = E(C_{i,t}) + \lambda^D \beta_i^{1,D} + \lambda^D \beta_i^{2,D} - \lambda^D \beta_i^{3,D} - \lambda^D \beta_i^{4,D} \quad (2)$$

where,

$$\begin{aligned} \beta_i^{1,D} &= \frac{\text{Cov}(R_{i,t}, R_t^D - E_{t-1}(R_t^D))}{\text{Var}(R_t^D - E_{t-1}(R_t^D) - [C_t^D - E_{t-1}(C_t^D)])} \\ \beta_i^{2,D} &= \frac{\text{Cov}(C_{i,t} - E_{t-1}(C_{i,t}), C_t^D - E_{t-1}(C_t^D))}{\text{Var}(R_t^D - E_{t-1}(R_t^D) - [C_t^D - E_{t-1}(C_t^D)])} \\ \beta_i^{3,D} &= \frac{\text{Cov}(R_{i,t}, C_t^D - E_{t-1}(C_t^D))}{\text{Var}(R_t^D - E_{t-1}(R_t^D) - [C_t^D - E_{t-1}(C_t^D)])} \\ \beta_i^{4,D} &= \frac{\text{Cov}(C_{i,t} - E_{t-1}(C_{i,t}), R_t^D - E_{t-1}(R_t^D))}{\text{Var}(R_t^D - E_{t-1}(R_t^D) - [C_t^D - E_{t-1}(C_t^D)])}. \end{aligned}$$

The risk premium is defined as $\lambda^D = E(\lambda_t^D) = E(R_t^D - C_t^D - R_{f,t})$.

Additionally, we define:

$$\begin{aligned} \beta_i^{5,D} &\equiv \beta_i^{2,D} - \beta_i^{3,D} - \beta_i^{4,D} \\ \beta_i^{6,D} &\equiv \beta_i^{1,D} + \beta_i^{2,D} - \beta_i^{3,D} - \beta_i^{4,D}. \end{aligned} \quad (3)$$

$\beta_i^{5,D}$ is defined as a linear combination of the three liquidity betas excluding market beta, while $\beta_i^{6,D}$ contains all four covariance terms in it. Henceforth, we will call $\beta_i^{5,D}$ the *liquidity net beta* and $\beta_i^{6,D}$ the *net beta*. It is worth noting that the net beta corresponds to the covariance term in equation (1) and the liquidity net beta helps distinguish the pricing effect of liquidity risks from that of market risk. Each beta has an associated economic interpretation:

- $\beta_i^{1,D}$ is similar to traditional market beta of CAPM except for the terms related to trading cost in the denominator.

- $\beta_i^{2,D}$ is a liquidity risk arising from the comovement of individual stock liquidity with market liquidity (Chordia, Roll, and Subrahmanyam (2000), Hasbrouck and Seppi (2001), Huberman and Halka (2001), Coughenour and Saad (2004)).³ $\beta_i^{2,D}$ is expected to be *positively* related to asset returns since investors require compensation for a stock whose liquidity decreases when the market liquidity goes down. For a similar reason, a stock whose liquidity negatively comoves with market liquidity will be traded at a premium since such stock is easier to sell when the market is highly illiquid.
- An unexpected decrease in stock market liquidity will bring a potential wealth reduction for investors who hold stocks that are highly sensitive to market-wide liquidity and need to liquidate them immediately since liquidation of such stocks would be costlier under low market liquidity (Pastor and Stambaugh (2003), Sadka (2004)). $\beta_i^{3,D}$ captures this liquidity risk and *negatively* relates to expected returns since investors are willing to accept low returns on stocks whose expected return is high when the market is illiquid.
- The fourth beta, $\beta_i^{4,D}$, is newly proposed by Acharya and Pedersen (2005) and is *negatively* related to asset returns since stocks that become more liquid in a down market will be preferred by investors, thus will be traded at a premium. The negative sign for $\beta_i^{4,D}$ is due to investors' willingness to accept low returns on such stocks.

If the world financial markets are fully segmented, the local market version of LCAPM in equation (2) should be able to explain the cross-sectional dispersion of asset returns. However, in perfectly integrated world financial markets, countries are irrelevant to investors and individual stocks should co-move with world-market factors rather than with local-market factors (Karolyi and Stulz (2002)). Thus, we have the following unconditional version of LCAPM under perfectly integrated financial markets.

$$E(R_{i,t} - R_{f,t}) = E(C_{i,t}) + \lambda^W \beta_i^{1,W} + \lambda^W \beta_i^{2,W} - \lambda^W \beta_i^{3,W} - \lambda^W \beta_i^{4,W}. \quad (4)$$

where,

$$\beta_i^{1,W} = \frac{Cov(R_{i,t}, R_t^W - E_{t-1}(R_t^W))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

³Throughout this paper, $\beta_i^{2,D}$ will sometimes be referred to as a *commonality* beta.

$$\begin{aligned}
\beta_i^{2,W} &= \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), C_t^W - E_{t-1}(C_t^W))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{3,W} &= \frac{Cov(R_{i,t}, C_t^W - E_{t-1}(C_t^W))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{4,W} &= \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), R_t^W - E_{t-1}(R_t^W))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}.
\end{aligned}$$

Superscript W denotes that the variable is defined in terms of the world market (W denoting ‘world’). The liquidity net beta and the net beta are defined in a similar way to equation (3).

$$\begin{aligned}
\beta_i^{5,W} &\equiv \beta_i^{2,W} - \beta_i^{3,W} - \beta_i^{4,W} \\
\beta_i^{6,W} &\equiv \beta_i^{1,W} + \beta_i^{2,W} - \beta_i^{3,W} - \beta_i^{4,W}
\end{aligned} \tag{5}$$

We investigate both of these versions of the LCAPM.

4 Data and liquidity measure

4.1 Sample screening

Daily returns are calculated using a daily total return index from Datastream for all available stocks from 48 countries for the period of January 1988 to December 2004.⁴ Out of 48 countries, 22 countries are developed markets (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Singapore, Spain, Sweden, Switzerland, United Kingdom and United States) and the other 26 countries are emerging markets (Argentina, Brazil, Chile, China, Colombia, Czech Republic, Greece, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Portugal, South Africa, South Korea, Sri Lanka, Taiwan, Thailand, Turkey, Venezuela and Zimbabwe).⁵ Our initial sample covers more than 42,000 stocks around the world.

To build a reliable sample, we use the following screening procedure. For a stock to be included in the sample, it should have market capitalization data at the beginning of each year (in US dollars) and year-end book-to-market ratio. We chose only stocks from major exchanges, which are defined as having the majority of stocks for that country.⁶ In addition, we use only

⁴The return index for each stock is built under the assumption that the dividends are re-invested and is adjusted for stock-splits.

⁵Categorizing countries into developed or emerging markets follows the definition of International Financial Corporation (IFC) of World Bank Group.

⁶Most of the countries have one major exchange except China (Shenzen and Shanghai stock exchanges), Japan (Osaka and Tokyo stock exchanges) and the US (Amex, NYSE and NASDAQ).

common stocks by excluding stocks with special features. Depository Receipts (DRs), Real Estate Investment Trust (REIT), and preferred stocks were hence excluded.⁷

We are using the zero-return proportion of Lesmond, Ogden, and Trzcinka (1999) as our illiquidity measure, so excluding non-trading days is important since Datastream fills the value of the return index of previous day for a non-trading day, which produces zero returns. Hence, if 90% or more of stocks in a given exchange have zero returns on that date, returns of all stocks in that exchange are classified as missing.⁸ For some countries (France, Germany, Hong Kong, Japan, UK and US), the local stock market index is also used to exclude non-trading days. To avoid survivorship bias, all data for dead stocks are maintained in the sample.

Ince and Porter (2003) emphasize caution in handling data errors in Datastream. Similar to their screening, we set the daily return to be missing if any daily return above 100% (inclusive) is reversed the next day.⁹ Daily returns calculated from a very small total return index may exaggerate the proportion of zero-return days since the return index is reported to the nearest tenth. Thus, the daily return is set to missing if either the total return index for the previous day or that of the current day is less than 0.01. Our illiquidity proxy, the zero-return proportion, is calculated as the number of zero-return days divided by the number of non-missing trading days in a given month.

After screening the daily data following the above procedure, the month-end total return index together with the month-end exchange rate is used to calculate monthly US dollar returns. The foreign exchange rate data from WM/Reuters is also obtained through Datastream.¹⁰ If the

⁷Excluding stocks with special features was mostly performed manually by examining the name of the securities given that Datastream/Worldscope do not provide any code to discern those stocks from common stocks. For US stocks, Cusip code is also used to exclude non-common shares since the two digits from the 7th digit of Cusip is 10 for common shares. Some examples of 'name filters' are: In Belgium, type AFV and VVPR (type named by Datastream/Worldscope) shares are dropped since they have preferential dividend or tax incentives. In Brazil, all PN shares were removed since they are preferred stocks. In Mexico, type ACP and BCP shares are removed since they have special features of being convertible into series A and B shares, respectively, after one year. In France, type ADP and CIP shares are dropped since they have no voting rights and preferential dividend rights. In Germany, type GSH shares are excluded since they have fixed dividends and no voting rights. In Italy, RSP shares are dropped due to non-voting provisions.

⁸Lesmond (2005) used a similar criterion but with a 100% cutoff rather than 90%. We found that there are days when only a handful of stocks have non-zero returns while all others have zeros. If only one stock has a non-zero return on a non-trading day, that non-trading day will not be captured by the 100% rule and this gives zero returns to all other stocks on that day, which inflates the proportion of zero-return days for that month.

⁹Specifically, the daily returns for both at day t and $t - 1$ are set to missing if $R_{i,t}R_{i,t-1} - 1 \leq 0.5$, where $R_{i,t}$ and $R_{i,t-1}$ are gross returns at day t and $t - 1$, respectively, and if at least one is greater than or equal to 200%.

¹⁰Since the exchange rate against the US dollar does not cover all our sample periods for some countries while the rate against UK sterling does, the US dollar exchange rate is calculated using cross-rates through sterling.

total number of non-missing return days is less than 15 within a month, the stock is dropped from the sample for that month.¹¹ By choosing US dollar denominated returns, the returns across countries are comparable and the effect of different inflation rates across countries is reflected under purchasing power parity (Rouwenhorst (1999), Harvey (1991), (1995)). We use the US 30-day Treasury bill as the risk-free asset.¹²

As with the daily return screening, any monthly returns calculated from the total return index of less than 0.01 and those above 300% that are reversed within a month are set to missing.¹³ To handle data errors, monthly returns or zero-return proportion of the extreme 0.1% (inclusive) and 99.9% in the cross-section of each country are set to missing for that month. If a stock has more than 80% of zero-return days in a year or in the whole sample, that stock is dropped for that year or from the sample, respectively.¹⁴

The previous literature on liquidity requires that the sample stocks have price levels within a certain range.¹⁵ To apply a similar filter to this, rather than applying an absolute level of price range restriction for stocks from 48 countries, we use the distribution of lagged prices: if the price, obtained from Datastream, at the end of the previous month is in the extreme 1% (inclusive) at the top and bottom of the cross-section in each country, that stock is dropped from the sample for that month.

After all these screens, the stock should have at least 12 months of data for the period 1988-2004 to be included in our sample.

4.2 Summary statistics

The number of stocks in our sample and the descriptive statistics of returns and zero-returns are reported in Table 1. The total number of stocks in the sample is 24,798. For some countries, especially for emerging markets, the sample begins in the late 1980's or early 1990's. For example,

¹¹Pastor and Stambaugh (2003) require stocks to have at least 16 days of daily returns within a month to give more accuracy to their measure and Amihud (2002) used 200 days within a year, which may correspond to 15 days per month. However, the 16-day rule may exclude a whole month for *all* stocks in some periods. For example, due to 9/11, the total available number of trading days in September 2001 was 15 days for US markets.

¹²Treasury bill data from Ibbotson Associates is obtained from K. French's data library.

¹³The monthly returns for month t and $t - 1$ are set to missing if $R_{i,t}R_{i,t-1} - 1 \leq 0.5$, where $R_{i,t}$ and $R_{i,t-1}$ are gross returns at month t and $t - 1$, respectively, and if at least one is greater than or equal to 400%.

¹⁴Lesmond (2005) dropped stocks with more than 80% zero-returns since too many zero-return days make the estimation of the illiquidity measure of Lesmond, Ogden, and Trzcinka (1999) impossible.

¹⁵Pastor and Stambaugh (2003) impose that the previous year-end price should be between \$5-1000 to be included in the sample. Chordia, Roll, and Subrahmanyam (2000), Stahel (2004b) and Lee (2005) also impose a similar restriction.)

the Czech Republic and Poland have data from 1996 while for most countries in developed markets, the starting year is 1988. The number of stocks in the sample varies according to countries and years. The country that has the largest number of stocks in the sample is the US (6,347 stocks) while Zimbabwe has only 13 stocks. We have more than 6,000 stocks every year for all years in the 1990's and about 15,000 stocks in the 2000's. The year with the largest number of stocks in the sample is 2003 (16,886 stocks).

The last six columns of Table 1 show the equally-weighted average (in percentage) of our monthly illiquidity and returns of stocks for each country. The average is computed in a pooled sample for each country using the entire sample period. We see zero-return days are frequent in developed markets as well as in emerging markets. The equally-weighted average (not reported) of zero-return proportion of each country is 32% for developed markets, and 31% for emerging markets.

The zero returns, or at least the ranking by zero returns of countries, are similar to those in Lesmond (2005) and Bekaert, Harvey, and Lundblad (2003) for emerging markets. For example, the latter paper shows that Taiwan, Korea and Greece are the most liquid and Chile and Colombia are the least liquid markets in their emerging market sample. Consistent to their statistics, the average of zero-returns in Table 1 is 13.67%, 12.08%, and 17.79%, respectively for Taiwan, Korea, and Greece and 41.82% and 46.22%, respectively for Chile and Colombia. Average zero-return is 11.32% for China and this small number is consistent with the small number of 9.14% from Lesmond (2005) for the same country. The average statistics of zero-returns in Table 1 are very similar to those in Lesmond (2005) for many emerging market countries though there are differences in sample periods and data frequency. For example, Table 1 shows that Argentina, Peru, Philippines, Poland, and South Africa have average zero-returns of 30.39%, 44.14%, 44.72%, 19.92%, and 40.85%, respectively. In Lesmond (2005), the corresponding numbers are 30.94%, 42.65%, 44.13%, 19.37%, and 40.33% for each country.

It is striking to see that the average zero-return is 47.89% for the UK, which is larger than most of other countries in the sample. We investigate the UK data further and find that this high number of zero-returns is wide-spread among UK stocks and is not coming from outliers. We form size quintile portfolios from the UK stocks and find that the time-series plot of zero-returns (not reported) for each portfolio shows that the zero-returns are high in all size groups

except for the largest stock portfolio.¹⁶

Table 1 also shows statistics for returns. Consistent with Harvey (1995), standard deviation of returns of emerging market countries is greater than that from developed market countries. Ten countries from emerging markets have return standard deviation exceeding 15%, while only three countries have such standard deviations in developed markets.

4.3 Is zero-return proportion a good proxy for illiquidity?

Several illiquidity measures from intra-day and daily data have been proposed and used in the study of US domestic market. Since intra-day data does not cover a long time series, some researchers proposed a illiquidity proxy based on daily return and volume data (Roll (1984), Lesmond, Ogden, and Trzcinka (1999), Amihud (2002), Pastor and Stambaugh (2003), Hasbrouck (2005)). However, in the study of international financial markets, daily trading volume data is rare for many countries, and hence an illiquidity measure based *only* on daily returns is attractive.

Lesmond, Ogden, and Trzcinka (1999) proposed such an illiquidity measure based on the portion of zero return days out of possible trading days. The economic intuition for the zero return measure is derived from simple trade-offs of the cost and benefit of trading for informed investors: When the trading cost is too high to cover the benefit from informed trading, informed investors would choose not to trade and this non-trading would lead to an observed zero return for that day. The zero return measure has been used to evaluate the impact of trading costs in a momentum strategy (Lesmond, Schill, and Zhou (2004)), the relation between market liquidity and political risks in emerging markets (Lesmond (2005)), liquidity contagion across international financial markets (Stahel (2004a)), and the implication of liquidity on asset pricing in emerging markets (Bekaert, Harvey, and Lundblad (2003)).

The high correlation of the zero-return measure with proportional spreads (quoted spread divided by bid-ask midpoint) and trading commissions in US markets is shown in Lesmond, Ogden, and Trzcinka (1999). In emerging markets, Lesmond (2005) compared the liquidity measures of Roll (1984), Amihud (2002) and turnover and argued the superiority of the zero-return based measure. Bekaert, Harvey, and Lundblad (2003) show that the zero-return proportion has a cor-

¹⁶Because we are conceived with the risk that data errors in the UK potentially affecting our basic inferences, we perform our Fama-MacBeth regression with and without the UK stocks and find similar results in both cases.

relation of 30-42% with other illiquidity proxies such as Amihud's (2002), the Gibbs-sampling measure by Hasbrouck (2005), and the proportional bid-ask spread of Jones (2002) in the US market. In addition, the same study shows that the zero return is highly correlated (67%) with bid-ask spreads in countries where spread data is available.

While the correlation analysis of zero-return measures with others are usually based on annual (Lesmond, Ogden, and Trzcinka (1999), Bekaert, Harvey, and Lundblad (2003)) or quarterly frequency (Lesmond (2005)) in market level illiquidity, we add more evidence by investigating the correlation of *monthly* zero returns with intra-day based measures for each size quintile as well as for overall market illiquidity in US market. From ISSM/TAQ data, daily quoted spread and proportional quoted spread (defined as quoted spread divided by quote mid-point) are calculated for AMEX and NYSE stocks for 1983-2003.¹⁷ The correlation between the zero-return proportion, ZR , and the spread measures for US markets is reported in Table 2.

As expected, zero-return proportion is highly correlated with spreads in every size quintile and in overall market level. At the market-wide illiquidity level (rows under the name of 'overall' in the table), ZR has a correlation of 88% and 90% with quoted spread and proportional quoted spread, respectively. In a small stock quintile (quintile 1), the correlation of ZR and proportional spread is 79%. Across all size quintiles, ZR 's correlation with proportional quoted spread exceeds 70%. Figure 1 shows a time-series plot of ZR and proportional quoted spreads for small stock quintile (variables with suffix 1) and for large stock quintile (suffix 5). As expected, large stocks are more liquid than small stocks, and thus appear in the lower part of the figure. We see that ZR moves closely together with proportional quoted spread across all time periods in the graph. On January 2001, when the decimalization of the NYSE and Nasdaq markets occurred, the gaps between ZR and proportional spread become wider. However, the comovement looks fairly strong from that period on.

The zero-return measure assumes that the value of non-informed random trading is idiosyncratic, and thus it is averaged away over time. However, De Long, Shleifer, Summers, and Waldmann (1990) propose a model where noise trader risk in financial markets is actually priced by affecting the behavior of informed traders. Recently, Spiegel and Wang (2005) argue that it

¹⁷For details about stock screening in the intra-day data and the procedure of constructing the daily measure, refer to Lee (2005).

is possible that liquidity actually reflects the idiosyncratic risks of stocks. In this line, some may argue that ZR is actually related to return volatility conjecturing that the highly volatile stocks would have fewer zero return days. However, Bekaert, Harvey, and Lundblad (2003) showed that the correlation between zero-return measures and volatility is insignificant in emerging markets.

In sum, this subsection supports the validity of using a zero-return proportion as our illiquidity measure. The next section introduces the test methodology.

5 Methodology

We employ Fama-MacBeth regression tests since it is a standard method in testing asset pricing models. In this section, we describe how we form local and world market factors and the innovations of return and illiquidity. Method of estimating factor loadings, predicted betas, is also introduced with a detailed description of Fama-MacBeth procedure.

5.1 Innovations of return and illiquidity

To build local and world market illiquidity and returns, we use market-value weighted averages of individual stocks.¹⁸

The level of local market illiquidity varies across countries and is highly persistent. First order auto-correlations of ZR range from 14.6% (Czech Republic) to 96.7% (US), with 30 countries having auto-correlations of more than 60%. Those countries with high auto-correlations include Canada (94.7%), South Africa (93.5%), Japan (87.8%), Spain (86.0%), Indonesia (85.4%), India (83.2%), Portugal (81.9%), Finland (81.7%), and Sweden (81.4%). Brazil (26.5%), Israel (30.1%), Italy (34.4%), Netherlands (36.7%), Thailand (36.6%), and Zimbabwe (33.3%) have correlations below 40%. The auto-correlation of the world market illiquidity measure is 92.6%.

While market illiquidity is persistent, market returns are not serially-correlated. The absolute value of first order auto-correlations of market returns is highest in Czech Republic (20.0%) and lowest in Israel (0.36%). Thirty countries have autocorrelations of less than 10% in absolute terms. The auto-correlation of the world market return is -0.43%.

As seen in the definition of betas under equations (2) and (4), LCAPM requires the construction of innovations in returns and illiquidity. Pastor and Stambaugh (2003) and Acharya and

¹⁸Chordia, Shivakumar, and Subrahmanyam (2004) found that the aggregate market liquidity is more strongly reflected in large firms than in small firms in US markets.

Pedersen (2005) employ residuals obtained from an AR(2) fitting of each variable for the entire sample period as innovations. However, we do not follow their approach in this paper for the following reasons. First, an AR(2) model fitting are using the entire sample period includes a *look-ahead* bias since it assumes that future time-series is known at any point of time during the sample period. Second, it is possible that individual stocks have discontinuous time-series due to the screening procedure described in subsection 4.1 or due to missing data during the sample period. As opposed to the above studies which use portfolios as test assets, this problem is more important in this paper since we use individual stocks as test assets rather than portfolios. Thus, instead of time-series fitting, we use a *change* of illiquidity as its innovation. In contrast, since the return series do not have any persistence, as we saw, we use the returns themselves as innovations.

5.2 Estimating predicted betas

We use 25,000 stocks from 48 countries as test assets. Individual stock level analysis has benefits and costs. First, using individual stocks as test assets helps avoid the potentially spurious results that can be brought by forming specific portfolios.¹⁹ Second, it prevents the loss of information from forming portfolios. Third, it increases the power of the test by providing more observations in the cross-section. Fourth, it is suitable to control individual stocks' characteristics. On the cost side, the problem stems from noise of the estimated loadings. Considering these cost and benefits, we employ the cross-sectional regressions based on individual stocks' predicted betas which adjust for pre-ranking betas and other firm characteristics. This method is similar in spirit to that in the research on liquidity by Pastor and Stambaugh (2003) and has been also used by Sadka (2004) and Liang and Wei (2005).

A brief description of the Fama-MacBeth procedure is as follows. First, for each individual

¹⁹We see some difficulty in obtaining consistent results using different portfolios as test assets in the US market in the empirical results in Acharya and Pedersen (2005). For example, the GMM tests based on Black, Jensen, and Scholes (1972) show a negative and significant coefficient on $\beta^{4,D}$ when 25 liquidity portfolios are used as test assets. However, when 25 size portfolios are used, the sign is positive and insignificant. In Appendix 1, we show Fama-MacBeth test results for the US market using 25 equally-weighted portfolios based on book-to-market (labelled 'B/M' in the table), average illiquidity (ZR) of previous year or size (MV). For comparison with Acharya and Pedersen (2005), in Appendix 1, AR(2) fitting is used to obtain innovations in illiquidity and returns. Time-series averages of premia on loadings estimated using the past five years (at least 36 months) portfolio returns and illiquidity are reported. It is easy to see that we have similar problems to those of Acharya and Pedersen (2005). In B/M portfolios, $\beta^{4,D}$ is negatively and significantly priced with t -values of -1.75 or -1.93 depending on the specification when the firm characteristics are not controlled for. However, the sign is flipped in the MV portfolios and insignificant.

stock, market risk as well as three liquidity risks in the LCAPM (“pre-ranking” betas) are estimated using the previous 5 years’ monthly return and illiquidity. Based on these pre-ranking betas and stock characteristics such as size, book-to-market and the level of illiquidity, we estimate predicted betas. Cross-sectional regressions are performed every month using individual stock returns and predicted betas and the time-series average of estimated premia are reported.

For each individual stock i , pre-ranking betas at year t with respect to local market factors, $\beta_{i,t}^{k,D}$ ($k = 1, 2, 3, 4$), are calculated by the definitions under equation (2) (equation (4) for betas, $\beta_{i,t}^{k,W}$, with respect to world market factors) using the innovations in returns and illiquidity in the previous 5 years from year $t - 4$ to t . The five-year window starts from January 1988 or from the first month when the stocks are present in the sample and is rolled forward at yearly intervals. Stocks should have at least 36 monthly returns and innovations in illiquidity within the given window to have pre-ranking betas in year t .

We estimate the predicted betas as follows.

$$\beta_{i,t}^{p,k} = \gamma_{0,t}^k + \gamma_{1,t}^k \beta_{i,t-1}^k + \gamma_{2,t}^k MV_{i,t-1} + \gamma_{3,t}^k B/M_{i,t-1} + \gamma_{4,t}^k ZRm_{i,t-1} + \epsilon_{i,t}. \quad (6)$$

Pseudo-predicted beta, $\beta_{i,t}^{p,k}$ ($k = 1, 2, 3, 4$), with respect to local or world market is calculated by the definition of betas in equations under (2) and (4), respectively, but using only the returns and illiquidity innovation of year t for stock i which has at least 5 month returns and illiquidity innovations in the same year (superscript p is from ‘P’seudo-predicted beta). $\beta_{i,t-1}^k$ is the pre-ranking beta obtained from the time-series of year $t - 5$ to $t - 1$ for stock i with at least 36 month data in the given 5-year window.

Previous research proposed various approaches to adjust forecasted loadings to increase the accuracy of forecasts (Vasicek (1973), Karolyi (1992)). In a Bayesian framework, these studies argue that the forecasting ability can be improved by adjusting the assumed prior distribution of betas with firm characteristics such as size and industry grouping.

Three additional firm characteristics are used as instruments in estimating predicted betas: MV_{t-1} , B/M_{t-1} and ZRm_{t-1} are the log market capitalization (in US dollar terms), the log book-to-market ratio, and the log of average ZR in year $t - 1$, respectively. Because of potential stationarity concerns, these variables are demeaned by the average obtained in an entire time-series of each variable. The coefficients, γ ’s, which are restricted to be the same across stocks

from all countries in the sample, are estimated in a cross-sectional regression of model specified in (6) every year. With the estimated coefficients, the predicted beta, $\beta_{i,t+1}^{pred,k}$, is obtained in the following equation.

$$\widehat{\beta}_{i,t+1}^{pred,k} = \widehat{\gamma}_{0,t}^k + \widehat{\gamma}_{1,t}^k \beta_{i,t}^k + \widehat{\gamma}_{2,t}^k MV_{i,t} + \widehat{\gamma}_{3,t}^k B/M_{i,t} + \widehat{\gamma}_{4,t}^k ZRm_{i,t} \quad (7)$$

Equation (6) and (7) show that the relations reflected in γ 's between the pseudo-predicted betas in year t and the instruments in year $t - 1$, are used to estimate the predicted beta in year $t + 1$ combined with characteristics in year t .

The estimated coefficients (t -values in parenthesis) from (6) are in Appendix 2. Coefficients on MV , B/M and ZRm are multiplied by 100. As expected, coefficients on the pre-ranking betas are highly significant in most cases. Other firm characteristics are also mostly significant indicating that the information contained in firm characteristics are helpful in predicting future liquidity risks as well as market risk.

At the last step of Fama-MacBeth procedure, the following cross-sectional regression is performed every month using the individual stock returns and predicted betas.

$$E(R_{i,t} - R_{f,t}) = a + bE(C_{i,t}) + \lambda_j^S \widehat{\beta}_{i,t}^{pred,1,S} + \lambda_j^S \widehat{\beta}_{i,t}^{pred,2,S} - \lambda_j^S \widehat{\beta}_{i,t}^{pred,3,S} - \lambda_j^S \widehat{\beta}_{i,t}^{pred,4,S} \quad (8)$$

where S denotes that the covariances are calculated with respect to local market ($S = D$) or world market factors ($S = W$). We use average monthly ZR obtained from the previous 12 months (and at least 6 months) as a proxy for expected illiquidity at time t , $E(C_{i,t})$. If the LCAPM holds, the intercept will not be significantly different from zero ($a = 0$) and the coefficient on the expected illiquidity will be one ($b = 1$).

Three different restrictions are imposed on equation (8). In the first case, the premia, λ , are allowed to vary according to countries but restricted to be the same for all stocks within the same country. With this restriction, the subscript j under the premia denotes each country, and thus has 48 different values. Secondly, premia are allowed to vary according to economic classification of countries (developed markets vs emerging markets) but should be the same across stocks and countries within the same classification. In this case, the subscript j has two different values for developed markets and for emerging markets. In the last case, we restrict the premia to be the same across all stocks from 36 countries ($\lambda_j = \lambda$). Empirical results in section 6 report the time-series averages of estimated risk premia separately by these restrictions on j .

6 Empirical results

This section reports empirical results of the tests of the international LCAPM. We begin this section by examining the features of predicted betas computed for the individual stocks. Fama-Macbeth regression results based on predicted betas will be presented in each separate subsection. Based on the results from the Fama-MacBeth regressions, we also test whether the US market is driving the asset pricing implications of global liquidity risks in international financial markets. In subsection 6.6, time-series test results are examined. Subperiod analysis is presented in the last subsection.

6.1 Local and global market betas

Table 3 show the averages of return, illiquidity, market value, and book-to-market by portfolios based on predicted betas with respect to local and world markets, respectively, obtained by the procedure described in section 5.2 based on the LCAPM of fully-segmented and fully-integrated world markets, respectively. The averages are obtained by equally-weighted averages across countries of time-series averages for each country. Predicted betas of $\beta^{2,S}$, $\beta^{3,S}$ and $\beta^{4,S}$ ($S = D, W$) are multiplied by 100 in the tables. For expositional purpose, stocks are sorted first by small (the number of stocks, N_c , in the country is greater than or equal to 100 and less than 300), medium ($300 < N_c < 500$) and large ($N_c > 500$) country-size groups and then arranged in alphabetical order within each country-size group. Predicted betas are shown according to predicted beta groups of 1 (small predicted beta) to 3, 5 or 10 (large predicted beta) in each country.²⁰ The last row in each country-size group shows the averages of predicted betas.

We see positive correlation of $\beta^{2,S}$ ($S = D, W$) with average returns. This pattern is consistent with what the LCAPM proposes. Average returns vary from 1.16% to 1.43%, from 1.03% to 1.50%, and from 1.06% to 1.40% by domestic commonality beta respectively in small, medium, and large country-size group. A similar pattern is found for the global commonality beta in panel B.

As the LCAPM suggests, average returns are negatively correlated with both $\beta^{3,S}$ and $\beta^{4,S}$

²⁰Stocks from Austria, Belgium, Chile, Denmark, Finland, Indonesia, Netherland, New Zealand, Norway, Philip-pines, Portugal, Spain, Switzerland and Turkey are included in small country-size group. Medium group consists of Greece, India, Italy, Singapore, Sweden, and Thailand. Large country-size group consists of Australia, Canada, China, France, Germany, Hong Kong, Japan, Malaysia, South Africa, South Korea, Taiwan, the UK and the US.

($S = D, W$) except for $\beta^{3,W}$ for the medium country-size group. For example, average returns vary from 1.68% to 0.99%, from 1.74% to 0.89%, and from 1.87% to 0.35% by the predicted beta of $\beta^{4,D}$, respectively, in small, medium, and large country-size group and the pattern is monotonic. This monotonic decline of average returns is also shown for the global liquidity beta of $\beta^{4,W}$. For $\beta^{3,D}$, average returns monotonically decreases from 1.48% to 1.05%, from 1.40% to 1.00%, and from 1.56% to 0.78% in each country-size group. A similar pattern is shown for the global liquidity beta, $\beta^{3,W}$, but only for the medium country-size group. The relation between average returns and liquidity betas found in Table 3 gives us preliminary insight supporting for the LCAPM.

We see that illiquid stocks tend to have higher liquidity risks in many cases. For example, ZR is monotonically increasing from 30.35% to 35.32%, from 22.75% to 33.45%, and from 23.22% to 30.45% according to $\beta^{2,D}$ suggesting that the stocks with higher commonality have higher risks due to commonality. This pattern is also shown for global commonality beta of $\beta^{2,W}$, $\beta^{3,D}$ and $\beta^{3,W}$ and is consistent with Acharya and Pedersen (2005). However, this pattern is not shown for $\beta^{4,D}$ and $\beta^{4,W}$.

We expect countries in the large country-size group would be more liquid than countries in the small country-size group. Consistent with this, we see that the zero-returns, ZR , are higher in the small country-group than in the large country-group: ZR varies from 34.91% to 30.07% according to $\beta^{1,D}$ in the small country-group. The range is from 30.27% to 24.88% and from 28.24% to 22.47% in the medium and large country-size groups, respectively. This pattern is observed for all liquidity betas and market betas computed with respect to both domestic and world factors. In many cases, we also see a negative relation between ZR and market cap, MV , which implies consistent with that large stocks are generally more liquid (i.e., less illiquid).

6.2 Fama-MacBeth test results for local liquidity risks

Table 4 summarizes the results of Fama-MacBeth cross-sectional regressions based on the model of fully-segmented world markets in equation (2).

The table shows that the liquidity net beta of $\beta^{5,D}$ is strongly priced in the US, emerging, developed and overall world markets. In the overall world market, $\beta^{5,D}$ is priced with a premium of 0.12 (t -value of 4.17). This is evidence that liquidity risks with respect to local market factors

matter in world financial markets. However, net beta including market risk, $\beta^{6,D}$, is not priced in most cases and is only marginally significant with a premium of 0.043 (t -value of 1.81) in emerging markets. Further investigation of market beta and liquidity betas suggest that the poor work of $\beta^{6,D}$ is largely due to market risk, $\beta^{1,D}$. In most cases except for one in emerging markets, $\beta^{1,D}$ is never priced or priced with a reversed sign. It is well known that market risks work poorly in explaining cross-sectional differences of asset returns (e.g., Fama and French (1992)). We see that the expected illiquidity, obtained from the average ZR for the previous 12 months (at least 6 months needed), is not priced in any case. Insignificant $\beta^{6,D}$ combined with insignificant expected illiquidity rejects the LCAPM.

By examining each liquidity risk, we see that the $\beta^{3,D}$ and $\beta^{4,D}$ drive pricing of the liquidity net beta in most cases. In all specifications shown in the table, $\beta^{4,D}$ is negative and significant at a conventional 1% significance level even after controlling for firm characteristics such as market cap and book-to-market. The significant premiums vary from -0.572 to -0.144 (t -values from -7.68 to -2.83). In the US market, the liquidity net beta is priced solely due to $\beta^{4,D}$, which is extremely strong with a premium of -0.22 and t -value of -7.68. This is consistent with evidence for the US market in Acharya and Pedersen (2005) in which they found that the covariance of individual stock illiquidity with market return has a strong effect on asset pricing in the US market.

$\beta^{3,D}$, which is derived from a sensitivity of asset return to market-wide illiquidity, is strongly priced in developed markets and in overall markets. For example, the premium of $\beta^{3,D}$ is -0.39 with t -value of -2.73 in the overall market when the firm characteristics are included as controls. However, inconsistent with US evidence of Pastor and Stambaugh (2003) and Bekaert, Harvey, and Lundblad (2003) for emerging markets, this beta is not priced in the US market and in emerging markets.

Fama-MacBeth regression tests based on predicted betas also show that the commonality beta, $\beta^{2,D}$, is significantly priced in emerging markets. However, it is only marginal at a 10% significance level. While the results for emerging markets show some evidence of priced local commonality liquidity risks, those for developed markets and for the US market do not.

In sum, we find strong evidence that investors are compensated for holding stocks whose returns are sensitive to the local market-wide illiquidity fluctuations. We also find that sensitivity

of stock returns to local market illiquidity is priced in developed markets and in overall world markets and that risks due to commonality in illiquidity is marginally priced in emerging markets. However, we could not find evidence that expected illiquidity and local market risks are related to cross-sectional differences in asset prices.

6.3 Fama-MacBeth test results for global liquidity risks

The LCAPM in equation (4) is based on the assumption that the world financial markets are fully-integrated, and thus only world market returns and illiquidity matter while those of local markets are not important. Table 5 shows the results from the Fama-MacBeth regression tests based on the fully-integrated world financial market model.

While liquidity net beta of $\beta^{5,W}$ is strongly priced in all specifications in the table, net beta ($\beta^{6,W}$) that also includes market risk is not priced in any case. Combined with evidence that expected illiquidity is not priced (ZR is never significant in the table), the world LCAPM is rejected. Sharp contrasts between liquidity net beta and net beta in their pricing implication suggest that poorly working world market beta, which is not significant in any specification, can be a force that rejects the model.

As seen in $\beta^{5,W}$, which is strongly priced with premiums varying from 0.10 to 0.19 with t -values much larger than three, liquidity risks with respect to world market factors are important in world financial markets. We see that $\beta^{3,W}$ and $\beta^{4,W}$ drive pricing of liquidity net beta in most cases. Global liquidity risk arising from the covariance of individual stock illiquidity with global market-wide returns, $\beta^{4,W}$, is priced in the overall market, in the emerging markets, and in the US market. $\beta^{4,W}$ is priced with a premium of -0.07 with t -value of -1.95 after controlling for size and book-to-market in the overall world market. Pricing of $\beta^{4,W}$ is stronger in other specifications. In the specification (not reported) with expected illiquidity and global market risk, $\beta^{4,W}$ has a premium of -0.12 (-0.17) with t -value of -4.09 (-4.42) in the developed markets (overall world markets). Collinearity among betas in the reported specification may camouflage significance of $\beta^{4,W}$ in the developed and overall world markets. In the US market, $\beta^{4,W}$ is priced in all presented specifications even when the firm characteristics are controlled for (premium of -0.12 with t -value of -3.95). We also find weak evidence that global commonality liquidity risks are priced in the US market (premium of 0.32 with t -value of 1.73).

$\beta^{3,W}$ is priced in the developed and overall world markets. This is consistent with Liang and Wei (2005), who find evidence that this liquidity risk is priced in developed markets. In an unreported specification, $\beta^{3,W}$ is priced in emerging markets as well as in the US market: when the regression contains expected illiquidity and market risk in addition to $\beta^{3,W}$, $\beta^{3,W}$ is weakly priced in emerging markets with a premium of -0.39 with t -value of -1.77 and in the US markets (premium of -0.23 and t -value of -1.74). Table 5 also shows weak evidence that global commonality liquidity risks are priced in the US market (premium of 0.32 with t -value of 1.73).

In this section, we find evidence that global liquidity risk arising from the covariances of individual stocks' illiquidity (return) with market returns (illiquidity) are priced globally. This implies that the global investors re-balance their portfolio according to changes in global market return or illiquidity and this re-balancing has a different impact on asset prices since impact of global market shock varies according to individual stocks depending on their covariance with market shocks. Considering that liquidity is a global phenomenon, as we can see from the episodes such as the Asian Financial Crisis and Long-Term Capital Management, it is appealing that global liquidity risks affect asset prices in world financial markets.

6.4 Fama-MacBeth test results for local and world market liquidity risks

Until now, the Fama-MacBeth regression results are based on the models of fully-segmented or fully-integrated world financial markets. It is reasonable to assume that the degree of integration of world financial markets lies somewhere in between (Errunza and Losq (1985)). When the local and world market risks are jointly tested, the relative importance of local and world factors will be affected by the degree of integration. To obtain an econometric model, we decompose world market returns and illiquidity into those of domestic and *non-local world* market components.

$$R_t^W = \omega R_t^D + (1 - \omega) R_t^{W-D}$$

$$C_t^W = \omega C_t^D + (1 - \omega) C_t^{W-D}.$$

ω is a ratio of market values of local and world markets. R_t^{W-D} and C_t^{W-D} denote the world market returns and illiquidity, respectively, obtained as value-weighted averages of returns and illiquidity of stocks from all sample countries except those from the given country of interest.

By putting the above equations into (4), we obtain the following model.

$$E(R_{i,t} - R_{f,t}) = E(C_{i,t}) + \lambda^{*W} \beta_i^{*1,W} + \lambda^{*W} \beta_i^{*2,W} - \lambda^{*W} \beta_i^{*3,W} - \lambda^{*W} \beta_i^{*4,W} \quad (9)$$

$$+ \lambda^{*D} \beta_i^{*1,D} + \lambda^{*D} \beta_i^{*2,D} - \lambda^{*D} \beta_i^{*3,D} - \lambda^{*D} \beta_i^{*4,D}$$

where,

$$\beta_i^{*1,D} = \frac{Cov(R_{i,t}, R_t^D - E_{t-1}(R_t^D))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

$$\beta_i^{*2,D} = \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), C_t^D - E_{t-1}(C_t^D))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

$$\beta_i^{*3,D} = \frac{Cov(R_{i,t}, C_t^D - E_{t-1}(C_t^D))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

$$\beta_i^{*4,D} = \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), R_t^D - E_{t-1}(R_t^D))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

$$\beta_i^{*1,W} = \frac{Cov(R_{i,t}, R_t^{W-D} - E_{t-1}(R_t^{W-D}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

$$\beta_i^{*2,W} = \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), C_t^{W-D} - E_{t-1}(C_t^{W-D}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

$$\beta_i^{*3,W} = \frac{Cov(R_{i,t}, C_t^{W-D} - E_{t-1}(C_t^{W-D}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

$$\beta_i^{*4,W} = \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), R_t^{W-D} - E_{t-1}(R_t^{W-D}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}$$

The weight, ω , is forced to be included in the estimated premia of λ^{*D} and λ^{*W} in our empirical tests. The covariance in the numerator of the betas with respect to world markets is now defined in terms of non-local world markets. All betas above have a common denominator of variances related to world market returns and illiquidity. Hence, if $\lambda^{*D} = \lambda^{*W}$, then equation (9) reduces to (4).²¹ The liquidity net beta and the net beta are defined as:

$$\beta_i^{*5,D} \equiv \beta_i^{*2,D} - \beta_i^{*3,D} - \beta_i^{*4,D} \quad (10)$$

$$\beta_i^{*6,D} \equiv \beta_i^{*1,D} + \beta_i^{*2,D} - \beta_i^{*3,D} - \beta_i^{*4,D}$$

$$\beta_i^{*5,W} \equiv \beta_i^{*2,W} - \beta_i^{*3,W} - \beta_i^{*4,W}$$

$$\beta_i^{*6,W} \equiv \beta_i^{*1,W} + \beta_i^{*2,W} - \beta_i^{*3,W} - \beta_i^{*4,W}$$

²¹In empirical studies in this paper, however, we use only the time-series of world market factors that coincide with that of local market factors. For example, if local market data is available from 1993 (e.g., Luxembourg), the variance of world market factors in the denominator of betas is calculated using world market factors from 1993.

The econometric model to jointly test local and world market liquidity risks is presented below.

$$E(R_{i,t} - R_{f,t}) = a^* + b^* E(C_{i,t}) + \lambda_j^{*W} \beta_{i,t}^{*1,W} + \lambda_j^{*W} \beta_{i,t}^{*2,W} - \lambda_j^{*W} \beta_{i,t}^{*3,W} - \lambda_j^{*W} \beta_{i,t}^{*4,W} \quad (11)$$

$$+ \lambda_j^{*D} \beta_{i,t}^{*1,D} + \lambda_j^{*D} \beta_{i,t}^{*2,D} - \lambda_j^{*D} \beta_{i,t}^{*3,D} - \lambda_j^{*D} \beta_{i,t}^{*4,D}$$

As in (9), betas have a common denominator of the variance in terms of world market returns and illiquidity and the betas with respect to world markets are defined by the covariance with non-local world markets. As in the cases for the model of fully-segmented or fully-integrated world financial markets, the LCAPM requires $a^* = 0$ and $b^* = 1$.

Table 6 summarizes the results of the Fama-MacBeth regression tests of equation (11), which is based on the decomposed world markets factors. It is striking to see that global liquidity net beta, $\beta^{*5,W}$, subsumes local liquidity net beta, $\beta^{*5,D}$, in all specifications in all markets. In the overall world market, local liquidity net beta which was significant with a premium of 0.117 (t -value 4.17) in Table 4 is now insignificant with a premium of 0.004 (t -value of 1.28). In contrast, global liquidity net beta, which was significant with a premium of 0.135 (t -value of 4.63) in Table 5 is still significant with a similar premium of 0.137 but with a larger t -value of 5.16. A similar phenomenon is observed in the developed, emerging, and the US markets. Local liquidity risk is no longer priced when the global liquidity risks are jointly tested. While premiums for global liquidity net beta are at similar levels with those in Table 5, premiums for local liquidity net beta vary from 0.004 to 0.037, which are much smaller than those in Table 4. In the US market, the global liquidity net beta, $\beta^{*5,W}$, is priced with a premium of 0.118 with t -value of 3.98 while local liquidity net beta is also priced (premium 0.037 with t -value of 3.25).

Pricing of the liquidity net beta seems to be driven by the global liquidity risk of $\beta^{*4,W}$. $\beta^{*4,W}$ is priced in all markets with premiums varying from -0.137 to -0.322 which are mostly larger than those in Table 5 (t -values of -2.81 to -4.31). It is priced even after controlling for size and book-to-market in all markets. Local liquidity risk, $\beta^{*4,D}$, is also significant in all markets and in all specifications but its premium is much smaller than those in Table 4 where only local risks are considered. For example, $\beta^{*4,D}$ has a premium of -0.216 (t -value of -3.46) in the overall world market in Table 4 but it is only -0.046 (t -value of -2.48), the magnitude of which is only roughly a quarter in Table 6. The net beta, $\beta^{*6,W}$, is never priced in any markets.

Table 6 shows that the global liquidity risk of $\beta^{*4,W}$ is more important than local liquidity risks and drives the global liquidity net beta, $\beta^{*5,W}$, to be priced subsuming local liquidity net beta in the overall world markets. Stronger effect of global liquidity risks on asset pricing than that of local liquidity risks is interesting and gives us some insight supporting that liquidity is a global phenomenon rather than a local phenomenon. However, it is still striking given that home bias is wide spread and country factors matter much in international financial markets (Tesar and Werner (1995), Kang and Stulz (1997), Stulz (2005) among others).

6.5 Do US markets drive world market liquidity risks?

In the previous subsections, we saw that global risks are more important than local risks in asset pricing both in developed and overall world markets. US results presented in the previous tables raise interesting questions as to whether the US market is a driving force of global liquidity risks. This section investigates the pricing effect of the comovements of individual stocks' returns or illiquidity with those of US markets.

We test the model of (9) by decomposing world market factors into those of the US market (superscript 'US') and the rest of the world market ($(W - D) - US$) after excluding local market and US market factors. All betas will be defined accordingly. In the regressions, US stocks are dropped from the test assets.²²

$$\begin{aligned}
E(R_{i,t} - R_{f,t}) = & E(C_{i,t}) + \lambda^{*D} \beta_i^{*1,D} + \lambda^{*D} \beta_i^{*2,D} - \lambda^{*D} \beta_i^{*3,D} - \lambda^{*D} \beta_i^{*4,D} \\
& + \lambda^{*US} \beta_i^{*1,US} + \lambda^{*US} \beta_i^{*2,US} - \lambda^{*US} \beta_i^{*3,US} - \lambda^{*US} \beta_i^{*4,US} \\
& + \lambda^{*W-US} \beta_i^{*1,W-US} + \lambda^{*W-US} \beta_i^{*2,W-US} \\
& - \lambda^{*W-US} \beta_i^{*3,W-US} - \lambda^{*W-US} \beta_i^{*4,W-US}
\end{aligned} \tag{12}$$

where,

$$\begin{aligned}
\beta_i^{*1,D} &= \frac{Cov(R_{i,t}, R_t^D - E_{t-1}(R_t^D))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*2,D} &= \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), C_t^D - E_{t-1}(C_t^D))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}
\end{aligned}$$

²²Thus, US stocks do not affect cross-sectional regression of equation (6) in predicted beta estimation.

$$\begin{aligned}
\beta_i^{*3,D} &= \frac{Cov(R_{i,t}, C_t^D - E_{t-1}(C_t^D))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*4,D} &= \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), R_t^D - E_{t-1}(R_t^D))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*1,US} &= \frac{Cov(R_{i,t}, R_t^{US} - E_{t-1}(R_t^{US}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*2,US} &= \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), C_t^{US} - E_{t-1}(C_t^{US}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*3,US} &= \frac{Cov(R_{i,t}, C_t^{US} - E_{t-1}(C_t^{US}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*4,US} &= \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), R_t^{US} - E_{t-1}(R_t^{US}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*1,W-US} &= \frac{Cov(R_{i,t}, R_t^{(W-D)-US} - E_{t-1}(R_t^{(W-D)-US}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*2,W-US} &= \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), C_t^{(W-D)-US} - E_{t-1}(C_t^{(W-D)-US}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*3,W-US} &= \frac{Cov(R_{i,t}, C_t^{(W-D)-US} - E_{t-1}(C_t^{(W-D)-US}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])} \\
\beta_i^{*4,W-US} &= \frac{Cov(C_{i,t} - E_{t-1}(C_{i,t}), R_t^{(W-D)-US} - E_{t-1}(R_t^{(W-D)-US}))}{Var(R_t^W - E_{t-1}(R_t^W) - [C_t^W - E_{t-1}(C_t^W)])}.
\end{aligned}$$

This econometric model is easy to derive in a similar way for equation (9) by decomposing the non-local world market returns and illiquidity, R_t^{W-D} and C_t^{W-D} , into those for US market, R_t^{US} and C_t^{US} , and those for non-US world market, $R_t^{(W-D)-US}$ and $C_t^{(W-D)-US}$, respectively. Again, the weights on each factor are reflected in the premia.

Time series averages of estimated premia in the Fama-MacBeth regressions are shown in Table 7. Overall, we have some evidence that the illiquidity of stocks across the world financial markets comoves with the US market return and such comovements significantly affect asset returns. The table shows that the liquidity beta with respect to US market return, $\beta^{4,US}$, is priced in all markets (premium varying from -0.094 to -0.180) while that with respect to the rest of the world, $\beta^{4,(W-D)-US}$ under the columns labelled with ‘Non-US’, is not significant.

Priced liquidity beta arising from the covariance of asset returns with world market returns is not seen in Table 5. We conjecture that the impact of such liquidity risks on asset prices were camouflaged because they were confounded by the influence of non-US world market illiquidity.

Separating out the US market illiquidity makes the effect of US market illiquidity on asset price clearer by removing such a confounding effect.

Table 7 also shows that the liquidity net beta with respect to the US market is priced in developed markets (premium of 0.065 with t -value of 2.02). Liquidity net beta with respect to non-US world market factors is priced in the emerging markets but not in the developed markets. Examining each component of the liquidity net beta reveals that the pricing of liquidity net beta is mostly driven by $\beta^{4,US}$ in developed markets. In contrast, liquidity net beta effect is driven by the commonality beta, $\beta^{2,(W-D)-US}$, in the emerging markets. The commonality beta is marginally priced in the overall world markets with a premium of 0.243.

The evidence in this subsection shows that US market returns affect asset prices of individual stocks from around the world through covariance of illiquidity with US market return. When the US market is in a downturn, global investors need to re-balance their portfolios. In such re-balancing, stocks whose liquidity plummets in a US market downturn is less valuable. Finally, investors request compensation to hold such stocks and the asset price is negatively related to such liquidity risk.

6.6 Time series tests

Until now, we have presented the results of cross-sectional regressions in a Fama-MacBeth framework. Another popular method of showing the importance of liquidity risks in asset pricing is a *time-series* tests (Pastor and Stambaugh (2003), Sadka (2004) and Liang and Wei (2005)). The time-series test does not directly test the LCAPM since it does not jointly test the multiple risks in the model. Thus, the time-series test results should be evaluated as supporting evidence confirming the pricing of risk factors, not as evidence in favor of or against a particular asset pricing model. Since our Fama-MacBeth regression tests show that the risks related to global markets are more important than those related to local markets, we perform time-series tests based on predicted betas with respect to world market returns and illiquidity only. Predicted global betas are obtained by the econometric model of (11).

Results from the three different restrictions on j in equation (11) are reported in panel A of Table 8, each labelled with ‘All countries’, ‘Developed markets’ and ‘Emerging markets’: In the rows labelled with ‘All countries’, stocks are sorted into ten equally-weighted portfolios

ignoring countries based on their estimated predicted betas. In ‘Developed markets’ (‘Emerging markets’), the ten portfolios are formed based only on stocks from developed (emerging) markets ignoring countries within the same region. In all cases, individual stock returns are equally-weighted to form portfolio returns. Each portfolio return in excess of the risk-free rate is regressed on excess returns of world market in the following market model:

$$R_{p,t}^k - R_{f,t} = \alpha_p^k + \delta_p^k (R_t^W - R_{f,t}) + \xi_{p,t}^k \quad (13)$$

$$R_{p,t}^k - R_{f,t} = \alpha_p^k + \delta_p^k (R_t^W - R_{f,t}) + \varphi_1^k SMB_t + \varphi_2^k HML_t + \eta_{p,t}^k \quad (14)$$

Global SMB and HML are formed in a way introduced in Griffin (2002). Table 8 shows the estimated intercepts with t -values in parentheses from the above regression of each of the ten portfolios ($p = 1, \dots, 10$) formed based on the predicted beta k ($k = 1, 2, 3, 4$). Rows labelled with ‘Market Model’ and ‘F-F 3 Factor Model’ denote that the intercepts are from equations in 14 and 14, respectively. The last column of the table (labelled with ‘10-1’) is the difference of estimated intercepts obtained from the regressions of portfolios with the highest predicted beta ($p = 10$) and from those with the lowest predicted beta ($p = 1$). Henceforth, we call this difference the ‘10-1 spread’. Economically, 10-1 spread denotes the excess return earned by taking long position in portfolio 10 and short position in portfolio 1 at the same time.²³ Panel A and B reports the test results based on predicted betas with respect to world markets. Panel B will be examined in section 6.7. Panel C reports the test results for the US markets. To save space, we report only the results based on the liquidity net beta and the net beta in the table.

Consistent with the results from the Fama-MacBeth regressions, panel A of Table 8 shows that the trading strategy of forming a factor mimicking portfolio using stocks from all over the world based on the global liquidity risks of $\beta^{5,W}$ produces significant excess monthly returns of 1.71% and 0.84% from market model and three factor model, respectively. On an annual basis, these returns are approximately annual 22.8% and 10.6%, respectively and are statistically (t -values are 4.63 and 3.88) and economically significant. However, considering that these profits are based on global trading, large trading costs would follow in performing this strategy. An unreported result shows that these excess returns are mostly driven by $\beta^{4,W}$: the 10-1 spread is 1.52% (market model) and 0.68% (three factor model) with respective t -values of 4.32 and 1.86.

²³We will refer to such trading strategy as trading strategy of forming factor mimicking portfolio or hedge-portfolio in this section.

While trading based on global liquidity net beta produces significant excess returns, similar trading based on net beta including market risk, $\beta^{6,W}$, does not produce any significant profits. In either the market model or the three factor model, we see that the 10-1 spread is statistically insignificant.

Panel A of Figure 2 plots intercepts from the market model for global liquidity net beta (Panel A of Table 8). Bars in the graph denote excess returns while lines with bullets are for matching t -values. The last columns of the graph (shaded area) denotes 10-1 spread. The graph clearly shows that monotonically increasing pattern of intercepts according to size of global liquidity net beta in overall, developed, and emerging markets. It also shows that excess returns based on global liquidity net beta are largest in emerging markets.

Panel C shows the time-series test results for US stocks. Every stock in the US market is sorted into 10 portfolios based on predicted betas estimated with respect to the US local market returns and illiquidity (rows labelled with ‘US local’) or with respect to those of world market (‘US world’). Local predicted betas are based on the fully-segmented world financial market model of (2) while the global predicted betas are obtained from the fully-integrated model of (4).

The liquidity net betas with respect to both local and world market factors are strongly priced in the US market. The trading strategy of buying high liquidity net beta stocks and selling low ones in the US market produces excess returns of 1.48% and 1.32%, respectively for the local and global market betas (three factor model). These correspond to annual excess returns of 19.43% and 17.16%, respectively. In contrast to Fama-MacBeth regression results for US market in Table 4, trading based on $\beta^{2,D}$ and $\beta^{3,D}$ in US market also produces significant profits (unreported). In a three factor model, 10-1 spread based on $\beta^{2,D}$ ($\beta^{3,D}$) produces 1.08% (0.58%) excess returns. In a market model, the spread is 0.95% and 0.80% for $\beta^{2,D}$ and $\beta^{3,D}$, respectively, or 12.07% and 10.07% annually.²⁴ However, a similar trading strategy based on the net beta, $\beta^{6,D}$, does not produce significant excess returns in the US market. Panel B of Figure 2 plots intercepts from market model for local and global liquidity net beta for US stocks (Panel C of Table 8).

²⁴Pastor and Stambaugh (2003) find annual 8.23% excess returns in a market model regression using equally-weighted portfolios based on $\beta^{3,D}$.

In this section, we find confirming evidence of the empirical results from the Fama-MacBeth regression tests in the previous subsections. In addition, we find that the trading strategy of forming hedge-portfolios based on global liquidity risks produces economically significant excess returns.

6.7 Subperiod analysis

In the previous sections, we saw that global liquidity risks are more important than local market illiquidity. We expect that the global effect would be stronger in recent years as the financial globalization process has evolved.²⁵ Bekaert and Harvey (2000) and Henry (2000), among others, suggest the specific dates of financial globalization before and after which, 12 to 20 emerging markets have structural breaks in the equity returns, cost of capital, volatility of returns, market risk or the correlation with global market returns. According to their research,²⁶ most countries in our sample have liberalization dates in the period between 1986 and 1992. However, splitting the sample period based on these financial globalization date would make the tests based on different samples of stocks. In Table 1, we see that many emerging markets begin to have data in late 1980s to mid-1990's. In addition, estimating pre-ranking betas requires the stocks to have five years data before they begin to have pre-ranking betas. Thus, stocks whose data start in the mid-1990's can be included in the Fama-MacBeth regression only from the late 1990's.

Instead of splitting the sample periods based on financial liberalization dates, we focus on the event of the Long-Term Capital Management (LTCM) crisis. It is interesting to see the difference, if any, in the pricing of liquidity risks pre- and post-LTCM crisis (January 1989 - August 1998 and September 1998 - December 2004, respectively) since the LTCM event is known to have led to a deterioration in liquidity in international financial markets and in the post-LTCM period, liquidity has improved rather quickly in many countries.²⁷

Table 9 shows the results from the Fama-MacBeth regression tests using predicted betas with respect to world market factors based on the model of fully-integrated world financial markets

²⁵Bekaert, Harvey, and Lundblad (2003) find the evidence that supports this hypothesis.

²⁶See Table I of Bekaert and Harvey (2000) and Table II of Henry (2000).

²⁷"It was felt that liquidity pre-LTCM in many markets was underpriced, and that this led financial institutions to underestimate liquidity risks", "Most of the indicators ... show that liquidity has since [fall of 1998] improved, sometimes significantly, across a large cross-section of markets, with the notable exception of the US government bond market." (*Structural Aspects of Market Liquidity from a Financial Stability Perspective*, Committee on the Global Financial System, June (2001), Bank for International Settlements)

of (4) for the period of January 1994 - August 1998 (panel A) and September 1998 - December 2004 (panel B). Global liquidity net beta $\beta^{5,W}$ is priced both in the pre- and post-LTCM period in all markets. The magnitude of the premium is larger in the pre-LTCM period (0.17) than in post-LTCM period (0.11) in overall world market. However, the magnitude of the premium is larger in the post-LTCM period (0.207) than in the pre-LTCM period (0.156) in emerging markets suggesting that the effect of world market integration on the pricing implication of liquidity risks improves in the post-LTCM period in emerging markets.

The test results based on global commonality liquidity risks show sharp contrasts between the two subperiods. We see that global commonality liquidity risks become significant in the post-LTCM period. In the post-LTCM period, global commonality liquidity beta, $\beta^{2,W}$, is priced in all markets while it is never priced in pre-LTCM period. For example, in emerging markets, commonality liquidity beta is not priced with a premium of -0.34 (t -value of -0.77) in the pre-LTCM period. This becomes significant in post-LTCM period with a premium of 0.36 (t -value of 1.95).

Subperiod analysis based on time-series tests in the panel B of Table 8 supports the inference from Table 9. In panel B of Table 8, global betas are obtained in a fully-integrated world financial market model of (4). In the post-LTCM period, the 10-1 spread based on the global liquidity net beta is statistically and economically significant. In emerging markets, trading based on global liquidity net beta produces higher excess returns in the post-LTCM period than in the pre-LTCM period supporting evidence in Table 9. In the emerging markets, the spread is 3.80% in the post-LTCM period and this excess return is larger than the 2.92% shown for the whole sample period in panel A in the same table.

Results from subperiod analysis can be summarized as follows. First, we find that global liquidity net beta is priced in both pre- and post-LTCM period. Second, the effect of global liquidity net beta on assets in emerging markets is stronger in post-LTCM period than in pre-LTCM period. Third, we find an increasing impact of global commonality liquidity risks on asset price in overall world markets in post-LTCM period. These findings are consistent with our conjecture that the importance of global liquidity risk increases over time with the degree of financial integration.

7 Robustness tests

The goal of this section is to evaluate the robustness of the empirical results in the previous section. In section 6, we used various test methods such as Fama-MacBeth regressions based on predicted betas, time-series tests and subperiod analysis. Consistent results produced by each test show the robustness of our empirical results. In this section, we show that the previous results are not specific to the method of constructing innovations in returns and illiquidity. We also show the test results based on standard two-way sorts in Fama-MacBeth regressions of Fama and French (1992) based on post-ranking betas.

7.1 Different innovation

At the cost of having look-ahead bias and employing discontinuous time-series (see section 5.1), we test the LCAPM based on innovations from AR(2) methods following Pastor and Stambaugh (2003) and Acharya and Pedersen (2005). Based on predicted betas, we also test whether the innovations from an AR(1) fitting produce similar results and find virtually no difference for our inference about the priced liquidity risks in the previous section.²⁸

Using an AR(2) fitting, we also find that global liquidity risk is more important than local liquidity risk and that global liquidity risk arising from the covariance of stock illiquidity with market return, $\beta^{4,W}$ is priced in the world financial markets. We also find that US market is an important driving force of world market illiquidity. Employing an AR(1) instead of an AR(2) and including time-trend in AR fitting does not make significant difference in the inference.²⁹

7.2 Two-way sorts

In the Fama-MacBeth regression tests of Fama and French (1992), post-ranking betas are estimated by the portfolios formed based on size and estimated pre-ranking betas (2-way sorts). Size is a popular instrument for sorting stocks because portfolios sorted based on size generally help produce sufficient dispersion in estimated loadings, and, in turn, such dispersion increases the power of the test. This might be controversial in that it may artificially infuse a size effect into the test. However, since the two-way sorts have been widely used in the previous studies in

²⁸Thus, the result is not tabulated. It is available upon request from the author.

²⁹Actually, previous version of this paper is based on AR(2) fitting throughout. Readers may refer to the tables in the previous version of this paper. It is available upon request.

asset pricing, as a robustness check, we report the Fama-MacBeth regression results from post-ranking betas estimated by portfolios from two-way sorts. For comparison with other studies which employ AR(2) fitting to construct innovations in returns and illiquidity, we follow AR(2) fitting in this two-way sorts exercise. Overall, the two-way sort does not change the previous results about the global liquidity risk of $\beta^{4,W}$.

In two-way sorts, stocks are first sorted into N ($N = 3, 5, 10$) size portfolios based on the market capitalization (in US dollar terms) at the beginning of each year. Then, within each size group, stocks are re-sorted into N portfolios by their estimated pre-ranking betas, which are estimated as described in section 5.2. If the number of stocks in a country is between 100 (inclusive) and 300, the stocks are sorted into 3×3 portfolios (small country-size group). $N = 5$ for each country who covers more than 300 and less than 500 stocks (medium country-size group) and $N = 10$ for countries with more than 500 stocks (large country-size group).³⁰ Similarly, stocks are sorted into portfolios based on their size and pre-ranking betas with respect to world market returns and illiquidity.

As in Fama and French (1992), post-ranking betas are calculated using portfolio returns and innovations in illiquidity for the entire time-series: Post-ranking beta k is calculated by the definition of beta k under the equation (2) or (4), respectively, with respect to local and world market factors using returns and innovations in illiquidity of portfolio formed based on local or world pre-ranking beta k . These post-ranking betas for each portfolio are assigned to individual stocks which belong to that portfolio. As a result, each individual stock has a market beta as well as three liquidity betas for both local and world market factors which are assigned from different portfolios that it belongs to.

Appendix 3 reports the result of Fama-MacBeth regression tests for individual stocks with two-way sorted post-ranking betas with respect to local market (panel A) and world market factors (panel B) for the period of 1988-2004. Local risks are based on the LCAPM of fully-segmented world markets while the global risks are obtained based on the model of fully-integrated world financial markets.

³⁰Stocks from countries of Austria, Belgium, Chile, Denmark, Finland, Indonesia, Israel, Mexico, Netherland, New Zealand, Norway, Philippines, Poland, Portugal, Spain and Turkey are sorted into three portfolios. The five portfolio groups for each beta are formed for the countries of Greece, India, Italy, Singapore, Sweden, Switzerland and Thailand. The ten portfolio group is for the countries of Australia, Canada, China, France, Germany, Hong Kong, Japan, Malaysia, South Africa, South Korea, Taiwan, the UK and the US.

We see that two-way sorts do not change the inference about global liquidity risk of $\beta^{4,W}$. Consistent with our previous results, it is priced in developed markets and the overall world markets. The average premium varies from 0.027 to 0.057 with absolute t -values of 1.95 and 3.18 in developed markets. In the overall world markets, the absolute values of the premiums are 0.025 to 0.050 with absolute t -values of 1.69 to 3.19 when the firm characteristics are not controlled for. This global liquidity risk is also priced in the US market together with $\beta^{3,W}$ and local liquidity risks of $\beta^{3,D}$ and $\beta^{4,D}$. We note that the commonality beta with respect to both local and world markets continuously have the wrong sign.

In developed markets, $\beta^{3,W}$ is priced in the specifications without size and book-to-market. However, this is not strong enough to lead $\beta^{3,W}$ to be priced in the overall world markets. Different from our previous results, local liquidity risk of $\beta^{4,D}$ is now priced in developed markets (premiums of -0.057 with absolute t -values of larger than 2) in the specifications without firm characteristics. This significant result for $\beta^{4,D}$ in developed markets contributes to the significance of the same liquidity risk in the overall world markets. In emerging markets, $\beta^{3,D}$ is no longer priced in any presented specification.

8 Conclusion

This paper investigates an equilibrium asset pricing relationship with liquidity both as a characteristic and as a risk factor in international financial markets. Our test assets cover 25,000 stocks from 48 countries from emerging and developed markets for January 1988 to December 2004. To our knowledge, this is the first paper that assesses multiple liquidity risks as well as market risk similar to Acharya and Pedersen (2005)'s liquidity-adjusted capital asset pricing model (LCAPM) for international financial markets. It is also the most comprehensive to date, in that our sample covers stocks from both emerging and developed markets, which helps form truly representative world market factors.

Using a variety of test methods including Fama-MacBeth cross-sectional tests, and in the time-series tests, we evaluate the unconditional version of the LCAPM extended to the international financial markets. Though we reject the overidentifying restrictions of the LCAPM of Acharya and Pedersen (2005), we find that a variety of liquidity risks arising from the covariances of asset return (liquidity) with local and global market liquidity (returns) are priced.

Interestingly, we find global liquidity risks subsume local liquidity risks and a trading strategy based on non-traded global liquidity risks is shown to produce annualized excess returns of 10.6 percent. We interpret our evidence as consistent with an intertemporal capital asset pricing model (Merton (1973)) in which stochastic shocks to global liquidity serve as a priced state variable.

In this paper, we show that the US market is an important driving force of global liquidity risks. Specifically, the US market returns affect asset prices of individual stocks from around the world through covariances of liquidity with US market returns. When the US market declines, global investors seek to re-balance their portfolios. In the process of this re-balancing, stocks whose liquidity plummets in a US market downturn are less valuable. Finally, investors require compensation to hold such stocks and the asset price is negatively related to such liquidity risk.

An important limitation is that we have tested only the unconditional version of the global LCAPM. An interesting extension of this study will be to test the conditional version of the LCAPM, where liquidity risks vary over time in a way that depend on predetermined information variables. Such an extension will also allow us to investigate the determinants of time-varying liquidity risk premia in international financial markets. Based on the results in this paper, we conjecture that the economic variables that have been revealed to affect US market returns would also influence time-varying liquidity risks in world financial markets.

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Figure 1: Correlation of liquidity measures in US market

From ISSM/TAQ data, daily proportional quoted spread (PQS; defined as quoted spread divided by quote mid-point) are calculated for AMEX and NYSE stocks for 1983-2003 and it is averaged every month to form monthly time-series. Figure plots the zero-return proportion, ZR, and PQS in the US market over time. The suffix 1 denotes the variables are from the smallest quintile, while the suffix 5 denotes the variables are from the largest quintile, where each quintile is formed based on individual stocks' previous end-year market capitalization.

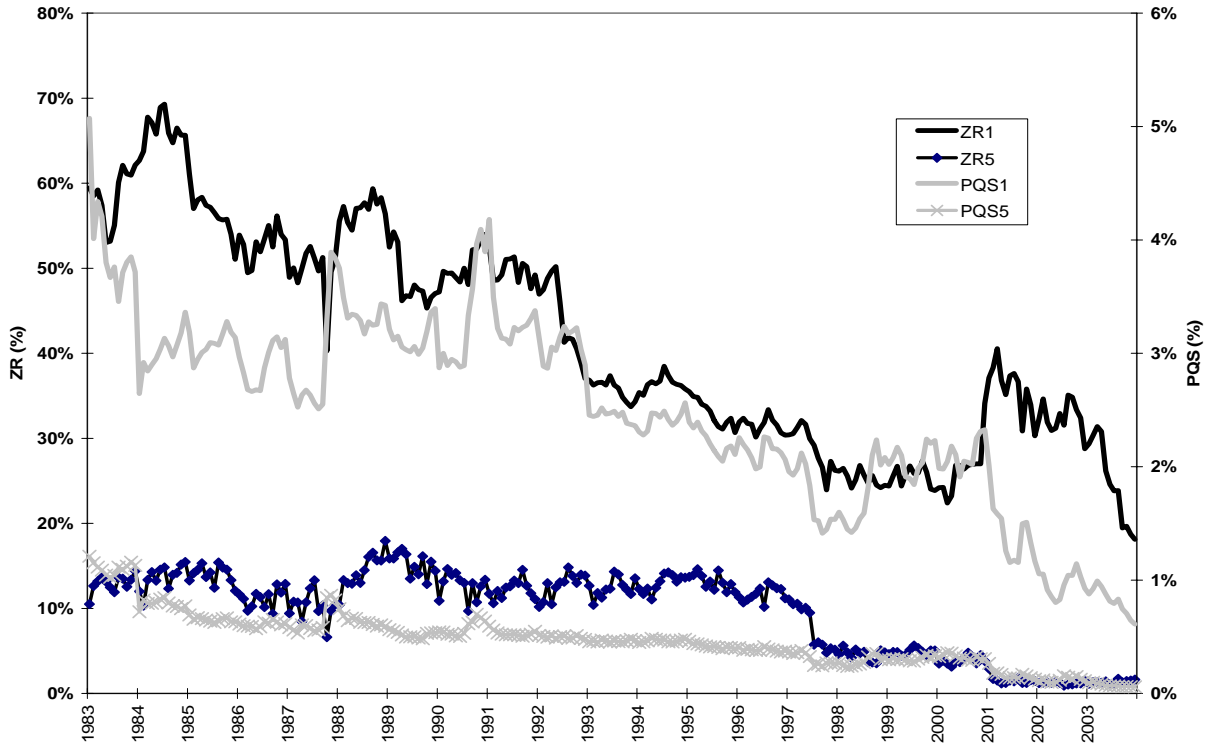
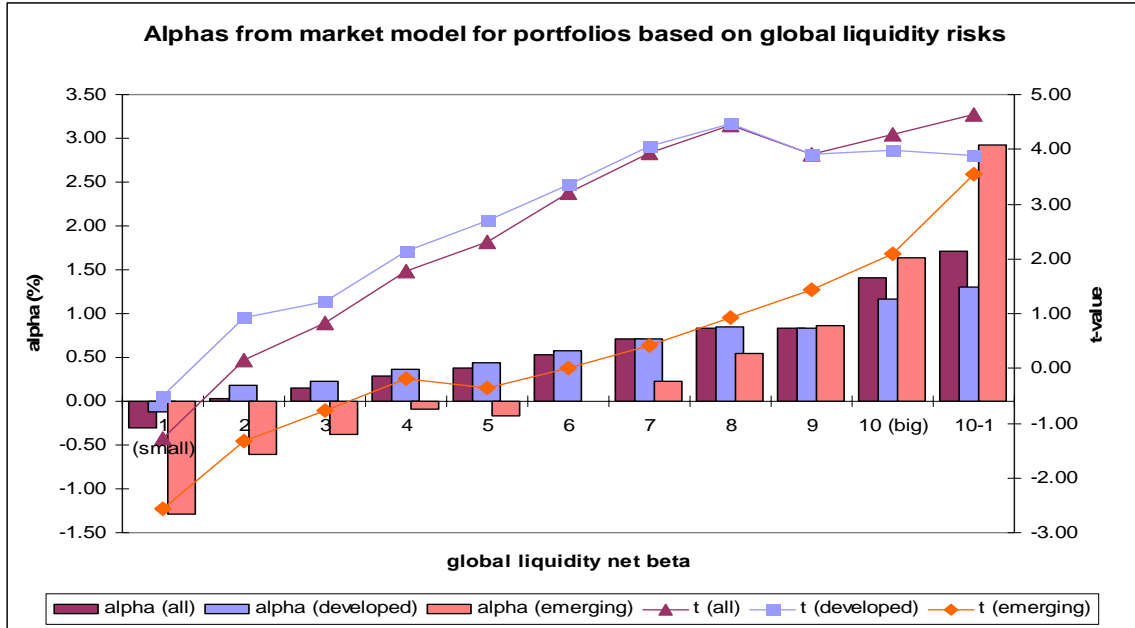


Figure 2: Alphas

Panel A and B plots intercepts and t-values from market model of panel A and C of Table 8. Bar denote intercept while bulleted lines are for t-values.

Panel A: Alphas from market model for portfolios based on global liquidity risks



Panel B: Alphas from market model for US portfolios based on US local and global liquidity risks

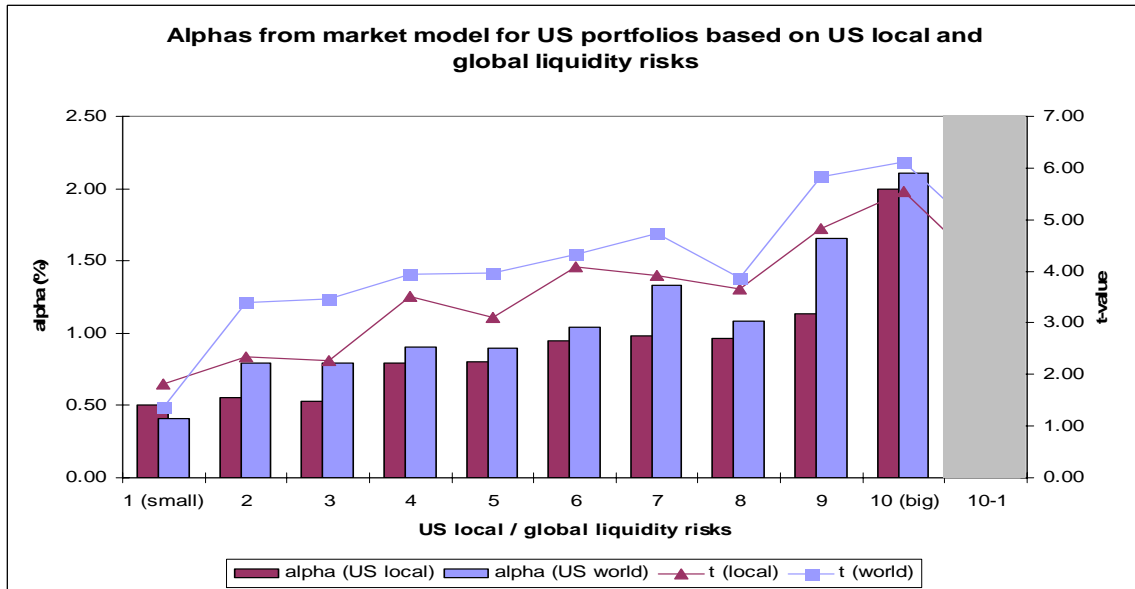


Table 1: Summary statistics

Daily returns are calculated using daily total return index from Datastream for all available stocks from 48 countries for the period of January 1988 to December 2004. For a stock to be included in the sample, it should have market capitalization and book-to-market data and be traded in major exchanges. Stocks with special features such as DRs, REITs, and preferred stocks were excluded. If the total number of non-missing return day is less than 15 days within a month, the stock is dropped from the sample for that month. If more than 90% (inclusive) of stocks in a given exchange have zero returns on that date, returns for all stocks in that exchange are set to missing. We set the daily return to be missing if any daily return above 100% is reversed the next day or if either the total return index for the previous day or that of the current day is less than 0.01. The zero-return proportion (ZR) is calculated as the number of zero-return days divided by the number of non-missing trading days in a given month. After screening the daily data following the above procedure, the end-month total return index together with the end-month exchange rate is used to calculate monthly US dollar returns. Monthly returns calculated from the total return index of less than 0.01 and those above 300% that are reversed within a month are set to missing. Monthly returns or zero-returns of extreme 0.1% (inclusive) in the cross-section of each country are set to missing for that month. If the price at the end of the previous month is in the extreme 1% (inclusive) of top and bottom, that stock is dropped from the sample for that month. If a stock has more than 80% (inclusive) of zero-return days in a year or in a whole sample, that stock is dropped for that year or from the sample, respectively. After all these screens, the stock should have at least 12 months data for the period of 1988-2004 to be included in the final sample. Table shows the number of stocks in the sample by country and by year and also show the equally-weighted average of monthly return and zero return proportion with their standard deviation (all in percentage). N denotes the total number of unique stocks across all sample period in a given country.

	N	Number of stocks in the sample															Average (%)		Median (%)		St dev (%)				
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	ZR	return	ZR	return	ZR	return	
Developed markets																									
AUSTRALIA	1140	29	57	85	96	98	97	100	99	125	158	154	182	235	395	801	841	865	38.50	1.97	35.00	0.51	22.62	18.39	
AUSTRIA	118	31	37	42	46	52	55	60	57	59	79	76	68	64	61	59	55	50	31.48	0.66	25.00	0.14	23.23	8.78	
BELGIUM	155	57	63	66	67	65	65	71	71	80	87	94	102	117	116	112	105	101	32.04	0.95	27.27	0.61	22.32	8.25	
CANADA	1308	250	274	299	324	338	348	372	388	429	450	464	596	756	794	834	874	820	25.46	1.45	22.73	0.47	17.62	15.32	
DENMARK	226	28	62	84	79	97	105	119	126	111	149	127	148	169	146	118	131	147	43.63	1.05	42.11	0.60	25.36	9.35	
FINLAND	159	17	26	30	40	44	45	45	57	55	75	85	94	120	124	121	122	121	34.15	1.18	30.00	0.41	22.66	11.84	
FRANCE	1058	109	161	338	373	384	392	391	392	402	499	561	630	680	727	697	635	591	28.41	1.05	21.05	0.31	22.87	13.09	
GERMANY	840	84	204	224	239	231	243	274	268	287	332	354	382	516	677	676	604	546	31.21	0.30	23.81	-0.21	24.28	14.25	
HONG KONG	828	57	76	83	89	113	133	131	153	257	347	358	379	379	497	618	678	698	32.99	1.40	27.27	-0.04	22.85	19.45	
IRELAND	52	14	19	22	19	14	15	14	15	11	16	12	15	13	16	18	21	23	48.96	1.04	52.17	0.53	22.92	12.08	
ITALY	366	143	166	184	186	191	190	178	161	157	172	185	200	215	243	235	232	218	16.59	0.48	10.00	-0.10	15.69	10.05	
JAPAN	1831	620	722	816	954	1202	1256	1274	1300	1353	1394	1400	1520	1542	1552	1601	1624	1583	23.45	0.41	15.79	-0.67	19.70	12.46	
LUXEMBOURG	23						8	10	7	10	13	14	13	12	13	16	15	13	34.65	0.82	31.82	0.53	19.57	7.81	
NETHERLANDS	240	78	92	95	116	126	128	133	139	138	153	165	183	182	164	145	140	135	26.46	0.99	19.05	0.62	21.14	10.17	
NEW ZEALAND	126	4	18	18	22	23	28	29	39	45	50	51	60	64	69	92	91	89	36.80	1.69	35.00	1.33	19.12	9.67	
NORWAY	245	38	46	49	53	51	66	71	83	87	110	135	155	141	127	124	126	128	35.41	1.25	30.00	0.70	24.22	13.71	
SINGAPORE	389	31	35	39	48	68	84	84	106	158	171	176	183	187	252	285	300	309	34.41	0.91	30.00	-0.12	21.36	14.43	
SPAIN	178	47	57	81	89	98	102	104	107	109	117	129	129	129	131	131	122	116	22.03	1.03	15.00	0.49	19.13	10.08	
SWEDEN	444	30	53	53	59	75	122	141	154	157	188	223	254	273	313	310	300	280	27.20	1.17	21.74	0.42	19.89	14.50	
SWITZERLAND	293	80	90	93	95	90	106	111	113	127	150	166	178	189	214	210	207	192	35.43	0.76	30.00	0.43	23.76	9.37	
UK	2765	848	1151	1169	1006	990	1006	1052	1032	1141	1356	1426	1388	1362	1400	1392	1364	1320	47.89	0.99	50.00	0.37	25.40	12.93	
US	6347	1757	1896	1870	1888	2136	2348	2637	3446	3782	4219	4391	4498	4429	4094	3865	3829	3637	20.22	1.62	17.39	0.68	14.75	13.95	
Emerging markets																									
ARGENTINA	64		1			3	9	15	21	26	32	40	39	42	32	44	49	49	30.39	0.74	22.73	-0.02	23.44	14.74	
BRAZIL	28							5	5	6	8	9	13	19	23	20	22	23	34.95	2.25	30.00	1.43	24.91	15.21	
CHILE	100			12	18	25	35	46	54	54	62	55	71	75	68	66	70	70	41.82	1.54	40.00	0.52	24.67	10.80	
CHINA	972						5	20	25	72	81	90	89	191	218	223	960	957	11.32	-0.86	8.70	-1.83	11.20	12.00	
COLOMBIA	23						7	10	10	10	12	12	14	11	9	12	16	17	46.22	1.78	45.00	1.14	20.68	10.89	
CZECH	64									16	53	60	51	34	23	6	8	9	38.59	-1.14	32.58	-1.45	26.56	14.17	
GREECE	322		25	27	31	29	55	74	97	110	161	161	59	72	276	277	163	130	17.79	0.66	13.64	-0.44	15.79	14.83	
HUNGARY	38								5	5	11	20	21	24	37	35	29	27	24.75	0.95	18.18	-0.10	20.81	12.10	
INDIA	302				1	15	59	107	119	189	211	217	208	222	237	264	241	201	20.82	0.21	15.00	-1.19	17.68	15.46	
INDONESIA	181						38	50	44	52	97	120	43	65	76	60	72	81	91	44.04	0.74	42.11	-0.30	22.58	16.38
ISRAEL	88								6	20	24	36	45	47	60	72	75	65	20.65	0.90	11.76	0.25	20.12	10.99	
MALAYSIA	603	46	54	66	77	120	176	186	191	274	322	361	364	373	431	481	513	536	26.69	0.81	22.73	-0.40	17.98	16.59	
MEXICO	94		6	7	6	13	22	36	42	43	50	50	54	54	44	38	42	50	33.34	0.63	23.81	0.05	25.46	14.56	
PAKISTAN	79						16	25	29	25	24	41	48	51	60	62	65	67	30.51	1.76	22.22	0.21	24.36	14.63	
PERU	33						3	7	13	11	19	16	13	13	13	13	12	19	44.14	0.14	43.48	-0.40	23.38	13.22	
PHILIPPINES	131		2	4	12	25	30	40	76	90	88	90	79	83	72	71	81	81	44.72	0.05	42.11	-1.65	22.35	20.22	
POLAND	96									17	32	38	56	68	78	81	78	76	19.92	1.30	15.00	0.56	15.39	12.91	
PORTUGAL	100		23	38	38	43	45	54	55	56	66	66	58	59	50	49	45	45	32.26	0.47	28.57	-0.23	21.89	9.90	
S.AFRICA	505	44	42	49	71	70	74	92	90	136	153	176	329	356	317	284	248	237	40.85	1.04	38.89	0.55	24.23	15.47	
S.KOREA	689	21	46	59	67	81	109	157	216	244	280	275	355	531	542	555	567	554	12.08	1.07	9.52	-0.61	8.82	17.68	
SRI LANKA	23									11	16	15	16	15	18	17	18	12	40.41	0.09	40.00	-0.68	19.27	11.96	
TAIWAN	664			1		7	20	43	99	190	205	211	222	327	402	580	626	628	13.67	0.66	10.53	-0.51	9.40	14.93	
THAILAND	414		1	5	7	47	86	155	191	212	215	185	193	156	228	236	272	296	35.74	0.95	30.00	-0.59	22.75	20.28	
TURKEY	207		3	9	13	28	47	48	50	64	85	110	132	146	159	183	171	171	18.59	2.95	18.18	1.01	9.81	22.05	
VENEZUELA	14						1	4	6	7	10	6	7	10	10	10	9	8	40.49	1.22	40.00	-0.04	24.39	15.61	
ZIMBABWE	13								2	2	6	5	8	8	9	13	13	12	47.12	5.30	45.45	0.00	16.36	43.69	
Total	24978	4446	5494	6005	6207	6998	7766	8563	9740	11050	12620	13109	13957	14835	15596	16199	16886	16410							

Table 2: Correlation of liquidity measures by size in US market

From ISSM/TAQ data, daily quoted spread and proportional quoted spread (defined as quoted spread divided by quote mid-point) are calculated for AMEX and NYSE stocks for 1983-2003. The correlation of zero return proportion and the spread measures for the US market is reported in the table. P-values are in parentheses.

	Quoted Spread	Proportional Quoted Spread	Quoted Spread	Proportional Quoted Spread	Quoted Spread	Proportional Quoted Spread	Quoted Spread	Proportional Quoted Spread
	overall		size quintile 1 (small)		size quintile 3		size quintile 5 (large)	
Zero Return	0.88 (<.0001)	0.90 (<.0001)	0.63 (<.0001)	0.79 (<.0001)	0.92 (<.0001)	0.86 (<.0001)	0.82 (<.0001)	0.72 (<.0001)
Quoted Spread		0.92 (<.0001)		0.85 (<.0001)		0.79 (<.0001)		0.91 (<.0001)

Table 3: Mean of portfolio formed based on predicted betas

For each individual stock, pre-ranking betas are estimated using the previous 5 years returns and illiquidity. The five-year window starts from January 1988 and is rolled forward at yearly intervals. To be included, stocks should have at least 36 monthly returns and innovations in illiquidity within the given window. Market returns and illiquidity are formed as a value-weight average of individual stocks' returns and illiquidity. Predicted beta is obtained by equation (7) using the coefficients estimated in equation (6). According to predicted betas, stocks are sorted into one of the following portfolios depending on the number of stocks for each country: If the number of stocks in a country is between 100 (inclusive) and 300, the stocks are sorted into 3 portfolios. We use 5 portfolios if the number of stocks in a country is between 300 and 500 and 10 portfolios if the number of stocks is greater than 500. Table reports the equally-weighted average across countries of time-series averages of each country for each variable according to predicted beta-based portfolio formed this way for the period of 1994-2004. Beta 1 to Beta 4 denote betas defined under equation (2) for panel A and (4) for panel B.

		panel A: predicted beta (LOCAL)														
		Beta 1			Beta 2					Beta 3					Beta 4	
					countries with number of stocks greater than 100 and less than 300											
		small	2	big	small	2	big	small	2	big	small	2	big	small	2	big
return (%)		1.42	1.31	1.09	1.16	1.21	1.43	1.48	1.28	1.05	1.68	1.16	0.99			
ZR (%)		34.91	33.79	30.07	30.35	32.95	35.32	32.49	33.09	33.17	33.67	32.93	32.18			
log(MV)		5.11	4.95	4.96	5.06	4.97	5.00	4.85	5.01	5.15	4.65	5.02	5.33			
log(B/M)		-0.27	-0.22	-0.26	-0.28	-0.25	-0.22	-0.12	-0.25	-0.37	-0.03	-0.25	-0.46			
predicted beta *		0.26	0.36	0.46	2.62	5.05	7.40	-3.69	-2.30	-0.92	-13.36	-9.84	-6.11			
		countries with number of stocks greater than 300 and less than 500														
		small	2	3	4	big	small	2	3	4	big	small	2	3	4	big
return (%)		1.64	1.48	1.25	0.96	1.27	1.03	1.47	0.98	1.48	1.50	1.40	1.62	1.28	1.23	1.00
ZR (%)		30.27	28.65	27.91	25.92	24.88	22.75	25.09	27.27	28.43	33.45	28.74	27.26	27.75	26.76	27.13
log(MV)		4.24	4.25	4.27	4.31	4.27	4.43	4.32	4.25	4.10	4.24	4.09	4.23	4.26	4.32	4.43
log(B/M)		-0.10	-0.01	0.00	0.05	-0.03	-0.06	0.03	0.00	0.03	-0.07	0.06	0.09	0.02	-0.05	-0.18
predicted beta *		0.16	0.25	0.31	0.37	0.47	2.05	4.14	5.23	6.40	8.13	-4.38	-3.23	-2.60	-1.87	-0.70
		countries with number of stocks greater than 500														
		small	3	5	7	10 (big)	small	3	5	7	10 (big)	small	3	5	7	10 (big)
return (%)		1.47	1.51	1.14	0.83	0.90	1.06	1.22	1.02	1.35	1.40	1.56	1.25	1.40	1.23	0.78
ZR (%)		28.24	28.46	27.02	26.18	22.47	23.22	25.13	25.76	26.69	30.45	25.31	25.95	26.35	27.21	26.29
log(MV)		4.96	4.97	4.98	4.99	4.95	4.93	4.99	5.06	5.02	4.88	4.77	4.94	5.04	5.03	5.00
log(B/M)		-0.32	-0.18	-0.21	-0.19	-0.30	-0.34	-0.22	-0.24	-0.20	-0.14	-0.05	-0.11	-0.17	-0.24	-0.57
predicted beta *		0.18	0.31	0.37	0.42	0.59	1.45	3.80	4.83	5.89	8.60	-4.82	-3.31	-2.53	-1.89	0.15
		panel B: predicted beta (WORLD)														
		Beta 1			Beta 2					Beta 3					Beta 4	
					countries with number of stocks greater than 100 and less than 300											
		small	2	big	small	2	big	small	2	big	small	2	big	small	2	big
return (%)		1.39	1.27	1.15	1.16	1.31	1.34	1.32	1.22	1.27	1.50	1.30	1.02			
ZR (%)		33.82	34.08	30.82	31.34	33.18	34.16	32.08	33.13	33.52	33.24	32.89	32.62			
log(MV)		4.98	4.98	5.06	5.09	5.01	4.93	4.91	5.00	5.11	4.71	5.01	5.30			
log(B/M)		-0.24	-0.24	-0.27	-0.30	-0.26	-0.20	-0.22	-0.21	-0.32	-0.09	-0.25	-0.40			
predicted beta *		0.23	0.35	0.51	1.76	2.73	3.63	-5.38	-4.26	-3.25	-14.30	-8.46	-2.58			
		countries with number of stocks greater than 300 and less than 500														
		small	2	3	4	big	small	2	3	4	big	small	2	3	4	big
return (%)		1.69	1.40	1.16	0.98	1.34	1.18	1.15	1.23	1.45	1.49	1.11	1.23	1.34	1.39	1.44
ZR (%)		28.96	28.71	27.59	27.73	24.46	24.33	24.99	27.93	28.15	31.64	26.70	27.16	27.86	27.60	28.29
log(MV)		4.17	4.18	4.29	4.34	4.35	4.41	4.36	4.21	4.31	4.05	4.20	4.28	4.29	4.23	4.33
log(B/M)		-0.09	0.03	-0.02	-0.01	0.02	-0.07	-0.02	0.02	0.00	0.01	-0.04	0.07	0.02	-0.01	-0.11
predicted beta *		0.14	0.25	0.33	0.40	0.54	1.58	2.39	3.03	3.51	4.42	-5.71	-4.65	-4.12	-3.41	-2.51
		countries with number of stocks greater than 500														
		small	3	5	7	10 (big)	small	3	5	7	10 (big)	small	3	5	7	10 (big)
return (%)		1.70	1.24	1.19	1.09	0.88	0.99	1.35	1.25	1.19	1.49	1.26	1.27	1.20	1.18	0.97
ZR (%)		26.84	27.67	27.36	26.23	23.38	24.56	25.84	26.50	26.99	28.12	24.66	25.92	26.69	27.38	26.01
log(MV)		4.83	4.92	4.99	5.03	5.04	5.04	5.03	5.03	4.97	4.79	4.79	4.96	4.99	4.98	5.07
log(B/M)		-0.25	-0.16	-0.19	-0.20	-0.35	-0.38	-0.22	-0.22	-0.20	-0.11	-0.16	-0.15	-0.18	-0.21	-0.42
predicted beta *		0.14	0.30	0.37	0.44	0.67	1.11	2.24	2.68	3.07	4.34	-6.51	-5.24	-4.60	-4.13	-2.49

Table 4: Fama-MacBeth regression by predicted betas (local market)

Table reports the time-series averages of estimated premia from Fama-MacBeth regression based on the fully-segmented world market model of (2) using predicted betas with respect to local market factors for the period of 1994-2004. For each individual stock, pre-ranking betas are estimated using the previous 5 years returns and illiquidity. To be included, stocks should have at least 36 monthly returns and innovations in illiquidity within the given window. In calculating betas, innovations in liquidity are obtained by first differencing. Market returns and illiquidity are formed as a value-weight average of individual stocks' returns and illiquidity. Predicted beta of individual stock is obtained by equation (7) using the coefficients estimated in equation (6). ZR denotes the coefficient of expected illiquidity which is an average of illiquidity for the previous 12 month data (at least 6 months is required). MV and B/M are the previous year-end market capitalization and book-to-market ratio, respectively. Beta 1 to Beta 6 denote the premium for liquidity risks defined under equation (2) and (3). T-values are in parenthesis.

	Intercept	ZR	Beta 1	Beta 2	Beta 3	Beta 4	Beta 5	Beta 6	log(MV)	log(B/M)
All countries	0.009 (2.52)		-0.025 (-2.63)							
	-0.023 (-3.05)	-0.001 (-0.16)	-0.009 (-0.76)				0.117 (4.17)			
	-0.001 (-0.17)	0.006 (1.36)						0.000 (-0.04)		
	-0.037 (-3.70)	0.000 (-0.03)	-0.018 (-1.34)	0.031 (0.72)	-0.284 (-2.10)	-0.216 (-3.46)				
	-0.034 (-3.14)	-0.006 (-1.03)	-0.013 (-0.92)	0.019 (0.45)	-0.389 (-2.73)	-0.203 (-3.69)			-0.001 (-1.89)	0.000 (-0.32)
	0.014 (3.62)		-0.040 (-3.75)							
Developed markets	-0.011 (-1.69)	-0.001 (-0.20)	-0.032 (-2.63)				0.085 (3.29)			
	0.006 (1.23)	0.005 (1.13)						-0.021 (-1.78)		
	-0.023 (-2.22)	-0.001 (-0.14)	-0.040 (-3.08)	0.001 (0.02)	-0.257 (-2.02)	-0.153 (-2.83)				
	-0.020 (-1.67)	-0.006 (-1.10)	-0.034 (-2.70)	-0.010 (-0.22)	-0.349 (-2.69)	-0.144 (-2.88)			-0.001 (-1.66)	0.000 (0.12)
	-0.006 (-0.83)		0.024 (1.30)							
	-0.050 (-2.86)	0.003 (0.22)	0.043 (1.77)				0.185 (2.71)			
Emerging markets	-0.020 (-1.69)	0.013 (1.12)						0.043 (1.81)		
	-0.125 (-4.67)	0.005 (0.46)	0.020 (0.78)	0.203 (1.67)	0.093 (0.35)	-0.572 (-3.95)				
	-0.131 (-4.65)	0.003 (0.22)	0.023 (0.87)	0.201 (1.81)	-0.070 (-0.21)	-0.535 (-3.53)			0.000 (0.00)	-0.001 (-0.51)
	0.015 (4.06)		-0.019 (-1.49)							
	-0.014 (-1.84)	-0.005 (-0.43)	-0.014 (-0.99)				0.106 (5.25)			
	0.000 (0.01)	0.012 (1.07)						0.005 (0.48)		
US	-0.035 (-2.90)	-0.006 (-0.57)	-0.026 (-1.46)	0.059 (0.63)	-0.018 (-0.15)	-0.227 (-6.63)				
	-0.020 (-1.39)	-0.024 (-1.46)	-0.022 (-1.39)	0.049 (0.65)	-0.096 (-0.85)	-0.218 (-7.68)			-0.003 (-2.10)	0.000 (0.18)

Table 5: Fama-MacBeth regression by predicted betas (world market)

Table reports the time-series averages of estimated premia from Fama-MacBeth regression based on the fully-integrated world market model of (4) using predicted betas with respect to world market factors for the period of 1994-2004. For each individual stock, pre-ranking betas are estimated using the previous 5 years returns and illiquidity. To be included, stocks should have at least 36 monthly returns and innovations in illiquidity within the given window. In calculating betas, innovations in liquidity are obtained by first differencing. Market returns and illiquidity are formed as a value-weight average of individual stocks' returns and illiquidity. Predicted beta of individual stock is obtained by equation (7) using the coefficients estimated in equation (6). ZR denotes the coefficient of expected illiquidity which is an average of illiquidity for the previous 12 month data (at least 6 months is required). MV and B/M are the previous year-end market capitalization and book-to-market ratio, respectively. Beta 1 to Beta 6 denote the premium for liquidity risks defined under equation (4) and (5). T-values are in parenthesis.

	Intercept	ZR	Beta 1	Beta 2	Beta 3	Beta 4	Beta 5	Beta 6	log(MV)	log(B/M)
All countries	0.008 (1.75)		-0.018 (-1.78)							
	-0.023 (-3.26)	-0.001 (-0.12)	-0.010 (-0.73)				0.135 (4.63)			
	0.000 (-0.03)	0.005 (1.03)						0.006 (0.75)		
	-0.035 (-2.40)	-0.003 (-0.59)	-0.002 (-0.11)	0.010 (0.07)	-0.557 (-3.24)	-0.054 (-1.54)				
	-0.029 (-1.78)	-0.007 (-1.30)	0.000 (0.02)	-0.058 (-0.40)	-0.513 (-2.95)	-0.066 (-1.95)			-0.001 (-1.99)	-0.001 (-1.21)
	0.010 (2.23)		-0.028 (-2.76)							
Developed markets	-0.015 (-2.34)	-0.001 (-0.18)	-0.021 (-1.75)				0.100 (4.13)			
	0.005 (0.91)	0.004 (0.88)						-0.006 (-0.85)		
	-0.026 (-1.65)	-0.003 (-0.70)	-0.008 (-0.61)	-0.014 (-0.10)	-0.498 (-2.72)	-0.013 (-0.34)				
	-0.020 (-1.12)	-0.008 (-1.35)	-0.006 (-0.44)	-0.065 (-0.47)	-0.469 (-2.53)	-0.025 (-0.66)			-0.001 (-1.77)	-0.001 (-0.92)
	0.004 (0.47)		-0.002 (-0.13)							
	-0.032 (-2.39)	0.008 (0.76)	-0.007 (-0.43)				0.186 (3.87)			
Emerging markets	-0.007 (-0.64)	0.012 (1.09)						0.013 (1.00)		
	-0.089 (-3.98)	0.009 (0.76)	-0.018 (-0.97)	0.291 (0.97)	-0.316 (-1.26)	-0.247 (-3.72)				
	-0.084 (-3.92)	0.005 (0.39)	-0.015 (-0.83)	0.155 (0.54)	-0.273 (-1.03)	-0.249 (-3.81)			-0.001 (-0.54)	-0.002 (-1.10)
	0.014 (2.63)		-0.016 (-1.19)							
	-0.014 (-1.47)	-0.004 (-0.39)	-0.022 (-1.35)				0.127 (6.00)			
	0.001 (0.12)	0.008 (0.70)						0.009 (1.18)		
US	-0.061 (-4.41)	-0.012 (-1.04)	-0.016 (-0.96)	0.319 (1.73)	-0.085 (-0.59)	-0.109 (-3.59)				
	-0.053 (-3.48)	-0.025 (-1.50)	-0.012 (-0.83)	0.246 (1.49)	-0.057 (-0.43)	-0.116 (-3.95)			-0.002 (-1.76)	-0.001 (-0.51)

Table 6: Fama-MacBeth regression by predicted betas (local and world market)

Table reports the time-series averages of estimated premia from Fama-MacBeth regression based on the model of (11), where the risks with respect to local and world markets are jointly tested, using predicted betas. For each individual stock, pre-ranking betas are estimated using the previous 5 years returns and illiquidity. To be included, stocks should have at least 36 monthly returns and innovations in illiquidity within the given window. In calculating betas, innovations in liquidity are obtained by first differencing. Market returns and illiquidity are formed as a value-weight average of individual stocks' returns and illiquidity. Predicted beta of individual stock is obtained by equation (7) using the coefficients estimated in equation (6). ZR denotes the coefficient of expected illiquidity which is an average of illiquidity for the previous 12 month data (at least 6 months is required). MV and B/M are the previous year-end market capitalization and book-to-market ratio, respectively. Beta 1 to Beta 6 denote the premium for liquidity risks defined under equation (9). T-values are in parenthesis.

Intercept	ZR	Local						World						log(MV)	log(B/M)
		Beta 1	Beta 2	Beta 3	Beta 4	Beta 5	Beta 6	Beta 1	Beta 2	Beta 3	Beta 4	Beta 5	Beta 6		
All countries															
0.009 (1.89)		-0.054 (-2.75)						0.018 (1.01)							
-0.025 (-3.11)	-0.001 (-0.28)	0.003 (1.17)					0.004 (1.28)	-0.031 (-1.90)					0.137 (5.16)		
0.003 (0.61)	0.003 (0.65)						0.003 (1.30)							-0.006 (-0.56)	
-0.071 (-4.81)	-0.004 (-0.89)	0.003 (1.07)	-0.006 (-1.61)	0.056 (1.43)	-0.046 (-2.48)			-0.030 (-1.68)	0.097 (0.61)	0.048 (0.25)	-0.213 (-4.31)				
-0.066 (-3.98)	-0.008 (-1.37)	0.003 (1.16)	-0.006 (-1.68)	0.045 (1.14)	-0.044 (-2.57)			-0.028 (-1.56)	0.056 (0.35)	0.045 (0.24)	-0.209 (-4.17)			-0.001 (-1.62)	-0.002 (-1.62)
Developed markets															
0.013 (2.74)		-0.070 (-3.07)						0.018 (0.92)							
-0.023 (-2.93)	-0.003 (-0.57)	-0.002 (-0.65)					0.004 (0.90)	-0.026 (-1.50)					0.134 (4.89)		
0.006 (1.02)	0.002 (0.35)						0.000 (0.03)							-0.010 (-0.91)	
-0.062 (-4.69)	-0.005 (-1.02)	-0.002 (-0.51)	-0.011 (-2.14)	0.044 (0.97)	-0.037 (-1.93)			-0.014 (-0.78)	0.159 (1.13)	-0.071 (-0.39)	-0.189 (-4.30)				
-0.057 (-3.53)	-0.009 (-1.47)	-0.001 (-0.20)	-0.011 (-2.25)	0.038 (0.84)	-0.035 (-1.96)			-0.014 (-0.75)	0.131 (0.97)	-0.089 (-0.49)	-0.184 (-4.14)			-0.001 (-1.43)	-0.001 (-1.33)
Emerging markets															
-0.006 (-0.69)		0.042 (1.51)						-0.013 (-0.59)							
-0.023 (-1.76)	0.011 (1.00)	0.002 (0.96)					0.005 (1.58)	-0.015 (-0.75)					0.173 (3.27)		
0.000 (0.02)	0.013 (1.18)						0.001 (0.62)							0.006 (0.40)	
-0.113 (-4.00)	0.004 (0.37)	0.002 (1.16)	0.000 (0.05)	0.042 (0.96)	-0.067 (-2.50)			-0.064 (-2.54)	0.360 (1.11)	0.530 (1.74)	-0.318 (-3.16)				
-0.111 (-3.86)	0.002 (0.16)	0.002 (1.15)	0.000 (0.12)	0.029 (0.67)	-0.058 (-2.14)			-0.060 (-2.41)	0.251 (0.79)	0.522 (1.71)	-0.322 (-3.25)			0.000 (-0.50)	-0.003 (-1.23)
US															
0.010 (1.85)		-0.028 (-1.39)						0.005 (0.28)							
-0.032 (-3.32)	-0.012 (-1.09)	-0.014 (-1.63)					0.037 (3.25)	0.001 (0.08)					0.118 (3.98)		
-0.001 (-0.18)	0.001 (0.12)						0.001 (0.22)							0.006 (0.69)	
-0.085 (-6.69)	-0.016 (-1.50)	-0.011 (-1.21)	-0.021 (-1.42)	0.096 (1.21)	-0.061 (-2.60)			0.013 (0.67)	0.446 (1.84)	-0.326 (-1.68)	-0.138 (-2.81)				
-0.070 (-4.37)	-0.025 (-1.62)	-0.007 (-0.83)	-0.027 (-1.86)	0.085 (1.15)	-0.062 (-2.72)			0.010 (0.50)	0.449 (1.90)	-0.245 (-1.31)	-0.137 (-2.92)			-0.002 (-1.52)	-0.001 (-0.89)

Table 7: Fama-MacBeth regression by predicted betas with respect to US market and Non-US world markets

Table reports the time-series averages of estimated premia from Fama-MacBeth regression based on the model specified in (12) derived from mildly-segmented world market model of (9), using predicted betas with respect to US market and Non-US world markets for the period of 1994-2004. Test assets do not include stocks from the US market. For each individual stock, pre-ranking betas are estimated using the previous 5 years returns and illiquidity. To be included, stocks should have at least 36 monthly returns and innovations in illiquidity within the given window. In calculating betas, innovations in liquidity are obtained by first differencing. Market returns and illiquidity are formed as a value-weight average of individual stocks' returns and illiquidity. Predicted beta of individual stock is obtained by equation (7) using the coefficients estimated in equation (6). ZR denotes the coefficient of expected illiquidity which is an average of illiquidity for the previous 12 month data (at least 6 months is required). MV and B/M are the previous year-end market capitalization and book-to-market ratio, respectively. Beta 1 to Beta 6 denote the premium for liquidity risks defined under equation (12). T-values are in parenthesis.

Intercept	ZR	US					Non-US					log(MV)	log(B/M)	
		Beta 1	Beta 2	Beta 3	Beta 4	Beta 5	Beta 1	Beta 2	Beta 3	Beta 4	Beta 5			
All countries (except US)														
-0.003	0.007	-0.030						-0.041						
(-0.38)	(1.46)	(-1.80)						(-1.62)						
-0.033	0.006	-0.019	-0.058					-0.048	0.243					
(-3.38)	(1.23)	(-0.90)	(-0.47)					(-1.88)	(1.81)					
-0.029	0.007	-0.048		-0.065				0.044		0.084				
(-2.47)	(1.64)	(-2.09)		(-0.27)				(1.25)		(0.47)				
-0.057	0.005	-0.010			-0.094			-0.036				-0.012		
(-3.16)	(1.04)	(-0.42)			(-2.05)			(-1.14)				(-0.17)		
-0.040	0.006	-0.010				0.045		-0.042					0.049	
(-3.75)	(1.38)	(-0.42)				(1.34)		(-1.48)					(1.45)	
-0.075	0.003	-0.026	-0.206	-0.051	-0.082			0.003	0.130	0.244		-0.008		
(-4.46)	(0.71)	(-1.01)	(-0.96)	(-0.20)	(-1.41)			(0.10)	(1.27)	(1.20)		(-0.18)		
-0.086	0.004	-0.029	-0.229	-0.123	-0.076			0.014	0.161	0.263		-0.010	0.000	0.000
(-4.89)	(0.73)	(-1.09)	(-1.08)	(-0.48)	(-1.34)			(0.41)	(1.46)	(1.31)		(-0.22)	(0.61)	(-0.43)
Developed markets (except US)														
-0.003	0.006	-0.023						-0.060						
(-0.44)	(1.29)	(-1.35)						(-2.37)						
-0.025	0.005	-0.011	0.050					-0.066	0.117					
(-2.60)	(1.01)	(-0.55)	(0.37)					(-2.53)	(0.99)					
-0.030	0.005	-0.036		-0.098				0.051		0.095				
(-2.47)	(1.12)	(-1.59)		(-0.40)				(1.56)		(0.48)				
-0.038	0.005	-0.002			-0.117			-0.066				-0.003		
(-3.11)	(1.02)	(-0.10)			(-2.31)			(-2.16)				(-0.09)		
-0.028	0.005	-0.002				0.065		-0.061					0.016	
(-2.80)	(1.15)	(-0.11)				(2.02)		(-2.13)					(0.49)	
-0.053	0.002	-0.022	-0.092	-0.056	-0.090			0.012	0.098	0.185		-0.003		
(-3.71)	(0.48)	(-0.88)	(-0.36)	(-0.22)	(-1.69)			(0.36)	(1.02)	(0.92)		(-0.06)		
-0.064	0.003	-0.023	-0.109	-0.117	-0.079			0.019	0.134	0.207		-0.009	0.000	0.000
(-4.11)	(0.55)	(-0.95)	(-0.42)	(-0.45)	(-1.51)			(0.61)	(1.25)	(1.04)		(-0.21)	(0.70)	(-0.12)
Emerging markets														
-0.003	0.011	-0.019						0.027						
(-0.25)	(0.97)	(-0.59)						(0.68)						
-0.046	0.009	-0.037	-0.086					0.012	0.433					
(-2.30)	(0.77)	(-1.00)	(-0.38)					(0.26)	(1.64)					
-0.043	0.013	-0.064		-0.320				0.022		0.134				
(-2.47)	(1.19)	(-1.71)		(-0.80)				(0.37)		(0.57)				
-0.097	0.006	-0.031			-0.180			0.062				-0.054		
(-2.75)	(0.46)	(-0.72)			(-2.13)			(1.06)				(-0.36)		
-0.072	0.008	-0.025				0.106		0.037					0.132	
(-3.76)	(0.73)	(-0.60)				(1.48)		(0.68)					(2.20)	
-0.128	0.004	-0.045	0.087	-0.216	-0.153			-0.006	0.223	0.332		-0.076		
(-3.63)	(0.38)	(-1.12)	(0.22)	(-0.50)	(-1.45)			(-0.08)	(1.24)	(1.20)		(-0.71)		
-0.137	0.004	-0.054	0.038	-0.321	-0.156			0.007	0.253	0.319		-0.072	0.000	-0.002
(-3.79)	(0.34)	(-1.40)	(0.09)	(-0.74)	(-1.44)			(0.09)	(1.35)	(1.18)		(-0.63)	(0.24)	(-1.03)

Table 8: Time series tests

Panel A (Panel B) reports the intercept (in percentage) of the market model regression (rows labeled with 'Market Model') and of three factor model ('F-F 3 Factor Model') specified in equations (13) and (14) using ten equally-weighted portfolio returns formed based on predicted betas with respect to world market returns and illiquidity for the period of January 1994-December 2004 (September 1998-December 2004). Predicted beta of individual stock is obtained by the equation (7) using the coefficients estimated in the equation (6) in the model of fully-integrated world financial markets in (4). Panel C shows the intercept from the same regression but ten portfolios are formed by US stocks only. In Panel C, predicted betas with respect to local market ('US local') are based on the fully-segmented world market model of (2) while the global predicted betas ('US world') are from the fully-integrated model of (4). The column with '10-1' denotes the difference of intercepts from portfolio 10 (high predicted beta) and 1 (low predicted beta). Beta 5 and Beta 6 denote the premium for liquidity risks defined under equation (3) and (5). T-values are in parenthesis.

		Panel A: World liquidity risk											
		1 (small)	2	3	4	5	6	7	8	9	10 (big)	10-1	
		Beta 5											
Market Model	All countries	-0.30 (-1.28)	0.03 (0.15)	0.15 (0.82)	0.29 (1.78)	0.38 (2.32)	0.53 (3.21)	0.72 (3.93)	0.84 (4.43)	0.84 (3.91)	1.42 (4.27)	1.71 (4.63)	
	Developed markets	-0.13 (-0.51)	0.18 (0.94)	0.22 (1.21)	0.36 (2.14)	0.44 (2.69)	0.57 (3.36)	0.71 (4.04)	0.85 (4.46)	0.83 (3.91)	1.17 (3.99)	1.30 (3.88)	
	Emerging markets	-1.29 (-2.57)	-0.61 (-1.32)	-0.38 (-0.77)	-0.09 (-0.18)	-0.17 (-0.36)	0.00 (0.00)	0.22 (0.41)	0.54 (0.93)	0.87 (1.45)	1.63 (2.09)	2.92 (3.54)	
F-F 3 Factor Model	All countries	-0.82 (-3.51)	-0.55 (-2.89)	-0.44 (-2.49)	-0.28 (-1.85)	-0.25 (-1.71)	-0.12 (-0.87)	-0.10 (-0.70)	0.00 (0.02)	-0.09 (-0.56)	0.02 (0.08)	0.84 (2.24)	
	Developed markets	-0.62 (-2.50)	-0.35 (-1.86)	-0.31 (-1.69)	-0.13 (-0.80)	-0.09 (-0.59)	-0.01 (-0.07)	0.05 (0.30)	0.16 (0.94)	0.08 (0.40)	0.15 (0.54)	0.77 (2.15)	
	Emerging markets	-2.00 (-3.63)	-1.73 (-3.58)	-1.60 (-3.11)	-1.36 (-2.68)	-1.50 (-3.11)	-1.43 (-3.35)	-1.59 (-3.19)	-1.69 (-3.31)	-1.33 (-2.49)	-0.76 (-1.00)	1.25 (1.42)	
		Beta 6											
Market Model	All countries	0.27 (1.06)	0.41 (2.20)	0.48 (2.89)	0.55 (3.12)	0.49 (2.96)	0.52 (3.25)	0.52 (3.24)	0.58 (3.26)	0.55 (2.58)	0.57 (1.84)	0.30 (0.96)	
	Developed markets	0.50 (2.34)	0.57 (3.12)	0.49 (2.90)	0.60 (3.37)	0.55 (3.38)	0.49 (3.02)	0.56 (3.37)	0.56 (3.05)	0.53 (2.56)	0.42 (1.48)	-0.08 (-0.28)	
	Emerging markets	-0.15 (-0.20)	-0.47 (-0.83)	-0.26 (-0.50)	0.09 (0.20)	0.25 (0.55)	0.05 (0.10)	0.20 (0.43)	0.10 (0.21)	0.08 (0.17)	0.77 (1.32)	0.92 (1.22)	
F-F 3 Factor Model	All countries	-0.49 (-1.99)	-0.27 (-1.66)	-0.16 (-1.15)	-0.10 (-0.61)	-0.16 (-1.11)	-0.11 (-0.84)	-0.11 (-0.79)	-0.15 (-1.05)	-0.35 (-2.07)	-0.69 (-2.67)	-0.20 (-0.56)	
	Developed markets	-0.13 (-0.62)	-0.04 (-0.25)	-0.08 (-0.54)	0.01 (0.09)	0.03 (0.18)	-0.04 (-0.23)	0.02 (0.10)	-0.07 (-0.41)	-0.20 (-1.08)	-0.54 (-2.06)	-0.41 (-1.39)	
	Emerging markets	-1.21 (-1.46)	-1.93 (-3.34)	-1.62 (-3.06)	-1.47 (-3.30)	-1.27 (-2.92)	-1.55 (-3.22)	-1.39 (-3.11)	-1.55 (-3.47)	-1.66 (-3.63)	-1.38 (-2.61)	-0.17 (-0.21)	
		Panel B: World liquidity risk (1998.9 - 2004.12)											
		Beta 5											
Market Model	All countries	0.26 (0.88)	0.59 (2.29)	0.70 (2.81)	0.76 (3.32)	0.90 (3.86)	0.94 (3.84)	1.22 (4.43)	1.28 (4.56)	1.23 (3.90)	1.93 (4.37)	1.68 (3.44)	
	Developed markets	0.45 (1.45)	0.67 (2.63)	0.69 (2.72)	0.76 (3.13)	0.85 (3.48)	0.92 (3.53)	1.09 (4.01)	1.16 (3.95)	1.11 (3.46)	1.40 (3.33)	0.95 (2.13)	
	Emerging markets	-0.32 (-0.59)	0.78 (1.56)	0.97 (1.80)	1.28 (2.29)	1.49 (2.83)	1.40 (2.56)	1.80 (3.01)	2.04 (2.68)	2.83 (4.11)	3.48 (3.51)	3.80 (3.57)	
F-F 3 Factor Model	All countries	-0.36 (-1.20)	-0.23 (-0.89)	-0.17 (-0.68)	-0.11 (-0.49)	-0.01 (-0.05)	-0.06 (-0.28)	-0.05 (-0.21)	0.02 (0.08)	-0.19 (-0.78)	0.09 (0.23)	0.45 (0.86)	
	Developed markets	-0.10 (-0.31)	-0.08 (-0.28)	-0.11 (-0.41)	0.00 (-0.02)	0.05 (0.18)	-0.05 (-0.20)	0.00 (-0.00)	0.05 (0.17)	-0.08 (-0.26)	-0.16 (-0.39)	-0.06 (-0.11)	
	Emerging markets	-1.38 (-2.21)	-0.72 (-1.43)	-0.59 (-1.04)	-0.30 (-0.53)	-0.37 (-0.73)	-0.37 (-0.68)	-0.26 (-0.44)	-0.78 (-1.08)	0.42 (0.62)	0.91 (0.83)	2.28 (1.81)	
		Panel C: Local and world liquidity risks for US market											
		Beta 5											
Market Model	US local	0.50 (1.82)	0.56 (2.34)	0.53 (2.27)	0.79 (3.50)	0.80 (3.10)	0.95 (4.09)	0.98 (3.91)	0.96 (3.65)	1.14 (4.82)	2.00 (5.54)	1.50 (4.01)	
	US world	0.41 (1.36)	0.79 (3.40)	0.79 (3.46)	0.90 (3.94)	0.90 (3.96)	1.04 (4.32)	1.33 (4.72)	1.08 (3.88)	1.65 (5.82)	2.11 (6.13)	1.70 (4.65)	
	F-F 3 Factor Model	US local	0.56 (2.02)	0.54 (2.24)	0.48 (2.06)	0.75 (3.26)	0.78 (2.95)	0.94 (3.98)	0.93 (3.67)	0.94 (3.53)	1.12 (4.69)	2.04 (5.69)	1.48 (3.92)
F-F 3 Factor Model	US world	0.14 (0.44)	0.48 (1.87)	0.40 (1.61)	0.56 (2.23)	0.59 (2.35)	0.69 (2.61)	0.82 (2.71)	0.54 (1.79)	1.11 (3.74)	1.47 (4.17)	1.32 (3.24)	
	Market Model	US local	0.86 (2.46)	0.96 (3.77)	0.78 (3.18)	0.76 (3.12)	0.92 (4.02)	0.86 (3.80)	0.92 (3.92)	0.93 (3.90)	1.02 (4.17)	1.28 (4.18)	0.42 (1.30)
	US world	1.18 (3.50)	1.15 (4.63)	1.04 (4.37)	0.90 (3.98)	1.00 (4.54)	0.94 (4.01)	1.05 (4.34)	1.20 (4.93)	1.18 (4.14)	1.50 (4.74)	0.31 (0.98)	
F-F 3 Factor Model	US local	1.01 (3.02)	1.00 (3.89)	0.74 (2.99)	0.72 (2.93)	0.87 (3.75)	0.80 (3.50)	0.91 (3.80)	0.87 (3.62)	0.97 (3.95)	1.29 (4.19)	0.28 (0.88)	
	US world	0.57 (1.69)	0.74 (2.77)	0.67 (2.59)	0.53 (2.14)	0.68 (2.81)	0.54 (2.12)	0.69 (2.62)	0.87 (3.22)	0.69 (2.25)	0.93 (2.77)	0.36 (1.02)	

Table 9: Fama-MacBeth regression by global predicted betas (subperiod)

Table reports the time-series averages of estimated premia from Fama-MacBeth regression based on the fully-integrated world market model in (4) using predicted betas with respect to world market factors for two separate periods of January 1994 to August 1998 (panel A) and September 1998 to December 2004 (panel B). For each individual stock, pre-ranking betas are estimated using the previous 5 years returns and illiquidity. To be included, stocks should have at least 36 monthly returns and innovations in illiquidity within the given window. In calculating betas, innovations in liquidity are obtained by first differencing. Market returns and illiquidity are formed as a value-weight average of individual stocks' returns and illiquidity. Predicted beta of individual stock is obtained by equation (7) using the coefficients estimated in equation (6). ZR denotes the coefficient of expected illiquidity which is an average of illiquidity for the previous 12 month data (at least 6 months is required). MV and B/M are the previous year-end market capitalization and book-to-market ratio, respectively. Beta 1 to Beta 6 denote the premium for liquidity risks defined under equation (4) and (5). T-values are in parenthesis.

Panel A: 1994.1 - 1998.8										Panel B: 1998.9 - 2004.12									
Intercept	ZR	Beta 1	Beta 2	Beta 3	Beta 4	Beta 5	Beta 6	log(MV)	log(B/M)	Intercept	ZR	Beta 1	Beta 2	Beta 3	Beta 4	Beta 5	Beta 6	log(MV)	log(B/M)
All countries																			
-0.004 (-0.58)		-0.029 (-1.67)								0.016 (2.74)		-0.010 (-0.83)							
-0.035 (-3.19)	0.000 (-0.06)	-0.005 (-0.18)				0.166 (3.11)				-0.015 (-1.56)	-0.001 (-0.11)	-0.014 (-0.95)				0.112 (3.50)			
-0.010 (-1.32)	0.005 (0.65)						0.013 (0.78)			0.007 (1.07)	0.005 (0.80)						0.001 (0.16)		
-0.043 (-1.71)	-0.002 (-0.28)	0.012 (0.44)	-0.471 (-2.41)	-1.106 (-3.13)	-0.068 (-1.00)					-0.030 (-1.68)	-0.003 (-0.55)	-0.012 (-0.73)	0.364 (1.88)	-0.152 (-1.17)	-0.044 (-1.25)				
-0.036 (-1.38)	-0.008 (-0.90)	0.012 (0.41)	-0.464 (-2.15)	-1.158 (-3.33)	-0.071 (-1.09)			-0.002 (-2.10)	-0.004 (-2.75)	-0.024 (-1.14)	-0.007 (-0.93)	-0.008 (-0.49)	0.241 (1.27)	-0.038 (-0.27)	-0.063 (-1.82)			-0.001 (-1.07)	0.000 (0.33)
Deveploed markets																			
-0.002 (-0.31)		-0.047 (-2.84)								0.019 (2.99)		-0.014 (-1.11)							
-0.027 (-2.98)	0.000 (0.07)	-0.030 (-1.45)				0.136 (3.20)				-0.007 (-0.74)	-0.002 (-0.30)	-0.014 (-1.00)				0.073 (2.63)			
-0.004 (-0.61)	0.006 (0.76)						-0.010 (-0.68)			0.011 (1.55)	0.003 (0.49)						-0.004 (-0.49)		
-0.029 (-1.07)	-0.001 (-0.15)	-0.005 (-0.21)	-0.519 (-2.73)	-1.171 (-3.12)	-0.003 (-0.03)					-0.024 (-1.26)	-0.005 (-0.80)	-0.011 (-0.64)	0.359 (1.95)	-0.001 (-0.01)	-0.021 (-0.63)				
-0.023 (-0.78)	-0.007 (-0.85)	-0.005 (-0.22)	-0.475 (-2.24)	-1.241 (-3.33)	-0.004 (-0.05)			-0.002 (-2.03)	-0.003 (-2.49)	-0.019 (-0.80)	-0.009 (-1.04)	-0.007 (-0.40)	0.237 (1.35)	0.100 (0.74)	-0.040 (-1.22)			-0.001 (-0.91)	0.001 (0.55)
Emerging markets																			
-0.016 (-1.35)		-0.009 (-0.33)								0.018 (1.96)		0.003 (0.15)							
-0.043 (-2.21)	0.011 (0.62)	-0.003 (-0.10)				0.156 (1.86)				-0.023 (-1.28)	0.006 (0.45)	-0.010 (-0.53)				0.207 (3.70)			
-0.024 (-1.40)	0.017 (0.91)						0.008 (0.33)			0.006 (0.43)	0.009 (0.62)						0.016 (1.21)		
-0.129 (-3.22)	0.013 (0.68)	-0.024 (-0.76)	-0.344 (-0.77)	-0.039 (-0.08)	-0.406 (-3.30)					-0.059 (-2.38)	0.006 (0.39)	-0.013 (-0.60)	0.758 (1.92)	-0.519 (-2.04)	-0.131 (-1.88)				
-0.114 (-3.07)	0.007 (0.35)	-0.022 (-0.73)	-0.558 (-1.38)	-0.150 (-0.31)	-0.371 (-2.89)			-0.001 (-0.72)	-0.002 (-0.91)	-0.062 (-2.45)	0.003 (0.19)	-0.010 (-0.43)	0.680 (1.71)	-0.364 (-1.22)	-0.159 (-2.59)			0.000 (-0.11)	-0.002 (-0.72)
US																			
0.000 (-0.02)		-0.022 (-1.41)								0.025 (3.15)		-0.011 (-0.55)							
-0.015 (-1.48)	0.016 (1.08)	-0.021 (-1.04)				0.084 (3.06)				-0.013 (-0.90)	-0.019 (-1.16)	-0.022 (-0.93)				0.158 (5.23)			
-0.006 (-0.68)	0.023 (1.62)						0.003 (0.27)			0.006 (0.60)	-0.003 (-0.19)						0.013 (1.36)		
-0.077 (-4.25)	0.009 (0.65)	-0.014 (-0.59)	-0.221 (-1.38)	-0.269 (-1.20)	-0.141 (-2.75)					-0.048 (-2.45)	-0.027 (-1.65)	-0.017 (-0.75)	0.717 (2.47)	0.052 (0.28)	-0.085 (-2.31)				
-0.072 (-3.34)	-0.001 (-0.06)	-0.012 (-0.54)	-0.152 (-1.01)	-0.236 (-1.08)	-0.147 (-3.18)			-0.001 (-0.66)	0.000 (0.26)	-0.039 (-1.85)	-0.042 (-1.71)	-0.012 (-0.63)	0.540 (2.08)	0.074 (0.44)	-0.093 (-2.45)			-0.004 (-1.63)	-0.001 (-0.70)

Appendix 1: Fama-MacBeth regression with 25 portfolios for US market

Table shows the time-series averages of estimated premia for illiquidity, market beta and liquidity betas for US market. Each 25 portfolio is formed based on the average illiquidity of the previous year (ZR portfolio), market capitalization (MV portfolio) and book-to-market ratio (B/M portfolio) at the end of previous year, respectively. Portfolio returns and illiquidity are obtained as equally-weighted averages of returns and illiquidity of member stocks, respectively. These portfolios are re-balanced every year. Each beta is estimated using the previous 5 years' portfolio returns and illiquidity and the value-weighted US market return and illiquidity. The five-year window starts from January 1983 and is rolled forward at yearly intervals. Innovations in returns and illiquidity are obtained from AR(2) fitting using the entire time-series for 1983-2004 of each variable. Using estimated betas and illiquidity, cross-sectional regression is performed and the time-series averages of each coefficient are reported in the table. ZR denotes the coefficient of expected illiquidity which is an average of illiquidity for the previous 5 years data (at least 36 months is required). Beta 1-Beta 4 denote betas defined under equation (2). MV and B/M are a log of market capitalization and a log of book-to-market ratio, respectively, at the end of previous year. T-values are in parenthesis.

	Intercept	ZR	Beta 1	Beta 2	Beta 3	Beta 4	log(MV)	log(B/M)
B/M portfolio	-0.025 (-2.46)	0.478 (4.23)	0.019 (1.83)					
	-0.025 (-2.46)	0.479 (4.26)	0.019 (1.83)	-0.178 (-0.20)				
	-0.021 (-2.17)	0.438 (3.87)	0.020 (2.19)		-0.299 (-1.45)			
	-0.022 (-2.18)	0.442 (3.94)	0.019 (1.77)			-0.070 (-1.93)		
	-0.020 (-2.13)	0.427 (3.83)	0.020 (2.19)	0.731 (0.77)	-0.111 (-0.50)		-0.067 (-1.75)	
	0.006 (0.60)	0.269 (2.21)	0.017 (2.41)	-0.208 (-0.24)	0.037 (0.22)	-0.027 (-0.67)	-0.003 (-3.43)	-0.001 (-0.62)
ZR portfolio	0.031 (3.84)	-0.051 (-1.42)	-0.018 (-2.14)					
	0.029 (3.70)	-0.040 (-1.01)	-0.017 (-2.11)	-0.052 (-0.04)				
	0.027 (3.31)	-0.052 (-1.43)	-0.010 (-1.25)		-0.701 (-3.30)			
	0.029 (3.75)	-0.032 (-0.97)	-0.017 (-2.01)			-0.010 (-0.25)		
	0.023 (3.02)	-0.019 (-0.50)	-0.009 (-1.16)	0.210 (0.15)	-0.702 (-3.39)	-0.008 (-0.19)		
	0.023 (2.47)	-0.052 (-1.27)	-0.008 (-1.06)	-0.253 (-0.21)	-0.262 (-1.36)	0.022 (0.52)	0.000 (0.51)	0.009 (2.81)
MV portfolio	0.004 (0.57)	0.209 (2.88)	-0.006 (-0.63)					
	0.005 (0.57)	0.209 (2.68)	-0.005 (-0.52)	-0.184 (-0.10)				
	0.002 (0.24)	0.206 (2.83)	-0.001 (-0.14)		-0.006 (-0.03)			
	0.006 (0.82)	0.201 (2.75)	-0.008 (-0.86)			0.028 (0.78)		
	0.006 (0.79)	0.181 (2.37)	-0.004 (-0.44)	-0.461 (-0.27)	-0.025 (-0.12)		0.035 (1.04)	
	0.000 (0.01)	0.150 (2.11)	-0.002 (-0.36)	-2.605 (-2.30)	-0.039 (-0.21)		0.078 (2.33)	0.001 (0.99)

Appendix 2: Coefficients from the estimation of predicted betas

Predicted beta of individual stock is obtained by the equation (7) using the coefficients estimated in the equation (6). Panel A is based on the fully-segmented world market model of (2) but for US stocks and panel B is based on the fully-integrated world market model of (4). The table shows the estimated coefficients and their t-values (in parenthesis) from the cross-sectional regression of equation (6). A column labeled with 'pre-b' a coefficient on pre-ranking beta. MV, B/M and ZRm denote coefficients (multiplied by 100) on the log of market capitalization, the log of book-to-market ratio both at the end of previous year and the log of average illiquidity for the previous one year, respectively. Beta 1 to Beta 4 denote betas defined under equation (2) for panel A and (4) for panel B.

year	intercept	pre-b	log(MV)	log(B/M)	log(ZR)	intercept	pre-b	log(MV)	log(B/M)	log(ZR)	intercept	pre-b	log(MV)	log(B/M)	log(ZR)	intercept	pre-b	log(MV)	log(B/M)	log(ZR)
Local Beta 1					Local Beta 2					Local Beta 3					Local Beta 4					
1994	-0.11 (-2.66)	0.52 (23.98)	0.01 (0.83)	0.11 (6.65)	-0.16 (-6.88)	0.07 (2.72)	0.10 (3.80)	0.02 (4.53)	-0.01 (-1.40)	0.10 (6.93)	-0.08 (-5.71)	0.12 (3.51)	-0.01 (-3.04)	-0.01 (-1.57)	-0.05 (-6.87)	-0.22 (-6.20)	0.05 (1.91)	0.00 (-0.28)	0.01 (0.79)	-0.13 (-6.04)
1996	-0.08 (-4.08)	0.26 (27.51)	0.02 (4.03)	-0.01 (-1.12)	-0.04 (-4.18)	0.03 (1.38)	0.18 (7.04)	0.02 (3.87)	0.01 (1.18)	0.05 (4.26)	0.02 (1.73)	0.03 (1.33)	-0.01 (-4.70)	0.00 (-0.44)	-0.02 (-4.44)	-0.14 (-4.81)	0.05 (2.48)	0.01 (1.37)	0.03 (2.77)	-0.04 (-2.72)
1998	0.04 (1.11)	0.44 (17.64)	-0.03 (-3.84)	-0.04 (-3.20)	-0.34 (-20.12)	0.09 (5.31)	0.13 (5.10)	0.01 (3.72)	0.00 (0.17)	0.07 (7.91)	-0.03 (-3.34)	0.03 (0.84)	0.00 (1.81)	0.01 (1.91)	-0.02 (-3.34)	-0.05 (-1.38)	-0.04 (-1.11)	0.02 (2.91)	0.00 (-0.06)	0.04 (2.04)
2000	0.15 (4.13)	0.48 (22.61)	-0.02 (-1.96)	0.13 (10.57)	-0.10 (-6.05)	0.05 (3.50)	0.10 (4.14)	0.01 (4.54)	0.01 (2.36)	0.05 (7.01)	0.04 (3.94)	0.06 (1.64)	-0.01 (-4.94)	-0.03 (-8.64)	0.00 (-0.89)	-0.30 (-10.44)	0.07 (2.51)	0.02 (2.93)	-0.04 (-3.70)	-0.05 (-3.67)
2002	1.07 (12.71)	0.00 (-0.00)	-0.25 (-14.32)	-0.18 (-6.47)	-0.71 (-17.95)	0.05 (2.15)	0.18 (4.31)	0.05 (9.24)	-0.03 (-3.12)	0.13 (10.91)	-0.03 (-1.71)	0.21 (4.26)	0.04 (11.43)	-0.02 (-3.39)	0.11 (13.62)	0.43 (7.21)	0.16 (3.28)	0.03 (2.06)	-0.05 (-2.57)	0.23 (8.14)
2004	0.44 (11.39)	0.11 (6.07)	-0.03 (-3.58)	-0.03 (-2.11)	-0.05 (-2.87)	0.02 (1.40)	0.10 (3.32)	0.01 (1.90)	0.01 (2.11)	0.02 (2.06)	0.02 (1.37)	0.18 (5.94)	0.00 (0.84)	-0.02 (-5.44)	0.02 (2.77)	-0.28 (-9.02)	0.06 (2.87)	0.04 (5.76)	-0.02 (-1.31)	-0.02 (-1.47)
World Beta 1					World Beta 2					World Beta 3					World Beta 4					
1994	0.02 (0.62)	0.48 (31.19)	0.01 (1.95)	0.07 (4.81)	0.01 (0.44)	-0.05 (-3.61)	-0.01 (-0.39)	0.01 (3.74)	0.00 (-0.32)	0.00 (-0.50)	0.02 (1.95)	-0.03 (-1.08)	-0.01 (-2.28)	0.01 (2.31)	-0.02 (-3.55)	-0.20 (-4.38)	0.04 (1.61)	0.01 (0.57)	-0.01 (-0.38)	-0.10 (-3.66)
1996	-0.13 (-5.26)	0.18 (16.72)	0.03 (5.99)	-0.04 (-3.68)	-0.03 (-2.38)	0.06 (2.81)	0.04 (1.10)	0.01 (1.79)	-0.01 (-0.84)	0.04 (3.52)	-0.03 (-3.67)	0.11 (3.86)	-0.01 (-4.14)	0.00 (0.14)	-0.03 (-5.83)	-0.05 (-1.36)	0.04 (1.83)	-0.01 (-0.71)	0.05 (3.23)	-0.04 (-1.93)
1998	0.01 (0.14)	0.25 (6.61)	0.03 (2.97)	0.04 (2.39)	-0.26 (-10.80)	0.09 (6.76)	-0.02 (-0.64)	0.00 (0.38)	0.01 (1.40)	0.03 (4.76)	0.00 (-0.36)	-0.06 (-1.99)	0.01 (4.24)	-0.01 (-1.55)	0.02 (4.96)	0.01 (0.26)	-0.05 (-1.25)	0.02 (1.58)	-0.04 (-1.81)	0.06 (2.18)
2000	0.08 (1.99)	0.49 (22.70)	-0.02 (-1.70)	0.12 (8.40)	-0.11 (-5.26)	0.03 (3.40)	0.00 (0.21)	0.00 (2.77)	0.00 (1.62)	0.02 (4.97)	0.04 (4.84)	0.16 (5.69)	-0.01 (-8.22)	-0.02 (-8.26)	-0.01 (-2.20)	-0.24 (-6.67)	0.04 (1.80)	0.04 (5.22)	-0.04 (-2.75)	0.03 (1.79)
2002	1.03 (10.30)	0.62 (16.16)	-0.17 (-7.96)	-0.36 (-10.83)	-0.46 (-9.98)	-0.06 (-4.89)	0.10 (3.12)	0.01 (4.52)	0.00 (0.63)	0.01 (1.50)	-0.13 (-11.22)	0.07 (1.65)	0.03 (12.77)	0.01 (2.86)	0.07 (12.04)	0.78 (8.96)	0.07 (1.39)	0.07 (3.51)	-0.06 (-1.88)	0.43 (10.43)
2004	0.41 (8.53)	0.20 (12.48)	-0.02 (-1.94)	-0.04 (-2.31)	-0.03 (-1.50)	0.07 (7.67)	-0.04 (-1.46)	-0.01 (-4.60)	0.01 (1.76)	0.01 (2.45)	-0.02 (-2.40)	-0.05 (-2.27)	0.00 (0.30)	-0.01 (-2.21)	-0.01 (-1.98)	-0.40 (-9.39)	0.02 (1.22)	0.05 (5.49)	-0.01 (-0.80)	-0.07 (-3.56)

Appendix 3: Fama-MacBeth regression with post-ranking betas (2-way sorts)

Table reports the time-series averages of estimated premia from Fama-MacBeth regressions based on the fully-segmented world market model of (2) (Panel A) and those from the regressions based on the fully-integrated world market model of (4) (Panel B) using post-ranking betas. For each individual stock, pre-ranking betas are estimated using the previous 5 years returns and illiquidity. The five-year window starts from January 1983 and is rolled forward at yearly intervals. To be included, stocks should have at least 36 monthly returns and innovations in illiquidity within the given window. In calculating betas, AR(2) fitting of returns and illiquidity is made using the entire time-series of 1983-2004. Market returns and illiquidity are formed as a value-weight average of individual stocks' returns and illiquidity. According to size and pre-ranking betas, stocks are sorted into one of the following portfolios depending on the number of stocks for each country: If the number of stocks in a country is between 100 (inclusive) and 300, the stocks are sorted into 3x3 (size and pre-ranking beta group, respectively) portfolios. We use 5x5 portfolios if the number of stocks in a country is between 300 and 500 and 10x10 portfolios if the number of stocks is greater than 500. Portfolio returns and illiquidity are calculated as an equally-weighted average of returns and illiquidity, respectively, of member stocks. These portfolios are re-balanced every year. Post-ranking beta k (k=1,2,3,4) is calculated using the returns and innovations in illiquidity for the entire time-series of 1988-2004 of each variables from a portfolio formed based on size and pre-ranking beta k. These post-ranking betas are assigned to individual stocks which belong to that portfolio. ZR denotes the coefficient of expected illiquidity which is an average of liquidity for the previous 5 years data (at least 36 months is required). MV and B/M are the previous year-end market capitalization and book-to-market ratio, respectively. B1 to B4 denote the premium for liquidity risks defined under equation (2) for panel A and (5) for panel B. T-values are in parenthesis.

	Panel A: post-ranking betas with respect to local market								Panel B: post-ranking betas with respect to world market							
	Intercept	ZR	B1	B2	B3	B4	MV	B/M	Intercept	ZR	B1	B2	B3	B4	MV	B/M
All countries	0.003	0.017	0.004						0.004	0.014	0.003					
	(0.81)	(1.23)	(0.80)						(1.00)	(1.06)	(0.66)					
	0.004	0.021	0.005	-0.152					0.005	0.021	0.004	-0.732				
	(0.97)	(1.56)	(0.86)	(-1.83)					(1.25)	(1.52)	(0.79)	(-3.07)				
	0.004	0.017	0.004		0.035				0.006	0.008	0.003		-0.291			
	(0.87)	(1.17)	(0.78)		(0.39)				(1.87)	(0.67)	(0.63)		(-1.33)			
	0.004	0.013	0.004			-0.048			0.004	0.013	0.003			-0.050		
	(0.97)	(0.97)	(0.68)			(-1.81)			(1.07)	(0.95)	(0.66)			(-3.19)		
	0.005	0.017	0.004	-0.128	0.072	-0.065			0.007	0.013	0.004	-0.572	-0.274	-0.025		
(1.12)	(1.27)	(0.70)	(-1.62)	(0.81)	(-2.66)			(2.22)	(1.03)	(0.72)	(-2.43)	(-1.25)	(-1.69)			
0.021	-0.030	0.001	-0.082	0.104	-0.012	-0.002	0.003	0.022	-0.034	0.000	-0.481	-0.134	0.003	-0.002	0.003	
(4.93)	(-2.06)	(0.30)	(-1.08)	(1.26)	(-0.49)	(-3.76)	(3.45)	(5.27)	(-2.36)	(0.09)	(-1.97)	(-0.49)	(0.19)	(-2.73)	(3.44)	
Developed markets	0.009	0.004	-0.001					0.011	0.001	-0.004						
	(3.41)	(0.30)	(-0.33)					(4.82)	(0.06)	(-0.99)						
	0.010	0.008	-0.001	-0.194					0.012	0.008	-0.003	-0.821				
	(4.06)	(0.67)	(-0.38)	(-2.35)					(5.36)	(0.69)	(-0.73)	(-3.25)				
	0.009	0.003	-0.001		-0.024				0.013	-0.007	-0.003		-0.262			
	(3.39)	(0.22)	(-0.33)		(-0.39)				(5.21)	(-0.53)	(-0.89)		(-2.17)			
	0.010	-0.001	-0.002			-0.057			0.011	0.000	-0.004			-0.057		
	(3.70)	(-0.04)	(-0.52)			(-2.32)			(4.92)	(-0.04)	(-0.95)			(-3.18)		
	0.011	0.005	-0.002	-0.186	0.016	-0.057			0.013	0.000	-0.003	-0.650	-0.210	-0.027		
(4.25)	(0.39)	(-0.56)	(-2.31)	(0.30)	(-2.47)			(5.60)	(0.03)	(-0.69)	(-2.74)	(-1.85)	(-1.95)			
0.024	-0.040	-0.002	-0.125	0.070	-0.009	-0.002	0.003	0.024	-0.040	-0.002	-0.492	-0.005	-0.008	-0.002	0.002	
(6.14)	(-2.90)	(-0.51)	(-1.64)	(1.22)	(-0.37)	(-3.41)	(2.42)	(6.52)	(-2.84)	(-0.60)	(-2.04)	(-0.04)	(-0.60)	(-3.37)	(2.23)	
Emerging Markets	-0.015	0.103	0.018					-0.014	0.074	0.018						
	(-1.12)	(2.21)	(1.34)					(-1.07)	(1.90)	(1.45)						
	-0.016	0.108	0.018	0.096					-0.015	0.073	0.018	0.292				
	(-1.22)	(2.34)	(1.36)	(0.50)					(-1.14)	(1.83)	(1.47)	(0.64)				
	-0.012	0.096	0.016		0.052				-0.014	0.091	0.016		-0.446			
	(-1.02)	(2.17)	(1.24)		(0.36)				(-1.17)	(2.14)	(1.58)		(-1.11)			
	-0.014	0.098	0.017			-0.040			-0.014	0.076	0.018			0.014		
	(-1.07)	(2.16)	(1.27)			(-0.61)			(-1.09)	(1.93)	(1.45)			(0.75)		
	-0.013	0.095	0.016	0.100	0.101	-0.061			-0.015	0.094	0.016	0.160	-0.451	-0.002		
(-1.08)	(2.29)	(1.25)	(0.58)	(0.67)	(-1.22)			(-1.23)	(2.13)	(1.59)	(0.32)	(-1.12)	(-0.09)			
0.002	0.021	0.014	0.282	0.115	-0.019	-0.002	0.004	0.002	0.045	0.015	-0.115	-0.595	0.034	-0.002	0.005	
(0.15)	(0.55)	(1.09)	(1.56)	(0.68)	(-0.33)	(-2.84)	(2.85)	(0.11)	(0.96)	(1.55)	(-0.25)	(-0.86)	(1.73)	(-2.27)	(2.82)	
US Markets	0.007	0.050	0.004					0.009	0.043	0.003						
	(2.55)	(1.93)	(0.82)					(2.79)	(1.64)	(0.51)						
	0.014	0.023	0.004	-3.596					0.011	0.035	0.003	-1.632				
	(5.54)	(1.09)	(0.82)	(-4.03)					(3.83)	(1.40)	(0.53)	(-3.41)				
	0.015	-0.010	0.005		-1.175				0.017	-0.050	0.003		-0.815			
	(5.37)	(-0.58)	(0.99)		(-3.97)				(5.73)	(-2.64)	(0.67)		(-3.80)			
	0.009	0.016	0.004			-0.251			0.010	0.020	0.003			-0.215		
	(3.47)	(0.80)	(0.83)			(-3.71)			(3.47)	(0.88)	(0.52)			(-4.26)		
	0.017	-0.023	0.004	-1.665	-0.893	-0.110			0.017	-0.051	0.003	-0.016	-0.770	-0.056		
(6.21)	(-1.37)	(0.95)	(-3.21)	(-3.75)	(-2.78)			(5.75)	(-2.68)	(0.67)	(-0.04)	(-3.55)	(-2.46)			
0.026	-0.073	0.005	-1.097	-0.527	-0.042	-0.002	0.001	0.026	-0.087	0.004	-0.298	-0.486	-0.022	-0.001	0.001	
(4.98)	(-2.65)	(1.18)	(-2.60)	(-2.97)	(-1.38)	(-2.27)	(0.83)	(4.90)	(-2.99)	(0.82)	(-0.98)	(-3.34)	(-0.94)	(-2.03)	(0.77)	