Global Liquidity Risk

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Abstract

The world economy has been global in which equity markets become sensitive to global systematic risks. The burst of Internet Bubble created the lowest global liquidity. We find that the global liquidity risk is positively priced and the world market illiquidity has a contemporaneous negative premium. Their contributions to market returns are significantly large. The characteristic of individual market illiquidity demands extra returns controlled for market, value, and size factors. The market liquidity and its return sensitivity to the global liquidity risk are non-linearly related and play multi-dimensional roles in market returns whose idiosyncratic components covariate with this risk.

Keywords: Global, liquidity risk, liquidity, sensitivity, asset pricing, Jensen's alpha, CAPM, multi-factor model, characteristic, risk

JEL Classification: G11, G12, G15

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I. Introduction

The world economy has become global[1], in which capitals can freely flow among developed and open financial markets. Investors usually hold assets across the globe so that they can enjoy benefits of diversification and expose to the higher economic growth of other countries and their higher market returns. World equity markets have been sensitive to global systematic risk factors that can be the exchange rate risk[2], the global liquidity risk and the world volatility market risk[3]. One draw back of the international CAPM is the lack of getting the true world market portfolio. Liang (2005) develops a dynamic equilibrium Demand Shock Asset Pricing Model in which exchange rates and demands from foreign investors influence domestic and foreign demands for risk assets across the globe. The model in the global economy theoretically and economically argues that the global liquidity risk should be priced at the locally diversified country market portfolios[4].

The recent Internet bubble originated in the U.S. market globally spread out because investors enriched from the US market bubble would generously take other risks to invest in other countries and created excess demands for risky asset across the globe. According to Liang (2005)'s Demand Shock Asset Pricing Model, current period demand shocks from home and foreign countries would dry up the current period return and price. At the end, its burst speeded up the burst of bubbles around the world because the shrinking demands put much higher

[1] The unification of European economy and the global trading activities are strong evidence after 1990.

[2] Baily and Chung (1995), and Choi, Hiraki, and Takezawa (1998) show that the exchange rate influence stock returns in emerging markets and Japan while exchange rate, stocks and bonds are jointly determined in Pavlova and Rigobon (2004).

[3] Liang and Wei (2004) find that world market volatility requires negative pricing premium at the locally diversified country market level.

[4] Liang (2005) defines it as the return sensitivity to volume or to turnover.

expected return on risky assets. At the same time, the current period liquidity would dramatically decrease as it is suggested by the model. Using Pastor and Stambaugh (2003) measure, we find that the burst of the recent market bubbles consequently created the lowest country market liquidity around the world and the lowest global liquidity. Then, investors naturally put higher expectation on risky assets and feared that the next period liquidity will become shortage. The burst of Internet bubble, the collapse of Long-Term Capital Management (LTCM) and the Asian Financial Crisis illustrated that liquidity shocks around the world significantly affected the market liquidity of other countries and their returns. This paper studies how the global liquidity risk-liquidity shock as a factor is priced at locally diversified country market portfolios and how the characteristic of the market liquidity influence market returns in the global economy. We also investigate the relationship between the return sensitivity of markets to the global liquidity risk and their liquidity. Our motivation to investigate the pricing of global risk factor across country markets portfolio is that the total market portfolios are locally diversified country portfolios that are not exposed to local risk factors[5]. In standard asset pricing theory, risky assets are related to return's sensitivities to state variables[6]. Hence, individual stocks[7] and industrial portfolios are sensitive to local risk factors and do not have a good portfolio characteristic for testing the pricing of global risk factors[8]. We use the market portfolios of developed countries because they can isolate the cross-listing effect and the currency liquidity constraints[9].

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[5] One alternative approach is to use industrial portfolios across different country. However, industrial portfolios are still not fully diversified at the country level and should be sensitivity to individual country risk factors.

[6] Fama and French (1992), (1993) and (1995) documented the market, size and value factors are priced, and Jegadeesh and Titman (1993) showed that momentum is a pricing factor.

[7] Bekaert and Harvey (2003) find that individual stocks are affected by liquidity across some emerging markets.

[8] Fama and French (1998) find that the market and value are pricing factors across the globe. Richards (1996) and Rouwenhorst (1998) find that the momentum factor is priced at the country level but not at country index level.

[9] Their currencies are freely exchangeable while they account for the majority of world market.

Interestingly, the model in Liang (2005) suggests that the relationship between the liquidity of country markets, their returns, and their sensitivities to global liquidity risk is complicated and complex. Once investors face liquidity limitation in one market, they will naturally liquidate their assets in or switch their funds to other markets that have higher liquidity[10]. Investors buying these liquidating assets require extra return for compensating the liquidity demand of the sellers because the liquidity of the more liquid markets will be dried out. However, the investors might not require extra returns from risky assets in more liquid markets if they switch their fund to them. Meanwhile, the highly liquid markets demanding less return are sensitive to the global liquidity risk. As a result, they also require higher return in this respect. On the other hand, according to asset pricing theory[11], we expect illiquid markets demand higher expected returns than that are more liquid. These markets may not be very sensitive to liquidity shocks of others markets or the global liquidity risk because these illiquid markets are historically small and not very attractive. Attracting much less foreign investments, these markets face much less liquidation from oversea investors or absorb much less foreign fund when other markets have illiquidity constraint. Therefore, the characteristic of market liquidity and its sensitivity to global liquidity risk do not have a linear relationship and play multi-dimensional roles in market returns as we find in this paper.

We convert both turnovers by value and market return into US dollar then construct the market liquidity of Pastor and Stambaugh (2003) measure and the market illiquidity of Ahimud (2002) measure. We are interested in the money flow causing country market liquidity among

[10] Investors will firstly decide switch their funds or liquidate their assets in the market level.

[11] Amihud, and Mendelson (1986), Brennan and Subrahmanyam (1996), Brennan, Chordia and Subbrahmanyam (1998), Datar, Naik and Radcliffe (1998) and Gervais, Kaniel and Mingelgrin (2001) use a variety of liquidity measures to examine the level of liquidity as a characteristic related to expected return; and generally find that illiquid stocks have higher average returns in the US market.

developed countries[12] while the Pastor and Stambaugh (2003) liquidity measure captures the dimension of liquidity associated with temporary price changes accompanying order flow or market turnover by value. We employ both Fama-MacBeth methodology and GMM estimation to examine the pricing of global liquidity risk. Using GMM estimation, we find that the global liquidity risk is significantly priced. Its contribution to market returns are significantly and economically large after controlled for global market, value, and size factors[13]. In particular, the contribution to the difference between the US and Japan market returns[14] is significantly 11.8% during the period from 1988 to 2001 and 12.1% during the period from 1990 to 2001. However, the idiosyncratic components of market returns covariate with the global liquidity risk because we can not find a significant factor loading by Fama-MacBeth methodology. On the other hand, we also find that the world market illiquidity has significant negative pricing premium while its contribution to the market returns between the US and Japan markets is also significantly large. This is consistent with Demand Shock Asset Pricing Model in which the decreased demand for risky assets in the current period generating the contemporaneous market illiquidity negatively affects asset returns.

Furthermore, we find that the characteristic of market liquidity does not linearly relate to the market return sensitivity to the global liquidity risk. Hence, we investigate how the illiquidity as a characteristic vs. the betas affecting market returns by sorting markets into portfolios on their liquidity and return sensitivity. We find that they play a multi-dimension role on market returns. The remainder of the paper is organized into another six sections. Section II, describes

[12] Chordia, Sarkar and Subrahmanyam (2004) that there is a linkage between market liquidity and money flows in the US equity and bond markets.
[13] Pastor and Stambaugh (2003) find that the market liquidity risk explains 60% of the momentum effect.
[14] The US and Japan markets are the biggest and the second biggest equity market in the world.

the source of data. Section III constructs the country market liquidity, the global liquidity risk, the market illiquidity and the world market illiquidity. Section IV investigates how the global liquidity risk is priced, and the pricing premium of the world market illiquidity. Section V presents how the characteristic of market liquidity vs. the global liquidity risk factor plays role in market returns. Section VI finally concludes.

II. Data Sample

The daily country total market indices value, their daily turnover by value, and their daily market values in local currency, and the daily exchange rates are retrieved from DataStream. The period with valid index value and market value is reasonable long, but the number of years that countries have daily turnover by value is limited. Hence, this paper can only use the data sample from January 1988 to December 2002. We also use eight global portfolio assets to mimic the global liquidity risk as they are not tradable asset when we use Fama-MacBeth methodology to estimate the factor premium. These eight assets are value weighted returns of global stocks that are categorized as 1) the top 30% of book-to-market (B/M) ratio; 2) the bottom 30% of B/M ratio; 3) the top 30% earning-to-price ratio (E/P); 4) the bottom 30% E/P; 5) the top 30% of high cash earning-to-price ratio(CE/P); 6) the bottom 30% CE/P; 7) the top 30% of dividend yield (YLD); and 8) the bottom 30% YLD. We select twenty-three markets of developed countries, which composite the MSCI world index and whose currencies are freely exchangeable. After converting them to US dollar unit, we construct the world market return and country market liquidity. The world market return of this paper is the value weighted return of these markets when they have valid index and of market value. There are only 14 countries having valid turnover by value in 1988, and the number of countries increases to 20 after 1990 and 22 after 1993. Ireland has valid turnover by value starting only from January 2001. The US market has the highest average turnover by value and is followed by Japan (in shorter length of period), United Kingdom (UK) and Germany. Therefore, we expected that its liquidity shock would significantly affect the liquidity around the world. After converting into US dollar, turnover by value of country index in small countries such as Greece, Portugal, Belgium and Austria become small. Deleting errors and outliers in the data, we first delete the data volume by value in US dollar if it is less than US$100,000 as sample errors or typos because these turnovers are the trading value of the total markets that are developed and sufficiently big. Selecting more accurate data sample, we delete the data whose turnover is below 0.2% of the mean of each country because it is outside of the range of over three standard deviations from their mean. One example is that the one-day turnover is only 19 millions in the total US market and the average is 32.8 billions for the period from January 1988 to March 2004. Hence, we consider these noise data as outliners or errors. We follow Fama-French (1992) to construct the size factor SMB from the country market returns. It is the small-minus-big value weighted return when countries are sorted into small, medium, and large size portfolios.

III. Country Market Liquidity Measure and Global Liquidity Risk

Pastor and Stambaugh Liquidity Measure

Capturing the liquidity dimension related with temporary price changes accompanying order flow, the world market liquidity of Pastor and Stambaugh's (2003) liquidity measure in a given month is the simple average of the liquidity of individual country market. The liquidity of country i in month t is the coefficient $\gamma_{i,t}$ from ordinary-least-squares (OLS) in the following regression (1):

$$r^{e}_{i,d+1,t} = \alpha_{i,t} + \beta_{i,t} r_{i,d,t} + \gamma_{i,t} * sign(r^{e}_{i,d,t}) * v_{i,d,t} + \varepsilon_{i,d+1,t}, \quad d = 1,..,D, \tag{1}$$

where[15]

$r_{i,d,t}$: the return in US dollar of market i on day d in month t,

$r^{e}_{i,d1,t} = r_{i,d,t} - r_{i,m,t}$: $r_{i,m,t}$ is the value weighted return US dollar of the world market on day d in month t,

$v_{i,d,t}$: the volume in ten million US dollar (turn over by value) of country market i on day d in month t.

This liquidity measures $\gamma_{i,t}$ is approximately the same as that is constructed from individual stock j because the following:

$$\gamma_i = \frac{\partial R_{t+1}}{\partial\left(S_i V_i^j\right)} = \sum_{j=1}^{M_i} w_i^j \frac{\partial R^j_{i,t+1}}{\partial\left(S_i^j V_i^j\right)} \approx \frac{1}{M_i}\sum_{j=1}^{M_i} \gamma_i^j = \sum_{j=1}^{M_i} \frac{\partial R^j_{i,t+1}}{\partial\left(s_i^j V_i^j\right)} = \gamma'_i, \tag{1a}$$

where $w_i^j = \dfrac{MV_i^j}{\sum_{j=1}^{M_i} MV_i^j}$ and the sign of country market i is $S_i = \sum_{j=1}^{M_i} w_i^j s_i^j$. On the other hand, it should be better measure for the total country market portfolio liquidity because it uses the market portfolio sign against the world market return. It also captures the temporary price fluctuations are induced by total market money order flow in each country, and implies that lower liquidity corresponds to stronger volume-related market return reversal against world market return. Therefore, a reversed future return is expected when the country market liquidity is low, which is constructed by the signed volume. It is consistent with the economic reasoning in Campbell, Grossman and Wang's (1993) in which investors are compensated for accommodating the liquidity demands of others. This means that the higher the reversal for a

[15] Note: All the country index excess returns, portfolio excess returns, returns, market excess return and value factor –HML returns in all regressions of this study are in percentage so that all coefficients of regressions are interpreted as monthly percentage. This is convenient for interpreting the Jensen's alpha and the estimated liquidity risk premium and its contribution to the country index return in following tables.

given dollar volume, the lower the country market liquidity is. We would expect negative $\gamma_{i,t}$ in general and larger in absolute magnitude when country market liquidity is lower. The constructed liquidity measure should reflect the cost of a trade whose size is relatively compensated with market size. The world market liquidity $\gamma_{m,t}$ is the simple average in equation (2) and representative[16] .

$$\gamma_{m,t} = (1/N_t)\sum(\gamma_{i,t}), \qquad i = 1,..,N \,. \tag{2}$$

We also multiply $\gamma_{m,t}$ by (m_t/m_1), where m_t is the total dollar value at the beginning of month t of country market included in the simple average in month t, and month 1 corresponds to the January 1988. We plot the monthly aggregate liquidity in both scaled global liquidity measure in figure 1.

[Figure 1 inserted here]

Global Liquidity Risk

The lowest global liquidity value occurs in January 2001 when the internet bubble was burst and spread while the second lowest points is during the Asian Financial Crisis in 1997. It illustrates that this global liquidity measure captures what actually happened around the world. Constructing the innovations of global liquidity, we first aggregate the monthly difference in market liquidity across N_t markets then scale it as in equation (3).

$$\Delta\gamma_{m,t} = (m_t/m_1)*(1/N_t)\sum(\gamma_{i,t} - \gamma_{i,t-1}), \quad i = 1,..,N \,. \tag{3}$$

We regress $\Delta\gamma_{m,t}$ on its lag as well as the lagged value of the scaled level series:

$$\Delta\gamma_{m,t} = \alpha + \beta\Delta\gamma_{m,t-1} + c(m_t/m_1)*\Delta\gamma_{m,t-1} + \delta_t \,. \tag{4}$$

[16] N_t can be viewed as actually N*M (where M is average number of stocks across country market indices, N is number countries).

This regression allows the predicted change relies on the most recent changes at the same time on the deviation of the most recent level from its long run mean. This regression is a second-order auto-regression in the level series, and produces the uncorrelated residuals or the innovation. The global liquidity risk L_t is taken as this global liquidity innovation divided by 10,000[17].

$$L_t = \delta_t / (100 * 100) . \tag{5}$$

Amihud Illiquidity Measure and World Market Illiquidity

Amihud (2002) uses different measure to construct illiquidity of stock and finds that the illiquidity requires extra expected return and the unexpected illiquidity has contemporaneous negative relationship with return. I constructed the following country market illiquidity according to Amihud's measure to investigate how different measures capture the market illiquidity of the locally diversified market portfolios in the global setting.

$$ILLIQ_{i,t} = \frac{1}{D_t} \sum_{d=1}^{D_{it}} | R_{itd} | / Turn_{itd} \, , \tag{6}$$

where D_t is the number of days on the month t, and $Turn_{itd}$ is the average daily turnover by value. This measure of market illiquidity is also almost the same as that is constructed from individual stock because

$$ILLIQ'_i = \frac{1}{M_i} \sum_{j=1}^{M_i} Illiq_i^j = \frac{1}{M_i} \sum_{j=1}^{M_i} \frac{\left| R_i^j \right|}{v_i^j} \approx \frac{\left| \sum_{j=1}^{M_i} w_i^j R_i^j \right|}{v_i} = ILLIQ_i \, , \tag{6a}$$

[17] It is arbitrary for reporting purpose.

where v_i is the average turnover of a stock j in market i and $Turn_{itd} = v_i = \frac{\sum_{j=1}^{M_i} v_{itd}^j}{M_i}$, when M is large enough. The value weighted market illiquidity is a better comparable measure with the previous market liquidity measure. Hence, the world market illiquidity at month t will be the following:

$$MILLIQ_{i,t} = \frac{1}{N_t} \sum_{i=1}^{N_t} ILLIQ_{i,t} \ , \qquad (7)$$

where N_t is the number of country at time t. We are interested in how the world market illiquidity contemporaneously affects market returns because the Demand Shock Asset Pricing Model of Liang (2005) theoretically and economically argue that the contemporaneous market illiquidity negatively affect market returns.

IV. The Pricing of Global Liquidity Risk

We first estimate betas using simple linearly normal regressions and then follow Pastor and Stambaugh (2003) to predict betas using seven characteristics of country market indices. We employ traditional portfolio approach to examine if the spread of sensitivity provides abnormal Jensen's alphas. We then employ both Fama-Macbeth (1973) methodology and GMM estimation to examine how the global liquidity risk and the world market illiquidity are priced, and their contributions to market returns.

Past and Predicted betas

We obtain the return past beta or sensitivity to the global liquidity risk from the OLS regression[18] (8):

[18] Fama-French (1998) find that the market and HML are common factors across the globe.

$$R_{i,\tau} = \alpha_i + \beta^L_{i,t-1} L_\tau + \beta^m_{i,t-1} MKTX_\tau + \beta^h_{i,t-1} HML_\tau + \varepsilon_{i,\tau},\ i = 1,..,N,\ \tau = t-36,..,t-1 \quad (8)$$

As the liquidity is an abstract concept and the global liquidity risk is non-tradable risk. We also follow Pastor and Stambaugh (2003) to predict the sensitivity of market returns to global liquidity risk so that we can capture the non-trivial nature of the global liquidity risk. We use seven characteristics of country market index to perform this task. These characteristics are 1) the linearly beta estimated using equation (6) with all data available from months t-36 through t-1; 2) the natural log of country index value in US dollar; 3) the natural log of market value of country index in million US dollar; 4) the average value of $\gamma_{i,t}$ from month t-6 to t-1; 5) the natural log of average turnover by value in thousand US dollar from month t-6 to t-1; 6) the accumulative country index return in US dollar; 7) the monthly standard deviation of the monthly return[19]. The predicted beta is a linear function of these seven elements specified as follow:

$$\beta^L_{i,t-1} = \psi_{1,i} + \psi_{2,i} C^1_{i,t-1} + \psi_{3,i} C^2_{i,t-1} + \psi_{4,i} C^3_{i,t-1} + \psi_{5,i} C^4_{i,t-1} + \psi_{6,i} C^5_{i,t-1} + \psi_{7,i} C^6_{i,t-1} + \psi_{8,i} C^7_{i,t-1}\ . \quad (9)$$

Getting the accurate value of $\psi_{j,i,}$ we use a two stage OLS regression method. We can get equation (10) by substituting the right-hand side of (9) in (8).

$$R_{i,t} = \alpha_i + \beta^m_i MKTX_t + \beta^h_i HML_t + \left(\psi_{1,i} + \psi'_{k,i} C_{i,t-1}\right) L_t + \varepsilon_{i,t},\ i = 1,..,N, \quad (10)$$

where $\psi'_{k,i,}$ is a 1x7 vector containing $\psi'_{j,i,}$ j=1, .. 7, and $C_{i,t-1}$ is a 7x 1 vector containing seven elements. The above regression for country i contains 10 independent variables, and 7 of which are cross product of the elements of $C_{i,t-1}$ with L_t . We restrict the coefficients $\psi_{1,i}$ and $\psi'_{k,i}$ in equation (9) to be the same for all country index and estimate them using the whole panel of

[19] They are firstly produced with decimal return then converted to percentage matching other returns in the regressions

country market index returns. At first, we estimate β^{M}_{i} and β^{H}_{i} using regression (8) for each country i, and then construct the historical series by the following equation (11):

$$e_{i,t} = R_{i,t} - \beta_i^m MKTX_t - \beta_i^h HML_t, \qquad i = 1,..,N \qquad (11)$$

We use the historical $e_{i,t}$ to run a pooled time-series, cross-sectional regression (11) of $e_{i,t}$ on the seven elements.

$$e_{i,t} = \psi_{0,i+}\left(\psi_{1,i} + \psi'_{k,i} C_{i,t-1}\right)L_t + v_{i,t}, \qquad i = 1,..,N \qquad (12)$$

We find that the signs of the coefficients of market value and turnover are opposite that the market return sensitivity is positively related to its turnover and negatively to its size. An opposite sign of log turnover by value and log market value gives a nice property that is log (turnover/market value) which can nicely capture the sensitivity in this dimension. The predicted beta being positively related to accumulative returns is a good property that markets with higher sensitivity to the global liquidity risk will require higher accumulative return since international investors or global fund managers would be attracted to invest foreign country equity market by the past accumulated return at country market level. In particular, investors will switch their attentions these performing markets with relatively higher liquidity when there is a global liquidity shock.

Post Ranking Portfolios

We sort countries into 5 portfolios based on the past and predicted betas ranking from 1 to 5 (the portfolio 1 has the lowest beta and portfolio 5 has the highest beta) to see if there is a increasing Jensen's alpha for both CAPM, Fama-French two and three factor models[20]. The first month being considered is January 1990 because we would like to include major

[20] we find that the size factor constructed from country market returns significantly priced.

markets[21]. The panel A of Table 1 reports the properties and alphas of the returns of these portfolios regressing on the three models.

[Table 1 inserted here]

The alpha of the equal-weighted portfolio return generally increases over beta even though the trend is not strictly monotonic. The zero-cost portfolio 5-1 or H-L that longs portfolio 5 and shorts portfolio 1 has significant Jensen's alphas. They are 0.80 (t=2.31), 0.79 (t=2.22), and 0.86 (t=2.37). The average market liquidity of portfolios is also not linearly related to their past betas. In fact, the portfolio of the second lowest beta has the lowest market liquidity and middle Jensen's alpha. Country markets are also sorted into 5 portfolios on their predicted betas at the end of each month, the next month return will be used (therefore, the first month of return in the portfolio is December 1991 as explained later). As shown in the panel B, the Jensen's alpha also has an increasing trend that is not strictly monotonic. However, the Jensen's alphas of equally weighted zero-cost high-minus-low portfolio are significantly positive for all three models. They are 0.69 (t=1.93), 0.68 (t=1.86) and 0.78 (t=2.11). This suggests that the global liquidity risk as a factor demand a positive pricing premium. This also means that the relationship between market returns and the global liquidity risk is not trivial.

The non-monotonic upward trend of the market liquidity within these five portfolios actually illustrates a non-linear relationship between the portfolio liquidity and its sensitivity to the global liquidity risk. In particular, the portfolio 2 has the second highest alphas because it has the second lowest market liquidity. This suggests that some of the extra returns are demanded from the illiquid nature of country markets as a characteristic and that the market liquidity and its return sensitivity to the global liquidity risk are not linearly related. This also infers that this

[21] Japan, being the second biggest market, has valid data from Datastream starting from 1990.

non-linear relationship is also at country market level and that the illiquid market demands extra returns. These patterns are align with the Demand Shock Asset Pricing Model and our economic explanation that illiquid markets required additional returns to compensate the illiquidity and meanwhile they are not sensitive to the global liquidity shock or risk due to their nature of small and non-liquid. These characteristic nature of the market usually have low attractive to investors across the global. On the other hand, investors will not normally switch their fund into or liquidate their assets in these illiquid markets[22] while they face global liquidity shocks in their local market or other markets. In particular, foreign investors normally do not invest large amount of their fund into these markets when there is liquidity constraint across the globe. When they invest in these markets at normal time, they will require additional expected return for compensating the illiquidity of the markets. These suggest that the country market liquidity as a characteristic does not have linear relationship with the market return sensitivity to global liquidity risk.

Here, we first use both Fama-Macbeth methodology and GMM method to test how the global liquidity risk as a factor demands a pricing premium. The Fama-MacBeth method investigates if the tradable asset helps to price other asset and assumes the independence between factors and the idiosyncratic component. The Generalized Method of Moments (GMM) method can estimate the pricing premium of the non-tradable risk and removes the covariance between the risk, other factors, and idiosyncratic components or the second moments. We employ both methods because markets are locally diversified portfolios and nontrivially related to the global liquidity risk as previously discussed. We also use GMM to examine whether the world market

[22] It will be also more difficult to liquidate assets in these illiquid and small markets when there is global liquidity shock

illiquidity has contemporaneous negative premium according to Demand Shock Asset Pricing Model.

The factor loading using Fama-MacBeth method

Estimating the factor loading of the global liquidity risk, we use eight global tradable assets to mimic the non-tradable global liquidity risk by the Lamont (2001) economic tracking regression (11).

Economic Tracking Model: $$Liqrisk_t = \beta^0 + \beta'_F \, MF_t + \varepsilon_t \,. \tag{13}$$

We define that $Mliq_t$ equals β'_F MF_t and then use Fama-Macbeth (1973) regressions (14) and (15) to examine if the pricing nature of the global liquidity risk is linearly normal.

$$R_{i,\tau} = \alpha_i + \beta_{i,t-1}^{Mliq} Mliq_\tau + \beta_{i,t-1}^{m} MKTX_\tau + \beta_{i,t-1}^{h} HML_\tau + \beta_{i,t-1}^{s} SMB_\tau + \varepsilon_{i,\tau}, \quad \tau = 1,..,t-1 \tag{14}$$

$$R_{i,t} = \psi^0 + \psi^{Mliq} \beta_{i,t-1}^{Mliq} + \psi^m \beta_{i,t-1}^{m} + \psi^h \beta_{i,t-1}^{h} + \psi^s \beta_{i,t-1}^{s} + \varepsilon_{i,t}, t = 1,..,T \quad . \tag{15}$$

The $\beta^F_{i,t-1}$ is using time series data from January 1988 to t-1 for regression (14). The factor premium is reported in table 2.

[Table 2 inserted here]

The factor loading of the mimicked global liquidity risk is not significant (t=0.85) although it is positive. The only significant factor is the size factor while the value factor is significant when it is not controlled for size. Examining the significance of the risk, we perform the similar test by using its direct value named LiqRisk to replace Mliq in the above two equations. We still can not find a significant factor loading of the global liquidity risk. They are t=0.79 and t=0.98 while the significance of other two factor increase as length of the data sample becomes longer. We infer that the global liquidity risk covariates with the idiosyncratic components of the market returns although the market portfolios are locally diversified portfolios. It is not surprised to find a simple relationship because Chordia, Subrahanyam and Anshuman (2001) find a non-linear relation between turnover-a liquidity proxy and returns at the stock level in the US Market. Although we do not find a significant factor loading form Fama-Macbeth method, we can not conclude that the global liquidity risk does not have a pricing premium because we find the significant abnormal returns of the zero-cost portfolios based on the return sensitivity to the risk.

The Pricing Premium using GMM methods

We then employ Generalized Method of Moments (GMM) method to estimate the liquidity risk premium and its contribution to the market returns. We use individual country market portfolios to eliminate the concern that the betas or sensitivity may not truly represent the market's true sensitivity to the global liquidity risk. We define the multivariate regressions (14) and (15),

$$R_{i,t} = \alpha_i + \beta_i^L L_t + \beta_i^m MKTX + \beta_i^h HML_t + \beta_i^s SMB_t + \varepsilon_{i,t} \text{ ,i=1,..,N,} \qquad (16)$$

The equation in matrix form,

$$R_t = \beta^0 + \beta^L L_t + \beta_i^F F_t \,, \qquad (17)$$

where R_t is a Nx1 vector containing the excess returns on the N countries where N is number of countries when we use individual country as a locally diversified portfolio. The β^0 and β^L are Nx1 vectors, F_t can be 2 x 1 and 3x1 vector containing realizations of "traded" factors MKT, HML and SMB, and β^F is Nx3 matrix. Assuming the N country markets are priced by the returns sensitivities to the traded factors and the non-traded global liquidity risk factor, we have:

$$E(R_i) = \beta_i^L \lambda_L + \beta_i^M \lambda_M + \beta_i^H \lambda_H + \beta_i^S \lambda_S \,, \text{ i=1,..,N.} \qquad (18)$$

In vector and/or matrix form,

$$E(R_i) = \beta^L \lambda_L + \beta^F \lambda_F \ , \tag{19}$$

where E(.) denotes the unconditional expectation; and λ_L and λ_M ,$\lambda_{H,}$(vector λ_F) are the true expectations of respected variables. After taking expectation of both sides of (15) and substituting to equation (17), we have

$$\beta_i^0 = \beta_i^L [\lambda_L - E(L_t)], \qquad \text{i=1,..,N.} \tag{20}$$

In vector form,

$$\beta^0 = \beta^L [\lambda_L - E(L_t)], \tag{21}$$

because the vector premium on the traded factors λ_F, is equal to $E(F_t)$. The global liquidity factor L_t is not the payoff on a traded position, so in general the liquidity risk premium λ_L is not equal to $E(L_t)$. In order to find the true risk premium for the non-tradable liquidity, we use Generalized Method of Moments (GMM) of Hansen (1982) Estimation to estimate the λ_L. Let θ denote the set of parameters: $\lambda_{L,}$ $\beta^L_{,}$ β^F and E (L_t) The GMM estimator of θ minimizes $g(\theta)'Wg(\theta)$, where $g(\theta) = (1/T)\sum f_t(\theta), \ t = 1,..,T$,

$$f_t(\theta) = \begin{pmatrix} h_t \otimes e_t \\ L_t - E(L_t) \end{pmatrix} \tag{22}$$

$$h'_t = (1F'_t \ L_t) \tag{23}$$

$$e_t = R_t - \beta^L [\lambda_L - E(L_t)] - \beta^L L_t - \beta^F F_t \ , \tag{24}$$

and W is a consistent estimator of the optimal weighting matrix. We perform GMM tests using individual country market portfolio to investigate the pricing premium at country market level because country markets are locally diversified portfolios that contains a large number of stocks, and do not rely on the estimation of time-varying beta or sensitivity. Table 3 reports the pricing premium of the global liquidity risk and its contribution to market returns.

[Table 3 inserted here]

The global liquidity risk premiums λ are respectively 20.65 (t=2.44) and 13.15 (t=2.91) for periods from January 1988 to December 2001 and to December 2002. Focusing on the increasing globalization of world economic after 1990, the pricing premiums λ of global liquidity risk are 30.30 (t=1.79) and 16.64 (t=2.58) for periods from January 1990 to December 2001 and to December 2002. The t-statistics of the premium are much stronger than that use the portfolio approach[23] and become higher with longer period. The country market approach does not rely on the portfolios sorted on either predicted or past betas and captures the pricing premium of the global liquidity risk at the locally diversified market portfolio level. Hence, the significant results of λ -the risk premium conclude that the global liquidity risk is a international asset pricing state variable. We know that the least sensitive country is either Japan or Finland, and the most sensitive country is Greece. The contribution of the pricing premium contribution to market returns is highly significant and annually large in economic term. The contribution to the portfolio that longs Greece market and shorts Japan market are annually 36.17 (t=3.28), 31.25 (t=3.12), (t=3.14) and 33.00 (t=3.0) for four different periods. This premium contributes to the difference between Greece market return and Finland market return is 20.00 (t=2.05) and 14.85 (t=1.97). Furthermore, its contribution to the zero cost portfolio that longs US market and shorts Japan market[24] is annually significant 17.78 (t=3.95) and 14.94 (3.75) for the periods from January 1988 to December 2001 and to December 2002 and annually 19.87 (t=3.82) and 17.05 (t=3.72) for the periods from January 1990 to December 2001 and to December 2002. Our estimation is in a weaker condition than if the data sample were using longer period since GMM favor larger sample size. Hence, our result is relatively strong.

[23] The pricing premium is 16.60 (t=2.08) and 11.63 (t=1.91) when portfolio returns are equally-weighted and value weighted.
[24] US market has higher past and predicted beta than Japan as shown in table 5.

The contemporaneous pricing premium of the world market illiquidity

We also follow the same procedure to investigate whether the world market illiquidity contemporaneously demand negative premium. We find that it significantly does. Table 4 reports the result.

[Table 4 inserted here]

The contemporaneous pricing premium is -14.24 (t=-7.10) and -15.46 (t=-6.96) for the periods from January 1988 to December 2002 and from January 1988 to December 2001. We are also interested in how it contributes to the world two biggest markets-US and Japan. US has much lesser sensitivity (-27) to this world market illiquidity than Japan does (-12). Its contribution is 18.64 (t=2.30) and 20.94 (t=2.48) for these two periods.

V. The Non-Linear Relationship and Characteristic vs. Factor

The properties of the portfolios sorted on predicted liquidity risk beta shows that the portfolios' liquidity and sensitivity to global liquidity risk is non-linear. The post ranking portfolio approach based on predicted betas and country market liquidity suggests that both markets' illiquidity and sensitivity demand extra returns controlled for market and value factors. Therefore, we are interested in the relationship between the country market liquidity and sensitivity at the country level. Therefore, we also construct 5 portfolios sorted on the country market liquidity and the low-minus-high zero cost portfolio[25] that longs the most illiquid portfolio and shorts the most liquid one at time t-1 so that we can study whether the country market's illiquidity as a characteristic demands a higher return premium.

[25] This portfolio longs the most illiquid portfolio and shorts the most liquid portfolio.

Country Market Liquidity vs. Sensitivity

We obtain the timely simple average of the market liquidity and sensitivity for each country. The following figure 2 plots the cross-section relationship between the market liquidity and the return sensitivity to the global liquidity risk. Their correlation is -0.10.

[Figure 2 inserted here]

We can clearly see that the relationship between country market liquidity and sensitivity is non-linear and fluctuate a lot. Table 5 shows the detail information about each country's market liquidity and sensitivity to global liquidity risk for both data samples.

[Table 5 inserted here]

This non-linear relationship together with previous study in the earlier section implies that the market liquidity as characteristic and its return sensitivity to global liquidity risk plays a multi-dimension role in market returns. Therefore, we further investigate how the illiquidity as a characteristic vs. betas affects the returns of the locally diversified market portfolios.

The Portfolios Sorted On Country Market Liquidity

Our liquidity measure captures the country total market index changes induced by the money "order flow" that are flowing in or out of the market. Therefore, the country market liquidity represents the overall cash movement of the markets or how easily the assets within these markets can be liquidated without moving the market. Therefore, global investors will demand a higher return for illiquid markets. We construct 5 portfolios sorted on the country market liquidity. The portfolio 1 has the lowest market liquidity and portfolio 5 has the highest market liquidity. The zero-cost low-minus-high spread portfolio longs the portfolio 5 and shorts the portfolio 1. The Jensen's alphas and properties of these portfolios are shown in the panel A of the following table 6.

[Table 6 inserted here]

The Jensen's alphas of equally weighted portfolio returns show a clear decreasing trend although it is not strictly a monotone. Furthermore, the most illiquid portfolio has 0.71% (t=1.93) monthly higher return than the most liquid portfolio after adjusted for world market, value and size factors, This confirms that the characteristic of country market illiquidity requires abnormal returns. However, relationship the country market liquidity and market size is not linear and has a concave $\cap$-shape[26]. The relationship between market liquidity and sensitive to the global liquidity risk is also not linear. These support our previous economic explanation for the non-monotonic Jensen's alpha of portfolios sorted on predicted betas and for the non-linear relationship between market return sensitivities to global liquidity risk as a factor and country market liquidity as a characteristic. It will be a natural and interesting question to investigate this non-linear relationship since it is contrast to the stock level evidence in the US market and suggests a multi-dimension role played by characteristic and betas at the locally diversified country market level.

The Portfolios Sorted on Amihud's Illiquidity Measure

After sorting portfolios on this illiquidity, I find that the illiquidity of country market significantly demands extra returns after controlled for market and value factors. The alphas for both CAPM and Fama-French two factor models are 0.86 (t=2.14) and 0.84 (t=2.04) for equally weighted high-minus-low portfolio and 0.98 (t=2.13) and 0.93 (t=1.99) for value-

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[26] Chordia, Subrahanyam and Anshuman (2001) find a non-linear relationship between size and returns at stock level in the US market.

weighted one. One interesting pattern is that the size of Amihud's illiquidity ranked portfolios is monotonically decreasing in illiquidity although the predicted beta has not linear relationship with this illiquidity measure. Therefore, I perform a similar test to control the size factor[27] for Amihud's illiquidity. The zero cost portfolios sorted on Pastor-Stambaugh market liquidity still demands significant returns but the ones sorted Amihud's does not as shown in the table 6. The economic reasons explaining the different results between Paster-Stamburgh liquidity measure and Amihud measure are that 1) Paster-Stambaugh measure captures the money flow affect on the market returns and 2) Amihud measure is dominated by the turnover by value in the denominator because the absolute value of return is relative small in magnitude and difference across countries. The total country market turnover is monotonically related to market size although it make not be true in stock level since the markets of developed countries in this sample are locally diversified.

Characteristic vs. Betas

We perform three tests to examine how the liquidity characteristic vs. betas affects market returns. At first, we sort country market into three portfolios based on the ranking of market liquidity then sort each country into three portfolios within each category based on the ranking of predicted betas. We choose 3x3 portfolio matrix as we would like to have at least two markets in one portfolio so that the portfolio can represent country level as well as common characteristics. The Panel A of table 7 summarizes the alphas of each portfolio for CAPM and Fama-French two factor model as well as the zero-cost portfolios that long the highest beta ranking ones and short the lowest beta ranking ones. As shown in the table, the high sensitive

[27] I find that the size factor- SMB constructed from market returns is global pricing factor as stated in table 2 in earlier section.

portfolios does not significantly demand additional returns than the low sensitive portfolios after controlled for market and value factors within the each country liquidity category except the value-weighted highly liquid and highly sensitive portfolio. But, the two zero-cost portfolios still have positive abnormal insignificant return. On the other hand, the illiquidity demands monthly 1.26% (t=2.75) and 1.10 (t=2.36) extra returns only within the lowest sensitivity sub-category. This confirms that our previous economic intuition that both illiquidity and sensitivity to global liquidity risk play different roles on the market returns while they are not in the same direction. We should note that the zero-cost portfolio that longs the most illiquid and sensitive portfolio and shorts the least illiquid and sensitive portfolio has significant abnormal alphas 1.31% (t=2.60) and 1.49% (t=2.92).

[Table 7 inserted here]

Consequently, we sort country market into three portfolios using the ranking of predicted betas then sorted markets into three portfolios by their ranking of country market liquidity within each predicted beta category. The Panel B shows the alphas and t-statistics of the corresponding portfolios. An interesting note is that all zero-cost portfolio using illiquid characteristic will still generate extra return but not significant for two beta categories. On the other hand, all zero-cost portfolio based on betas within each illiquidity category have abnormal return, but not significant. This means that illiquidity disturb the betas' affect on market return in a complex direction. Furthermore, the zero-cost portfolio that longs the most sensitive and illiquid portfolio and shorts the least sensitive and illiquid portfolio has significant abnormal alphas 1.11% (t=2.19) and 1.33% (t=2.59).

At last, we independently rank markets by their sensitivity and liquidity then put them into corresponding portfolios. As we can see from the table, the illiquid market only demands significant abnormal returns within the low sensitivity or beta category, and the portfolios with highest sensitivity will only requires significant abnormal returns within the highly liquid category although the sign for other two zero-cost portfolios are the same ad the prediction. Interestingly, the zero-cost portfolio that longs the most illiquid and sensitive portfolio and shorts the least illiquid and sensitive portfolio significantly has higher abnormal alphas 1.53% (t=2.50) and 1.65% (t=2.67). These alphas are economically large because characteristic of market illiquidity and its return sensitivity to global liquidity risk contribute to the returns. We therefore conclude that the country market illiquidity play an important role on market returns as a characteristic, but is not linearly related to market's sensitivity. These tests and results supports and are consistent with our previous findings that country market liquidity and sensitivity to global liquidity risk factor is non-linearly related for both portfolios and country market level, and play a multi-dimensional role on market returns.

VI. Conclusion

We find that the burst of Internet Bubble and its spread created the lowest global liquidity around the world while the global liquidity risk as a factor is an international asset pricing state variable. Its contribution to market returns is significantly large, in particular, to the US and Japan markets. Countries with higher sensitivity to the global liquidity risk have higher return after adjusted for the global market, value and size factors. Being consistent with the Demand Shock Asset Pricing Model in which negative demand shocks decrease realized returns, we also find that the world market illiquidity contemporaneously demands a significant negative premium. Its contribution to market returns is also economically big.

But, we do not find a significant factor loading using Fama-MacBeth methodology. A potential explanation is that the sample contains only twenty-three countries, which may not have normal distribution at a given time t. Another explanation is that the country market portfolio is locally diversified portfolio. Furthermore, the liquidity is an abstract notion and complicated by exchange rate shown in Liang (2005). This global liquidity risk will covariate with the idiosyncratic components of market portfolio returns. We also find that the characteristic of country market illiquidity demands higher expected returns after adjusted for world market, value and size factors. However, the market liquidity and the return sensitivity to global liquidity risk are not linearly related. We find that the market illiquidity and global liquidity risk play different dimensional roles in market returns. Illiquid markets require additional return while they are non-sensitive to the global liquidity risk at the same time because their low attractive characteristics to investors as being small markets and illiquid. This complex relationship and multi-dimension role could be due to the exchange rate risk. A future study will be examining how the exchange rate risk affects the pricing premium of the global liquidity risk.

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Table 1: Properties and Alphas of Portfolios Sorted on Past Betas

At the end of each month between December 1990 and December 2002, countries are sorted into 5 portfolios on historical liquidity betas and predicted betas. The past betas are estimated as the slope coefficients on the aggregated liquidity innovation in the regression: $R_{i,\tau} = \alpha_i + \beta^L_{i,t-1} L_\tau + \beta^m_{i,t-1} MKTX_\tau + \beta^h_{i,t-1} HML_\tau + \varepsilon_{i,\tau}$, $i = 1,..,N$, $\tau = t-36,..,t-1$. The regressions are estimated using all past years data up to one month before the current month (t-1). The predicted betas are constructed from equation $\beta^L_{i,t-1} = \psi_{1,i} + \psi_{2,i} C^1_{i,t-1} + \psi_{3,i} C^2_{i,t-1} + \psi_{4,i} C^3_{i,t-1} + \psi_{5,i} C^4_{i,t-1} + \psi_{6,i} C^5_{i,t-1} + \psi_{7,i} C^6_{i,t-1} + \psi_{8,i} C^7_{i,t-1}$ that seven country index characteristics multiply the timely regression coefficients from the pool regression: $e_{i,t} = \psi_{0,i+} (\psi_{1,i} + \psi'_{k,i} C_{i,t-1}) L_t + v_{i,t}$. Panel A and B report the properties and Jensen's alphas of reports the equally weighted portfolios sorted on past betas and predicted betas. Market value is the average within the portfolio in billion US dollar, and portfolio liquidity is the average of each country's slop coefficient $\gamma_{i,t*}$100 from regression(1) $r^e_{i,d+1,t} = a_{i,t} + b_{i,t} * r_{i,d,t} + \gamma_{i,t} * sign(r^e_{i,d,t}) * v_{i,d,t} + \epsilon_{i,d+1,t}$, d= 1,….D, across country and time. The parenthesis is the t-statistic.

	Panel A: Portfolio sorted on past betas					Panel B: Portfolio sorted on predicted betas				
Rank	CAPM	Fama-French two factor	Fama-French three factor	Portfolio Liquidity	Market Value	CAPM	Fama-French two factor	Fama-French three factor	Portfolio Liquidity	Market Value
Low (L)	-0.01	0.01	-0.45	-3.66	588	0.08	0.11	-0.35	-0.60	403
	(-0.03)	(0.03)	(-1.57)			(0.24)	(0.31)	(-1.22)		
2	0.50	0.43	0.00	-5.53	812	0.50	0.44	-0.10	-2.69	255
	(1.76)	(1.49)	(0.00)			(1.52)	(1.31)	(-0.39)		
3	0.62	0.54	0.05	2.94	704	0.09	0.06	-0.31	0.59	245
	(1.97)	(1.69)	(0.20)			(0.33)	(0.24)	(-1.40)		
4	0.26	0.31	-0.04	-2.10	688	0.26	0.25	-0.09	-2.29	293
	(1.06)	(1.25)	(-0.20)			(0.96)	(0.91)	(-0.39)		
High (H)	0.79	0.79	0.41	-0.15	235	0.77	0.78	0.43	-3.59	2422
	(2.43)	(2.40)	(1.40)			(2.62)	(2.62)	(1.63)		
(H-L)	0.80	0.79	0.86			0.69	0.68	0.78		
	(2.31)	(2.22)	(2.37)			(1.93)	(1.86)	(2.11)		

Table 2: Factor loading estimated by Fama-MacBath Methodology

This table reports the factor premium using Fama-MacBeth two stage regressions to estimate the factor premium for market return, HML (high-minus-low book-to-market) return, SMB (small-minus-big market value) and mimicking factor of global liquidity risk (Mliq). The first regression (12): $R_{i,t} = \beta^0_i + \beta^{Mliq}_{i,t-1}\, Mliq_t + \beta^M_{i,t-1}\, MKT_t + \beta^H_{i,t-1}\, HML_t + \beta^S_i\, SMB_t + \epsilon_{i,t}$ and second stage regression (13): $R_{i,t} = \psi^0_t + \psi_t^{Mliq} * \beta^{Mliq}_{i,t-1} + \psi_t^{M} * \beta^M_{i,t-1} + \psi_t^{H} * \beta^H_{i,t-1} + \epsilon_{i,t}$ where $R_{i,t}$ is the excess return of country total market return. The parenthesis is the t-statistic of the factor premium. The time-varying betas are retained from a regression (12)$R_{i,t} = \beta^0_i + \beta^{Mliq}_i\, Mliq_t + \beta^M_i\, MKT_t + \beta^H_i\, HML_t + \beta^S_i\, SMB_t\ \epsilon_{i,t}$: using data from January 1988 to t-1 for the period from January 1990 to December 2002. The parenthesis is the t-statistic. The $Mliq_t$ equals $\beta'_F\, MF_t$ of regression $Liqrisk_t = \beta^0 + \beta'_F\, MF_t + \varepsilon_t$. Testing the non-tradable global liquidity risk t-statistic, we replace Mliq by LiqRisk –the constructed global liquidity risk δ_t in equation $\Delta\gamma_{m,t} = a + b*\Delta\gamma_{m,t-1} + c*(m_t/m_1)*\gamma_{m,t-1} + \delta_t$ (4). The coefficients of Mliq and LiqRisk, multiply by 100. Panel A is for the period from January 1990 to December 2001 and Panel B is for the period from January 1990 to December 2002.

Factor	Panel A		Panel B		
MKTX	-0.72	-0.61	-0.71	-0.90	-0.87
	(-1.25)	(-1.05)	(-1.75)	(-1.84)	(-1.82)
HML	0.66	0.67	0.64	0.26	0.16
	(1.85)	(1.84)	(2.57)	(0.66)	(0.43)
SMB				0.88	0.89
				(1.94)	(1.99)
Mliq	1.63				
	(0.85)				
LiqRisk		0.11	0.10		0.12
		(0.79)	(0.98)		(0.85)

Table 3: Global Liquidity Risk Premium and Its Contribution to Country Market Returns Using GMM Estimation

The table reports the estimate of the risk premium associated with the global liquidity risk factor, as well as its contribution to market returns at the locally diversified country market level. The premium is annualized by multiply 12*100 that is adjusted for the division of 10000. The contribution of the global liquidity risk to market returns $(\beta_H^L - \beta_L^L)* \lambda$, is also expressed in annual percentage (multiply by 12). The asymptotic t-statistics are in parentheses. Data sample excludes additional outliers[28] for the period from January 1988 to December 2002. The panel A reports the pricing premium and its contributions to market returns after adjusted for global market and value factors. The panel B reports the pricing premium and its contributions to market returns after controlled for market, value and size factors.

Periods	January 1988-December 2001	January 1988-December 2002	January 1990-December 2001	January 1990-December 2002
Panel A: Controlled for MKTX and HML factors				
Pricing premium	20.65	13.15	30.30	16.64
λ	(t= 2.44)	(t= 2.91)	(t= 1.79)	(t= 2.58)
Contribution				
$(\beta_{greece}^L - \beta_{japan}^L)*\lambda$	36.17	31.25	37.55	33.00
	(t= 3.28)	(t= 3.12)	(t= 3.14)	(t= 3.0)
$(\beta_{us}^L - \beta_{japan}^L)* \lambda$	17.78	14.94	17.05	19.87
	(t=3.95)	(t=3.75)	(t=3.72)	(t=3.82)
Panel B: Controlled for MKTX, HML, and SMB factors				
Pricing premium	8.01	4.25	8.64	5.91
λ	(t= 2.98)	(t= 2.55)	(t= 2.65)	(t= 2.69)
Contribution				
$(\beta_{greece}^L - \beta_{japan}^L)*\lambda$	26.99	17.13	27.23	21.66
	(t= 2.81)	(t= 2.21)	(t= 2.53)	(t= 2.28)
$(\beta_{us}^L - \beta_{japan}^L)* \lambda$	11.8	7.00	12.10	9.29
	(t=3.26)	(t=2.51)	(t=2.89)	(t=2.65)
$(\beta_{greece}^L - \beta_{finland}^L)*$	20.00	14.85		
λ	(t= 2.05)	(t= 1.97)		

[28] We delete the data that the turnover is below 0.2% of the mean of the country market turnover since it is over three standard deviations below the mean and we consider it is outlier. One example is that the one-day turnover is only 19 millions in the total US market and the average is 32.8 billions for the period from January 1988 to March 2004.

Table 4: World Market Illiquidity Contemporaneous Premium and effect, and Its Contribution to Country Market Returns Using GMM Estimation

The table reports the estimate of the risk premium associated with the world market illiquidity as well as its contribution to market returns at the locally diversified country market portfolio. MILLIQ is the contemporaneous world market illiquidity of Amihud measure. The premium is multiplied by 12*100, so that the reported premium can be comparable to the global liquidity risk premium. Its contemporaneous contribution to market returns (β_L^L-β_H^L)* λ, is also expressed in annual percentage (multiply by 12). The asymptotic t-statistics are in parentheses. Data sample excludes additional outliers[29] for the period from January 1988 to December 2002. The pricing premium and its contributions estimated by using individual country market as a country diversified portfolio for different periods after controlled for market, value and size factors.

Panel A: Controlled for MKTX, HML, and SMB factors				
Periods	January 1988-December 2001	January 1988-December 2002	January 1990-December 2001	January 1990-December 2002
Pricing premium λ_{MILLIQ}	-15.46 (t= -6.96)	-14.24 (t= -7.10)	-13.91 (t= -6.88)	-13.73 (t= -6.45)
Contribution				
((β_{us}^L- β_{japan}^L)* λ_{MILLIQ}	20.97 (t=2.48)	20.97 (t=2.48)	17.12 (t=1.78)	16.00 (t=1.76)

29 We delete the data that the turnover is below 0.2% of the mean of the country market turnover since it is over three standard deviations below the mean and we consider it is outlier. One example is that the one-day turnover is only 19 millions in the total US market and the average is 32.8 billions for the period from January 1988 to March 2004.

Table 5: Country market liquidity and sensitivity

This table outlines the country market liquidity and sensitivity of each country. The country market liquidity is the slop coefficient $\gamma_{i,t}$ from regression (1) $r^e_{i,d+1,t} = a_{i,t} + b_{i,t} * r_{i,d,t} + \gamma_{i,t} * sign(r^e_{i,d,t}) * v_{i,d,t} + \epsilon_{i,d+1,t}$, d= 1,….D, across time for each country. The predicted sensitivity is constructed from equation (7) that seven country index characteristics multiply the timely regression coefficients from the pool regression (10). Panel A shows the market liquidity and its sensitivity to global liquidity risk L_τ estimated from simple linear regression $R_{i,\tau} = \alpha_i + \beta^L_{i,t-1} L_\tau + \beta^m_{i,t-1} MKTX_\tau + \beta^h_{i,t-1} HML_\tau + \varepsilon_{i,\tau}$, $i = 1,..,N$. Panel B is the market liquidity and its predicted sensitivity to global liquidity risk estimated from past three years. All value of market liquidity and sensitivity are monotonically scaled. The data is sorted on country market sensitivity.

Panel A: Using Linear Regression For the period from January 1988 to December 2002			Panel B: Using Predicted Beta For the period from January 1992 to December 2002		
Country	Pastor-Stambaugh Market Liquidity	Time Series Sensitivity	Country	Pastor-Stambaugh Market Liquidity	Predicted Sensitivity
Finland	-224.81	-163.94	Japan	-0.24	-39.88
Norway	6.27	-75.15	Sweden	-6.02	-22.44
Japan	-0.30	-73.75	Austria	-33.43	-7.67
NewZeland	-60.544	-68.28	Denmark	3.76	-6.15
Australia	-3.11	-44.10	Swiss	-0.84	-6.02
Canada	-0.08	-26.95	Italy	-178.16	-4.83
Austria	-74.82	2.67	Netherlands	-0.88	-3.50
Italy	-191.54	4.72	Spain	85.74	-3.47
Denmark	-59.42	6.58	Australia	-3.80	-2.36
Netherlands	-2.25	7.78	Hong Kong	-1.31	-0.83
Belgium	-195.34	20.22	Norway	3.93	0.63
United Kindom	-0.05	24.56	Canada	-0.58	0.92
Singapore	-11.32	25.62	Portugal	48.79	1.11
France	9.74	28.45	New Zealand	-60.85	2.37
Sweden	-0.71	34.79	Finland	-44.84	3.44
Ireland	-28.58	45.95	Singapore	-8.55	6.98
United States	0.01	47.21	Germany	-0.96	9.37
Hong Kong	-2.09	59.58	Belgium	-83.36	12.77
Spain	136.71	61.32	France	-2.441	18.25
Sweden	-2.62	82.70	UK	-0.05	22.99
Germany	-4.22	87.62	US	0.01	27.34
Portugal	-99.57	93.57	Greece	-254.24	32.53
Greece	-280.43	243.60			

Table 6: Properties and Alphas of Portfolios Sorted on Country Market Liquidity and Illiquidity

Country returns are sorted into 5 portfolios on their liquidity $\gamma_{i,t}$ of Pastor-Stambaugh measure and their illqudity $ILLIQ_{i,t}$ of Amihud measure. The liquidity is the slop coefficient $\gamma_{i,t}$ from regression (1) $r^e_{i,d+1,t} = a_{i,t} + b_{i,t} * r_{i,d,t} + \gamma_{i,t} * sign(r^e_{i,d,t}) * v_{i,d,t} + \epsilon_{i,d+1,t}$, d= 1,….D, across country and time. The country illiquidity is the $ILLIQ_{i,t} = \frac{1}{D_t}\sum_{d=1}^{D_{it}} | R_{itd} | / Turn_{itd}$, where D_t is the number of days on the month t. The alpha α adjusted for Fama-French three factors is α of regression $r_{i,t} - r_{f,t} = \alpha + \beta_m Mktx + \beta_h HML + \beta_s SMB + \varepsilon_{i,t}$. The parenthesis is the t-statistic. Portfolios H-L is the zero-cost portfolios that long country markets that have the most illiquid or highest liquidity and short that have the least illiquid or lowest liquidity. The market value in billions US dollar is the average across country and time. The beta is the average of predicted beta across country and time, and monotonically scaled.

	Panel A: Alphas of portfolio sorted on the market liquidity of Pastor-Stambaugh measure					Panel B: Alphas of portfolios sorted on market Illiquidity of Amihud measure				
Rank	CAPM	Fama-French two factors	Fama-French three factors	Beta	Market Value	CAPM	Fama-French two factors	Fama-French three factors	Beta	Market Value
Low (L)	0.84	0.87	0.33	11.66	31	0.30	0.28	-0.13	85.51	2171
	(2.30)	(2.35)	(1.12)			(1.21)	(1.11)	(-0.62)		
2	0.46	0.42	0.11	10.20	494	0.12	0.15	-0.08	-64.80	840
	(1.71)	(1.53)	(0.45)			(0.60)	(0.77)	(-0.41)		
3	0.37	0.39	0.16	34.22	1218	0.43	0.38	0.09	-21.00	199
	(1.59)	(1.67)	(0.73)			(1.51)	(1.32)	(0.33)		
4	-0.08	-0.15	-0.57	-9.81	1336	0.53	0.55	-0.08	11.38	79
	(-0.28)	(-0.55)	(-2.69)			(1.70)	(1.73)	(-0.39)		
High (H)	0.19	0.21	-0.37	-16.31	277	0.95	0.92	0.02	60.14	29
	(0.53)	(0.56)	(-1.34)			(2.04)	(1.94)	(0.07)		
H-L	-0.64	-0.66	-0.71			0.65	0.64	0.15		
	(-1.82)	(-1.84)	(-1.93)			(1.83)	(1.77)	(0.48)		

Table 7 Characteristic vs. Betas

This table presents the study results on how the liquidity characteristic vs. betas affects market returns. Panel A shows the alphas and t-statistics of the portfolios sorted on market liquidity then sorted on past betas. Panel B, reports the alphas and t-statistics of the portfolios sorted on past betas then sorted on market liquidity. Panel C reports the Jensen's alphas and t-statistics of the portfolios independently sorted on predicted betas and on market liquidity.Data sample period is from November 1991 to December 2002. The H-L portfolios are the zero-cost portfolios that long the highest ranked portfolio and short the lowest rank portfolio within the same category. The predicted beta is the predicted beta constructed from equation (7) that seven country index characteristics multiply the timely regression coefficients from the pool regression (10). The country market liquidity is the slop coefficient $\gamma_{i,t}$ from regression (1) $r^e_{i,d+1,t} = a_{i,t} + b_{i,t} * r_{i,d,t} + \gamma_{i,t} * sign(r^e_{i,d,t}) * v_{i,d,t} + \epsilon_{i,d+1,t}$, d= 1,….D, across time for each country.

Panel A: Alphas of portfolios sorted on market liquidity then on predicted betas

		Adjusted for MKTX and HML					Adjusted for MKTX, HML and SMB			
		Sensitivity					Sensitivity			
		L	M	H	H-L		L	M	H	H-L
Liquidity	L	1.01	0.15	1.07	0.05	L	0.36	-0.22	0.76	0.40
		(2.26)	(0.43)	(2.66)	(0.11)		(1.00)	(-0.68)	(1.95)	(0.83)
	M	-0.13	0.32	0.32	0.45	M	-0.43	0.01	0.11	0.53
		(-0.38)	(1.13)	(1.22)	(1.19)		(-1.26)	(0.04)	(0.43)	(1.37)
	H	-0.24	0.20	0.41	0.65	H	-0.73	-0.35	-0.15	0.58
		(-0.63)	(0.52)	(1.03)	(1.50)		(-2.20)	(-1.13)	(-0.48)	(1.31)
	H-L	-1.26	0.05	-0.66	1.31*	H-L	-1.10	-0.14	-0.91	1.49*
		(-2.75)	(0.13)	(-1.29)	(2.60)		(-2.36)	(-0.35)	(-1.77)	(2.92)

Panel B: Alphas of portfolios sorted on predicted betas then on market liquidity

		Liquidity					Liquidity			
		L	M	H	H-L		L	M	H	H-L
Sensitivity	L	0.85	0.44	-0.07	-0.91	L	0.24	0.14	-0.64	-0.87
		(2.01)	(1.18)	(-0.16)	(-2.28)		(0.70)	(0.38)	(-1.86)	(-2.13)
	M	-0.05	0.13	-0.10	-0.05	M	-0.42	-0.17	-0.66	-0.24
		(-0.12)	(0.48)	(-0.26)	(-0.13)		(-1.25)	(-0.70)	(-2.16)	(-0.61)
	H	1.05	0.54	0.34	-0.71	H	0.69	0.35	-0.18	-0.87
		(2.49)	(2.22)	(0.80)	(-1.34)		(1.72)	(1.48)	(-0.49)	(-1.62)
	H-L	0.20	0.10	0.40	1.11#	H-L	0.45	0.21	0.45	1.33#
		(0.42)	(0.24)	(0.86)	(2.19)		(0.98)	(0.49)	(0.94)	(2.59)

Panel C: Alphas of portfolios sorted independently on market liquidity and on predicted betas

		Sensitivity					Sensitivity			
		L	M	H	H-L		L	M	H	H-L
Liquidity	L	1.10	0.07	1.32	0.21	L	0.35	-0.31	0.99	0.48
		(2.57)	(0.20)	(2.57)	(0.38)		(1.01)	(-0.96)	(1.97)	(0.85)
	M	0.07	0.19	0.19	0.10	M	-0.26	-0.11	-0.06	0.13
		(0.21)	(0.67)	(0.65)	(0.23)		(-0.75)	(-0.46)	(-0.21)	(0.29)
	H	-0.25	-0.16	0.73	0.98	H	-0.75	-0.73	0.09	0.90
		(-0.62)	(-0.42)	(1.70)	(2.05)		(-2.24)	(-2.38)	(0.24)	(1.84)
	H-L	-1.20	-0.32	-0.53	1.53*	H-L	-1.06	-0.51	-0.77	1.65*
		(-2.79)	(-0.80)	(-0.84)	(2.56)		(-2.42)	(-1.27)	(-1.20)	(2.67)

*: The zero-cost portfolio that longs LH and shorts HL. #: The zero-cost portfolio that longs HL and shorts LH.

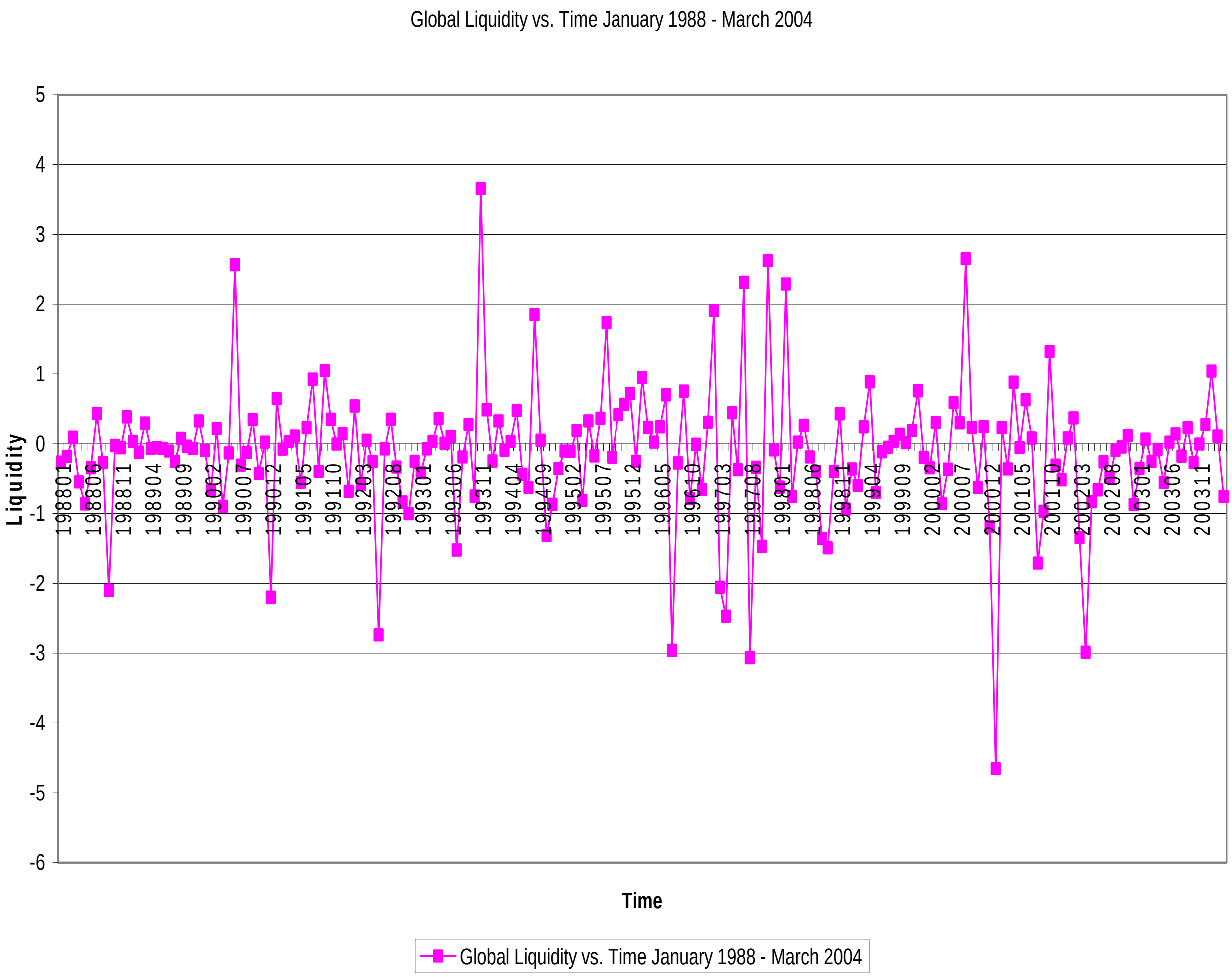

Figure1: Global market average liquidity plot. The global market liquidity is constructed by averaging each country's measure for the month and then multiplies by (m_t/m_1), where m_t is the total dollar value at the end month t-1 of the market value of countries that are included in month t, and month 1 corresponds to January 1988. The liquidity measure of a country for a given month is the slope coefficient of a regression (1), which is estimated using daily total market return and its volume in ten million in US dollar unit. The figure can present a clear movement of the world wide liquidity while returns are in percentage.

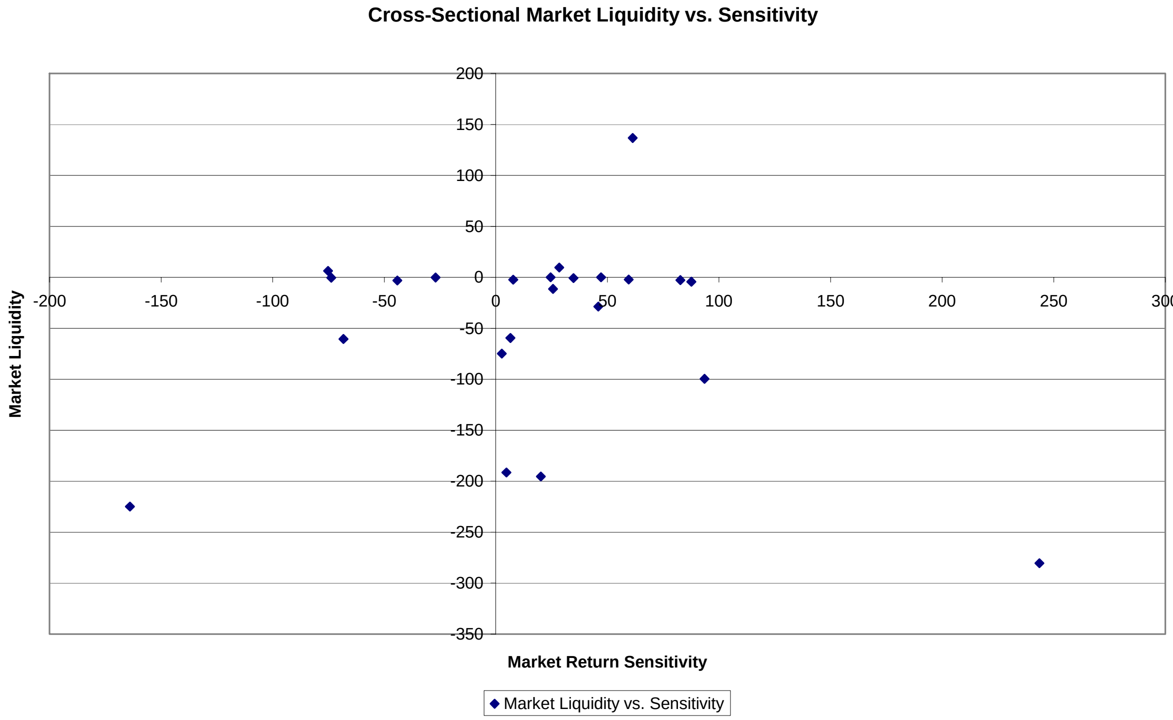

Figure 2: Cross-Sectional market Liquidity vs. the return sensitivity to the global liquidity risk. The country market liquidity is the slop coefficient $\gamma_{i,t}$ from regression (1) $r^e_{i,d+1,t} = a_{i,t} + b_{i,t} * r_{i,d,t} + \gamma_{i,t} * sign(r^e_{i,d,t}) * v_{i,d,t} + \epsilon_{i,d+1,t}$, d= 1,….D, across time for each country. The sensitivity to the global liquidity risk L_τ estimated from simple linear regression $R_{i,\tau} = \alpha_i + \beta^L_{i,t-1} L_\tau + \beta^m_{i,t-1} MKTX_\tau + \beta^h_{i,t-1} HML_\tau + \varepsilon_{i,\tau}$, $i = 1,..,N$. All value of market liquidity and sensitivity are monotonically scaled. The correlation is -0.10.