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Understanding commonality in liquidity around the world ☆

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ABSTRACT

We examine how commonality in liquidity varies across countries and over time in ways related to supply determinants (funding liquidity of financial intermediaries) and demand determinants (correlated trading behavior of international and institutional investors, incentives to trade individual securities, and investor sentiment) of liquidity. Commonality in liquidity is greater in countries with and during times of high market volatility (especially, large market declines), greater presence of international investors, and more correlated trading activity. Our evidence is more reliably consistent with demand-side explanations and challenges the ability of the funding liquidity hypothesis to help us understand important aspects of financial market liquidity around the world, even during the recent financial crisis.

1. Introduction

The liquidity of a stock and how it evolves over time are of important concern to many investors. Empirical evidence shows that investors prefer stocks that are liquid (Amihud and Mendelson, 1986; Brennan and Subrahmanyam, 1996; Amihud, 2002; Liu, 2006). Other studies find that a stock's exposure to systematic liquidity risk and whether its liquidity dries up at inopportune times matter for investors (e.g., Pástor and Stambaugh, 2003; Acharya and Pedersen, 2005; Sadka, 2006; Korajczyk and Sadka, 2008; Lee, 2011). Acharya and Pedersen (2005) propose

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an asset pricing model in which a stock has a significantly lower average return if its liquidity moves inversely with market returns or market liquidity. Intuitively, investors are willing to pay more for stocks that allow them to exit positions at a reasonable cost during pervasive market declines or liquidity dry-ups. Overall, these findings suggest that a full assessment of how liquidity affects investors and asset prices requires an understanding of the co-movement—or so-called "commonality"—in liquidity among individual stocks.

Although extensive research has documented significant commonality in liquidity among stocks (Chordia, Roll, and Subrahmanyam, 2000; Hasbrouck and Seppi, 2001; Huberman and Halka, 2001), we know relatively little about the fundamental sources that drive it. Some empirical studies have found support for *supply-side* sources of commonality in liquidity related to the funding constraints of financial intermediaries (Coughenour and Saad, 2004; Hameed, Kang, and Viswanathan, 2010). Other work has explored *demand-side* sources driven by correlated trading activity (Chordia, Roll, and Subrahmanyam, 2000; Hasbrouck and Seppi, 2001), the level of institutional ownership (Kamara, Lou, and Sadka, 2008; Koch, Ruenzi, and Starks, 2009), and investor sentiment (Huberman and Halka, 2001). Almost all of the evidence of commonality in liquidity to date focuses on U.S. markets. Indeed, little is known about the level of commonality in liquidity in other countries and even less about what determines how it varies over time.[1]

In this paper, we furnish a better understanding of both supply-side and demand-side sources of commonality in liquidity by taking a global perspective. Our encompassing approach examines how and why the level of commonality in liquidity among stocks within a country differs across countries and varies over time by investigating monthly time-series measures of commonality in liquidity based on daily data for 27,447 individual stocks from 40 developed and emerging countries from January 1995 through December 2009. Our empirical strategy is to exploit the rich variation in institutional backgrounds and capital market experiences in these countries over an extended period of time to uncover the determinants of commonality. This global approach allows us to investigate not only which institutional characteristics help to attenuate a country's level of commonality in liquidity (a potential indicator of the financial fragility of its markets), but also whether the relative ability of supply- and demand-side sources to explain time-series variation in commonality in liquidity varies across countries in a meaningful way.

Our cross-country experimental setting is designed to evaluate a number of specific hypotheses related to supply- and demand-side explanations for commonality in liquidity. An intriguing *supply-side* explanation arises from recent theoretical models that investigate the role of funding constraints for liquidity provision. Brunnermeier and Pedersen (2009) and other models predict that large market declines or high volatility adversely affect the funding liquidity of financial intermediaries that act as liquidity suppliers on financial markets. As a consequence, these intermediaries reduce the provision of liquidity across many securities, which results in a decrease in market liquidity and an increase in commonality in liquidity. We also consider three potential *demand-side* explanations for commonality in liquidity. First, Kamara, Lou, and Sadka (2008) and Koch, Ruenzi, and Starks (2009) argue that the correlated trading behavior of institutional investors can give rise to commonality in liquidity. Second, commonality in liquidity can arise when demand for liquidity is correlated across stocks because investors have weak incentives to trade in individual securities. Prior studies (among others, Morck, Yeung, and Yu, 2000) link these incentives to the level of investor protection and transparency in a country. Third, various studies suggest that commonality in liquidity may in part be driven by investor sentiment. We discuss these hypotheses and how they relate to prior research in detail in the next section.

We propose four empirical tests to evaluate the predictions of these supply- and demand-side explanations for commonality in liquidity. The first is a cross-sectional test based on cross-country regressions of the average level of commonality in liquidity in each country on country characteristics that proxy for the importance of the supply- and demand-side channels. The second is a time-series test based on seemingly unrelated regression (SUR) models across countries to link our time-series measures of commonality in liquidity to proxies for time-variation in supply-side and demand-side factors in each country, while controlling for general variation in capital market conditions. The third and the fourth are also time-series tests based on similar SUR models, but they specifically evaluate the predictions of the supply- and demand-side explanations regarding differences in the time-variation of commonality within the cross-section of individual stocks and within the cross-section of countries, respectively.

For each stock in each month, we define its commonality in liquidity as the R^2 (Roll, 1988) of a regression of the stock's innovations in daily liquidity measured by the price impact proxy of Amihud (2002) on innovations in daily market liquidity (defined as the value-weighted average of the daily liquidity innovations of each stock within the country, excluding the stock of interest). For each country, we create a monthly time-series measure of commonality in liquidity as the equally weighted average of the R^2 in that month across the individual stocks in the country. We subject our analyses to a number of robustness tests to deal with concerns about data screens, sample selection, and potential endogeneity of the supply- and demand-side factors we investigate.

There are large differences in the average level of commonality in liquidity across the 40 countries in our

[1] To our knowledge, there are only four studies of commonality in liquidity in markets other than the U.S. See Brockman and Chung (2002) and Domowitz, Hansch, and Wang (2005) for evidence on commonality in liquidity in Hong Kong and Australia, respectively. Two recent cross-country studies are Qin (2006) and Brockman, Chung, and Pérignon (2009). None of these studies attempts to explain the sources of cross-country and time-series variation in commonality in liquidity.

sample. Developed markets, such as the Netherlands, Switzerland, and the U.K., exhibit lower commonality in liquidity than emerging markets, such as China, Pakistan, and Turkey. Commonality in liquidity trends down for many countries over our sample period. Our cross-country tests show that, even after controlling for Gross Domestic Product (GDP) per capita and various other structural variables, commonality in liquidity is greater in countries with higher average market volatility. This finding is consistent with the argument that funding constraints may bind more often in these countries although it does not rule out other explanations. Our other proxies for supply-side forces are not significant in these regressions, but several of the demand-side factors are. Commonality in liquidity is greater in countries with more correlated trading activity (measured using a similar R^2-based measure but for turnover), in countries that have experienced greater equity inflows, and in countries that are characterized by weaker legal protection of investors' property rights and lower transparency. These results point to the importance of the demand-side hypotheses for the existence of commonality in liquidity.

The time-series tests show that commonality in liquidity is high during periods of high market volatility and high market-wide trading activity. The volatility effect is asymmetric: commonality in liquidity is much higher when the market experiences large declines as compared to large market increases. This overall finding is generally consistent with the predictions of Brunnermeier and Pedersen (2009) and with the U.S. evidence of Hameed, Kang, and Viswanathan (2010). But the results of additional tests of the supply-side hypotheses that evaluate the potential role of funding constraints of financial intermediaries acting as liquidity providers are weak. There is little evidence that commonality is greater in times of higher local interest rates, which represent tighter credit conditions when financial intermediaries are more likely to hit their capital constraints. If anything, the U.S. default and commercial paper spreads are negatively related to commonality. And we find no evidence that commonality is negatively related to changes in the financial health of funding agents like local banks or global prime brokers, as measured by the value-weighted returns on portfolios of their stocks.

Our demand-side proxies, on the other hand, have more reliable explanatory power in the time-series tests. There is consistent evidence that the behavior of foreign investors can explain time-variation in commonality. Commonality in liquidity in a country tends to be greater when the equity market of that country experiences larger foreign capital inflows. As capital flows are mainly driven by institutional investors, this finding is in line with the arguments of Kamara, Lou, and Sadka (2008) and Koch, Ruenzi, and Starks (2009) that the correlated trading behavior of institutional investors increases commonality. At the same time, we find that a broad measure of capital market openness is associated with less commonality among individual securities within a country. The effects of our measures of investor sentiment, another potential demand-side factor, suggest that more optimistic sentiment is associated with greater commonality in liquidity.

By far, our most reliable demand-side variable to explain time-variation in commonality in liquidity is the monthly R^2-measure of commonality in turnover—our measure of correlated trading activity within each country. It has reliable explanatory power for commonality in liquidity in almost every country we study. This result accords well with the demand-side explanation for commonality in liquidity proposed by Koch, Ruenzi, and Starks (2009), who link commonality in liquidity in the U.S. to the correlated trading behavior of mutual fund investors.

The results of the third and the fourth set of tests are also more supportive of the demand-side hypotheses. In the third test, we estimate the SUR models to explain time-variation in commonality in liquidity based on four portfolios of stocks sorted on size and volatility in all 40 countries, allowing the coefficients on the supply- and demand-side factors to differ across the four portfolios. In the fourth test, we allow the coefficients in the SUR models to differ across different groups of countries. The next section details the specific predictions of the supply- and demand-side hypotheses that we examine in these tests. We find that the differences in the coefficients on the supply-side factors across the portfolios and across the countries are hard to reconcile with the predictions of the funding liquidity hypothesis, while the differences in the coefficients on the demand-side factors are more reliably in line with the international and institutional investor and sentiment hypotheses.

Overall, we interpret our cross-sectional and time-series evidence as consistent with demand-side forces being more influential than supply-side forces in explaining variation in commonality in liquidity around the world. Although recent research proposes an important role for the funding liquidity channel on the U.S. equity market (in particular during the recent financial crisis), our findings suggest that this channel is not of paramount importance in other equity markets, even during the recent global financial crisis.

2. Hypotheses

In this section, we develop the hypotheses for our empirical tests. Sections 2.1 and 2.2 discuss, respectively, the relevant literature on the supply- and demand-side explanations, as well as the variables and hypotheses in our main cross-sectional and time-series tests. Section 2.3 summarizes the hypotheses in the additional time-series tests.

2.1. Supply-side hypothesis: funding liquidity

Recent theoretical research models how commonality in liquidity can arise as a result of forces related to the supply of liquidity. In Brunnermeier and Pedersen (2009), financial intermediaries provide liquidity to markets, but face funding constraints and obtain financing by posting margins or by pledging securities that they hold as collateral. When markets decline or when uncertainty about fundamentals rises, the intermediaries endure losses in their collateral values or face increasing margins and are forced to reduce the provision of liquidity and liquidate their positions across many securities. The resulting decrease in market liquidity leads to further losses and/or margin increases, creating an "illiquidity spiral" or "feedback loop" that further restricts intermediaries from providing liquidity. Other important models that investigate the consequences of funding constraints of financial intermediaries for market liquidity include Kyle and Xiong (2001) and Gromb and Vayanos (2002). Similar effects arise through different channels in Bernardo and Welch (2004) and Morris and Shin (2004), where traders with private trading limits generate "liquidity black holes" by mutually reinforcing liquidation. In Vayanos (2004), professional investors who are subject to capital withdrawals display a flight to liquidity during volatile times. In Gârleanu and Pedersen (2007), tighter risk management by institutions due to higher fundamental volatility leads to lower market liquidity. What is common across these models is a prediction that large market declines or high volatility increase the demand for liquidity as agents liquidate their positions across many assets and reduce the supply of liquidity as liquidity suppliers hit their capital constraints. So, commonality in liquidity arises and is intensified during periods of large market declines or high market volatility. To now, there is only some evidence in support of these predictions, and what there is focuses exclusively on U.S. markets. For example, Coughenour and Saad (2004) find commonality in liquidity among NYSE stocks handled by the same specialist firm. Hameed, Kang, and Viswanathan (2010) show that commonality in liquidity on the NYSE increases during market declines, especially when funding liquidity is tight.

We investigate whether these supply-side forces can explain cross-country and time-series variation in commonality in liquidity in 40 countries. For our cross-country tests, the supply-side hypothesis predicts that commonality is greater in countries with higher market volatility, higher interest rates, and less developed financial markets, as the capital constraints of financial intermediaries are more likely to be binding in these countries and under such conditions. For our time-series tests, the supply-side explanation predicts that commonality is higher during periods of high market volatility, and, in particular, during large market declines. But, as any rise in commonality during these periods may in part be driven by a correlated increase in the demand for liquidity, we also carry out tests of more direct proxies for time-variation in funding liquidity. In particular, the supply-side hypothesis predicts that commonality in liquidity is positively related to the level of local short-term interest rates and U.S. default and commercial paper spreads, as they reflect more constrained global credit conditions. Commonality in liquidity should also be negatively related to the stock returns of local and global financial intermediaries who act as funding agents, which are likely to be inversely related to the tightness of capital in the market.

2.2. Demand-side hypotheses

2.2.1. Correlated trading behavior of international and institutional investors

The first demand-side explanation we consider links commonality in liquidity to the correlated trading behavior of institutional investors. Kamara, Lou, and Sadka (2008) provide evidence that the increase in commonality in liquidity among U.S. large cap stocks in particular over the past 25 years can be attributed to the increasing importance of institutional and index-related trading for these stocks, consistent with Gorton and Pennacchi's (1993) result that basket trading increases commonality. Koch, Ruenzi, and Starks (2009) show that stocks with higher mutual fund ownership and stocks owned by mutual funds with high turnover or funds that experience liquidity shocks exhibit greater commonality in liquidity. The intuition is that growing institutional ownership may give rise to correlated trading across stocks, which, in turn, creates common buying or selling pressure, and thus higher levels of common variation in liquidity.

This demand-side hypothesis predicts that commonality in liquidity is greater in countries with greater prevalence of institutional investors and during times of more correlated trading activity. Our proxy for correlated trading activity is a measure of commonality in turnover in each country, constructed based on the same sample of firms and methodology used to estimate commonality in liquidity. Because correlated trading may also be related to funding constraints, we orthogonalize our R^2-measure for commonality in turnover relative to large market declines as well as to the supply-side factors (local short-term interest rates, U.S. default and commercial paper spreads, and the stock returns of local and global financial intermediaries). We use a variety of proxies for the prevalence of institutional investors. In most countries, an important contingent of institutional investors is foreign institutional investors; for example, Ferreira and Matos (2008) report that about 75% of the \$2.6 trillion of holdings of non-U.S. stocks by U.S. investors in 2004 were held by institutions. One advantage of our global approach is that we can obtain monthly data on global investing behavior originating at least to and from the U.S. by using Treasury International Capital (TIC) capital flow data from the U.S. Department of Treasury.

We expect a positive coefficient on commonality in turnover and on capital inflows in both our cross-country and our time-series regressions of commonality in liquidity. In addition, for the cross-country regressions, this demand-side hypothesis predicts a positive effect of the size of the equity mutual fund sector and the fraction of the local equity market capitalization held by foreign institutional investors in each country. Our time-series regressions also include exchange rate changes (as another factor that may affect the presence and behavior of foreign institutional investors) and the trading volume in exchange-traded country funds (ETFs) (as a measure of index-related basket trading). We expect that commonality is greater when the local currency depreciates (as this may attract foreign investors) and when there is greater ETF volume.

2.2.2. Incentives to trade individual securities

The second demand-side explanation proposes that the incentives of investors to trade individual stocks (as opposed to basket trading) determine how correlated the demand for liquidity is across stocks, and thus commonality in liquidity. Prior research suggests that these incentives are affected by the level of investor protection and the transparency of the information environment in a country. Morck, Yeung, and Yu (2000) argue that information acquisition is endogenous (in the spirit of Grossman and Stiglitz, 1980; Shleifer and Vishny, 1997) and that there are fewer incentives to collect firm-specific information in countries with weaker legal protections of investors' property rights, since informed arbitrage is less attractive when investor protection is weak. Consistent with this argument, they show that commonality in returns among local stocks is greater in countries with weaker investor protection. In a related study, Jin and Myers (2006) find that commonality in returns is greater in countries with a less transparent information environment.[2]

We hypothesize that investor protection and transparency also affect commonality in liquidity through their influence on the incentives to trade individual stocks. If firm-specific information acquisition is hampered by low transparency or by uncertainty about whether investors can actually reap the benefits of firm-specific arbitrage, investors are more likely to engage in market-wide basket trading. Consequently, we expect more correlated demand for liquidity and thus greater commonality in liquidity in countries with weaker investor protection and lower transparency. In our cross-country regressions, we test the prediction of this demand-side hypothesis of a negative coefficient on the good government index of Morck, Yeung, and Yu (2000) and on the financial disclosure variable of Bushman, Piotroski, and Smith (2004).

Though we motivate how investor protection laws and transparency may affect commonality in liquidity in a similar way that others have done for commonality in returns, we do not mean to imply that commonality in returns is necessarily linked to commonality in liquidity. Commonality in returns can arise because of less firm-specific and more market-wide, public information flows, and also because of correlated order imbalances with the same sign across stocks. On the other hand, commonality in liquidity can just as easily arise when trading activity runs in different directions for different stocks, since both heavy buyer-motivated trading and heavy seller-motivated trading can strain liquidity. Hence, correlation in returns does not necessarily imply correlation in liquidity.

2.2.3. Investor sentiment

The third demand-side explanation is based on various studies that suggest that investor sentiment may be an important source of commonality in liquidity. Huberman and Halka (2001) conjecture that commonality in liquidity arises because of the "presence and effects of noise traders." Froot and Dabora (1999) suggest that country-specific sentiment shocks can induce excess co-movement of stock returns in a country. Baker and Wurgler (2006) show that waves of investor sentiment affect many stocks at the same time, albeit not to the same extent. Barberis, Shleifer, and Wurgler (2005) provide evidence in favor of sentiment-based theories of return co-movement. Although they support supply-side explanations for commonality in liquidity, Hameed, Kang, and Viswanathan (2010) do acknowledge that panic selling by investors is a potential sentiment-based cause of commonality in liquidity.

To test this sentiment hypothesis, we include the U.S. investor sentiment index of Baker and Wurgler (2006) and local and global closed-end country fund discounts (Lee, Shleifer, and Thaler, 1991) as proxies for variation in investor sentiment in our time-series regressions. The sentiment hypothesis does not offer clear predictions on whether these proxies for optimistic/pessimistic investor sentiment should have a negative or positive effect on commonality in liquidity.

2.3. Further empirical tests

In addition to the cross-country and time-series tests outlined in Sections 2.1 and 2.2, we carry out a third and a fourth time-series test to evaluate the predictions of the supply- and demand-side hypotheses regarding differences in the dynamics of commonality in liquidity across different types of stocks and across different countries, respectively. For our third test, Brunnermeier and Pedersen (2009) predict that the impact of funding liquidity on market liquidity is particularly pronounced for high volatility stocks. Indeed, Comerton-Forde, Hendershott, Jones, Moulton, and Seasholes (2010) find that the liquidity level of high volatility stocks is more sensitive to specialists' trading losses. Following Hameed, Kang, and Viswanathan (2010), we thus test whether high volatility stocks show a stronger relation between commonality in liquidity and funding constraints than low volatility stocks. The demand-side hypothesis related to international and institutional investors proposes that the commonality in liquidity of large capitalization stocks is more affected by correlated trading or net capital inflows than that of small capitalization stocks, as both institutional and international investors are more active in these stocks (e.g., Kang and Stulz, 1997; Gompers and Metrick, 2001). The sentiment hypothesis suggests that the sentiment factors are a more important driver of commonality in liquidity for small and volatile stocks, as Baker and Wurgler (2006) find that these stocks' returns are more

[2] In related work, Bartram, Brown, and Stulz (forthcoming) provide a cross-country comparison of idiosyncratic risk, the orthogonal component to commonality or so-called "synchronicity" in stock returns, among global stocks relative to U.S. stocks using a propensity-score matching procedure. They show that the lower idiosyncratic risk is more closely related to the rule of law and investor protection, like Morck, Yeung, and Yu (2000), and less so to corporate disclosure quality, like Jin and Myers (2006). Lai, Ng, and Zhang (2009) compute measures of the probability of informed trading (PIN) in a country using the global Reuters Datascope Tick History (hereafter, "TAQTIC") database and show, after controlling for firm and country characteristics, that it is more prevalent in less developed markets in which there is less idiosyncratic risk.

sensitive to changes in sentiment. To test these predictions, we sort the stocks in each country in each year into four double-sorted (2×2) portfolios based on their size and volatility in the previous year. We compute the commonality in liquidity of each portfolio in each country as the equally weighted average across the stocks within the portfolio. We then estimate the SUR models based on the time-series of commonality of all four portfolios in all 40 countries, allowing the coefficients on the supply- and demand-side factors to differ across the four portfolios.

In our fourth set of tests, we examine whether the effects of the supply- and demand-side factors on commonality in liquidity are different across different groups of countries in ways that the various supply- and demand-side explanations predict. We again estimate SUR models of the time-series of commonality in liquidity in all 40 countries, but we now allow the coefficients to differ across different groups of countries. We separate countries into two groups along the following dimensions: the level of economic development (based on GDP per capita), market volatility, commonality in turnover, and net equity capital flows. Our cross-country tests show that the average commonality in liquidity in a country is significantly positively related to the average level of market volatility, commonality in turnover, and net equity inflows over the sample period. If, for example, the finding that the level of commonality is greater in more volatile countries is indeed driven by the strength of supply-side forces in these countries, we would expect time-variation in commonality in liquidity in these countries to be more sensitive to our supply-side factors. Similarly, we test the hypothesis that the relation between the average level of commonality in liquidity and the average commonality in turnover and net equity inflows is due to underlying demand-side forces by estimating SUR models that allow the coefficients on the supply- and demand-side factors to differ across groups of countries sorted on these characteristics.

3. Data and empirical measures of commonality

In this section, we describe the data sources, the screening procedures, and the variable definitions we use to construct our time-series measures of commonality in liquidity.

3.1. Data sources and screens

We collect the daily total return index (*RI*), the daily trading volume (*VO*; expressed in thousands of shares), the daily adjusted price (*P*; in local currency), and the market capitalization at the beginning of each year (*MV*; expressed in millions of U.S. dollars) for individual stocks from Datastream. Our final sample includes 27,447 stocks from 40 countries for the period January 1995 to December 2009. According to the classification by International Finance Corporation (IFC) of the World Bank Group, 21 out of these 40 countries are developed (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Singapore, Spain, Sweden, Switzerland, the U.K., and the U.S.) and 19 countries are emerging (Argentina, Brazil, Chile, China, Greece, India, Indonesia, Israel, Malaysia, Mexico, Pakistan, Philippines, Poland, Portugal, South Africa, South Korea, Taiwan, Thailand, and Turkey).

We restrict the sample to stocks from major exchanges, which we define as the exchanges on which the majority of stocks in that country are listed. We acknowledge that we have some discretion in choosing which exchanges to include in the sample. We try to strike a balance between obtaining maximum breadth in each country and avoiding problems related to differences in trading mechanisms and conventions. For the U.S., we use NYSE data only, because trading volume definitions are different on Nasdaq. For two countries we use data from more than one stock exchange: China (Shanghai and Shenzen) and Japan (Osaka and Tokyo). Datastream reports that the volume definitions used by different exchanges are the same for these countries. For Brazil, we use data after 1999 because of a change in trading volume definitions. For Germany, we also use data after 1999 because the daily trading volume data are not readily available for most German stocks before this year. We exclude depositary receipts (DRs), real estate investment trusts (REITs), preferred stocks, investment funds, and other stocks with special features.[3] To limit the effect of survivorship bias, we include dead stocks in the sample.

We use the following screens. To exclude non-trading days, we define days on which 90% or more of the stocks listed on a given exchange have a return equal to zero as non-trading days. We also exclude a stock if the number of zero-return days is more than 80% in a given month. Following Ince and Porter (2006), who call for caution in handling data errors in Datastream, we set daily returns to missing if the value of the total return index for either the previous or the current day is below 0.01.

The liquidity proxy we use is the price impact measure of Amihud (2002). He suggests the daily ratio of absolute stock return to dollar volume as a proxy for the illiquidity of a stock. This measure closely adheres to the intuitive description of liquid markets as those that accommodate trading with the least impact on price. Amihud (2002)

[3] The exclusion of these stocks is done manually by examining the names of the individual stocks, as neither Datastream nor Worldscope provide codes for discerning non-common shares from common shares. We drop stocks with names including “REIT,” “REAL EST,” “GDR,” “PF,” “PREF,” or “PRF” as these terms may represent REITs, Global DRs, or preferred stocks. We drop stocks with names including “ADS,” “RESPT,” “UNIT,” “TST,” “TRUST,” “INCOME FD,” “INCOME FUND,” “UTS,” “RST,” “CAP.SHS,” “INV,” “HDG,” “SBVTG,” “VTG.SAS,” “GW.FD,” “RTN.INC,” “VCT,” “ORTF,” “HI.YIELD,” “PARTNER,” ”HIGH INCOME,” “INC.&GROWTH,” and “INC.&GW” due to various special features. In Belgium, “AFV” and “VVPR” shares are dropped since they have preferential dividend or tax incentives. In Brazil, “PN” shares are excluded because they are preferred stocks. In Canada, income trusts are excluded by removing stocks with names including “INC.FD.” In Mexico, shares of the types “ACP” and “BCP” are removed since they have the special feature of being convertible into series A and B shares, respectively. In France, shares of the types “ADP” and “CIP” are dropped since they carry no voting rights but carry preferential dividend rights. In Germany, “GSH” shares are excluded since they offer fixed dividends and carry no voting rights. In Italy, “RSP” shares are dropped due to their non-voting provisions. For the U.S., we delete American DRs by examining the names of stocks. We also use the CUSIP code for U.S. stocks to exclude non-common shares since the 7th and 8th digits of the CUSIP are 1 and 0, respectively, for common shares.

presents empirical evidence for the U.S. indicating that this measure is strongly positively related to microstructure estimates of illiquidity, including the bid-ask spread, price impact, and fixed trading costs. Goyenko, Holden, and Trzcinka (2009) investigate to what extent different liquidity proxies capture high-frequency measures of transaction costs based on U.S. data. The Amihud measure performs well relative to other proxies as a measure of several important aspects of transaction costs.[4] Hasbrouck (2009) reports that: "among the daily proxies, the Amihud illiquidity measure is most strongly correlated with the TAQ-based price impact coefficient" (p. 1459). For global markets, Lesmond (2005) shows that the Amihud measure has a high correlation with bid-ask spreads in 23 emerging markets.[5] An important advantage of the Amihud liquidity measure is that we can compute it at the daily frequency.[6]

Many empirical studies rely on the Amihud liquidity measure to capture systematic liquidity risk and even commonality in liquidity among stocks. Acharya and Pedersen (2005) employ the measure in their investigation of the role of liquidity risk in asset prices. Spiegel and Wang (2005) investigate the link between the idiosyncratic volatility and Amihud liquidity (as well as other liquidity measures) for individual stocks. Watanabe and Watanabe (2008) use Amihud liquidity to uncover time-variation in liquidity betas and the liquidity risk premium. Avramov, Chordia, and Goyal (2006) use it in their analysis of the relation between liquidity and short-run stock return reversals. Kamara, Lou, and Sadka (2008) link variation in commonality in Amihud liquidity among stocks to differences in institutional ownership.

We add a constant to the Amihud measure and take logs, to reduce the impact of outliers. We multiply the result by -1 to arrive at a variable that is increasing in the liquidity of individual stocks:

$$Liq_{i,d} \equiv -\log\left(1+\frac{|R_{i,d}|}{P_{i,d}VO_{i,d}}\right), \tag{1}$$

where $Liq_{i,d}$ is the Amihud liquidity proxy, $R_{i,d}$ is the return in local currency, $P_{i,d}$ is the price in local currency, and $VO_{i,d}$ is the trading volume of stock i on day d. We discard stock-day observations with a daily return in the top or the bottom 0.1% of the cross-sectional distribution within a country. In addition to daily time-series of Liq for each stock, we construct monthly time-series by calculating the equally weighted average of the daily Liq in a given month for that stock. We construct monthly return index and price series by taking the end-of-month total return index and the end-of-month adjusted price from the daily data files. For the monthly returns, we adopt the screen suggested by Ince and Porter (2006) and discard stock-month observations if:

$$(1+R_{i,t}) \times (1+R_{i,t-1})-1 \leq 0.5, \tag{2}$$

where $R_{i,t}$ and $R_{i,t-1}$ are the stock returns of firm i in month t and $t-1$, respectively, and at least one is greater than or equal to 300%. We also set monthly returns to missing if the total return index for either the previous month or the current month is smaller than 0.01. To control for general variation in capital market conditions in our time-series tests, we compute a daily turnover measure for stock i on day d:

$$Turn_{i,d} \equiv \log\left(1+\frac{VO_{i,d}}{NSH_{i,y}}\right)-\frac{1}{N}\sum_{k=1}^{100}\log\left(1+\frac{VO_{i,d-k}}{NSH_{i,y}}\right), \tag{3}$$

where $Turn_{i,d}$ and $VO_{i,d}$ are the turnover and the trading volume, respectively, of stock i on day d and $NSH_{i,y}$ is the number of shares outstanding at the beginning of the year y. We measure turnover in logs and detrend the resulting series with a 100-day moving average to account for non-stationarity. The moving average is calculated using the available data over the past 100 day. A similar approach is taken by, among others, Campbell, Grossman, and Wang (1993), Lo and Wang (2000), and Griffin, Nardari, and Stulz (2007). We discard daily observations of $VO_{i,d}$ that are greater than $NSH_{i,y}$. As we did for Liq, we construct a monthly time-series of $Turn$ by calculating an equally weighted average of the daily $Turn$ in a given month for that stock. We exclude stock-month observations with a monthly return or stock price at the end of previous month in the top or the bottom 1%, or a $Turn$ or Liq in the top 1% of the cross-sectional distribution within a country.[7] We carry out these distribution-based screens simultaneously.

3.2. Commonality measure

Inspired by Roll (1988), Morck, Yeung, and Yu (2000) use the R^2 of a regression of individual stock returns on the market return as a measure of the extent to which the stock prices of individual firms within a country move together. We follow their approach and use the R^2 of regressions of the liquidity of individual stocks on market liquidity to obtain a measure of commonality in liquidity. Chordia, Sarkar, and Subrahmanyam (2005) document

[4] Specifically, Goyenko, Holden, and Trzcinka (2009) conclude that "…measures widely used in the literature, namely Amihud's Illiquidity, Pastor and Stambaugh's Gamma, and Amivest's Liquidity, are not appropriate to use as proxies for effective or realized spread." (p. 179). But "For specific high-frequency transaction costs benchmarks, we suggest different low-frequency measures. To capture Lambda (TAQ) … we suggest either Amihud's Liquidity or one of the new measures." (p. 179) and "To measure 5-Minute Price Impact, or the five-minute change in midpoint after the trade, we suggest using the Amihud illiquidity measure." (p. 180).

[5] More recently, Fong, Holden, and Trzcinka (2010) evaluate nine liquidity proxies relative to four benchmarks for over 16,000 stocks on 41 exchanges around the world using the TAQTIC data set. They recommend most highly their newly designed measure, but they do show that Amihud's liquidity and an extended version of it proposed in Goyenko, Holden, and Trzcinka (2009) perform well among low-frequency liquidity cost-per-volume measures. Zhang (2009) also recommends the Amihud proxy in a study of 20 emerging markets using the same TAQTIC data.

[6] In a supplementary test (not tabulated), we show that commonality in Amihud liquidity is significantly positively correlated with commonality in proportional bid-ask spreads in the U.S. market for the period from 1995 to 2004.

[7] As a robustness check, we performed analyses based on a sample obtained with a 2.5%, instead of 1%, top or bottom screening rule. The results are very similar.

important day-of-the-week effects in liquidity. Hence, in line with the approach taken by Hameed, Kang, and Viswanathan (2010), we first run the following filtering regressions for each stock i based on observations on day d within each month t:

$$Liq_{i,t,d} = \alpha_{i,t}^{Liq} Liq_{i,t,d-1} + \sum_{\tau=1}^{5} \beta_{i,t,\tau}^{Liq} D_\tau + \gamma_{i,t}^{Liq} HOLI_{t,d} + \omega_{i,t,d}^{Liq}, \quad (4)$$

where D_τ ($\tau=1,\ldots,5$) denote day-of-the-week dummies, and $HOLI_{t,d}$ is a dummy for trading days around non-weekend holidays. We note that we include lagged liquidity on the right-hand side of (4) and thus essentially take the innovations in daily liquidity, because we are interested in measuring whether fluctuations in the liquidity of individual stocks are correlated within a country. We perform a similar filtering regression for an individual stock's turnover, $Turn_{i,t,d}$, but without lagged values since turnover already is a flow variable so computing innovations is not necessary.

We use the residuals from (4) to obtain monthly measures of commonality in liquidity (R^2_{liq}) for each stock by taking the R^2s from the following regressions, based on daily observations within a month:

$$\hat{\omega}_{i,t,d}^{Liq} = a_{i,t}^{Liq} + \sum_{j=-1}^{1} b_{i,t,j}^{Liq} \hat{\omega}_{m,t,d+j}^{Liq} + \varepsilon_{i,t,d}^{Liq}, \quad (5)$$

where $\hat{\omega}_{m,t,d}^{Liq}$ denotes the aggregate market residual from (4) in the country of stock i, obtained as the market-value (at the end of previous year) weighted-average of the residuals for all stocks in the country. Following prior studies (e.g., Chordia, Roll, and Subrahmanyam, 2000; Coughenour and Saad, 2004), we exclude stock i in our computation of the innovations in market liquidity (i.e., the aggregate market residual from (4)). However, unreported robustness checks confirm that our main results are not sensitive to including i in the market liquidity innovations. In line with Chordia, Roll, and Subrahmanyam (2000), we include the one-day leading and lagging aggregate market residual in the commonality regressions in (5). A parallel computation is done for commonality in turnover (R^2_{turn}). To ensure that our measures of commonality in liquidity and commonality in turnover are based on the same sample of stocks, we drop a stock from the sample on a day when the filtered Amihud liquidity or turnover is missing. We require a minimum number of 15 daily observations to estimate the R^2 of a stock in a given month. Monthly time-series of the R^2 measures at the country-level are constructed by taking the equally weighted average of the R^2 across the individual stocks in a month. We impose a minimum number of ten stocks for the calculation of these aggregate R^2 measures for a country in a given month. Our raw commonality measures are not suitable to use as the dependent variable in regressions, because their values always fall within the interval [0, 1]. Following Morck, Yeung, and Yu (2000), we use the logistic transformation of the R^2 measures, $\ln[R^2/(1-R^2)]$, in both the cross-sectional and the time-series regressions.

4. Why is commonality in liquidity higher in some countries?

4.1. Summary statistics and correlations

Table 1 presents summary statistics of market returns, volatility, liquidity, turnover, and R^2_{liq} for each of the 40 countries in the sample. The table also contains information about the number of stocks, the number of stock-month observations, and the sample period for each country. Countries are listed in order of decreasing GDP per capita in 2003. Returns and volatility are expressed as a percentage per month. By construction, Amihud liquidity is negative, with greater values (i.e., negative values closer to zero) indicating greater liquidity. Turnover is expressed as a percentage per day. The average Amihud liquidity and turnover statistics of the emerging markets in our sample lie in the same range of values as reported by Lesmond (2005). It is important to note that a direct comparison of the level of Amihud liquidity across countries is not possible because of differences in currency units and trading volume definitions. This measurement issue does not affect our analyses of commonality in liquidity, as we only relate the liquidity of stocks within a country.

Fig. 1 illustrates the cross-country variation in commonality in liquidity. The figure depicts bar graphs of R^2_{liq} for select months over the sample period in each of the 40 countries in our sample, sorted from high to low. The level of commonality in liquidity varies substantially across countries, with greater values for less developed countries. The extent of cross-country variation is also higher in some periods than others. In February 1995, for example, less developed countries like China, Pakistan, Malaysia, and India had R^2_{liq} measures well in excess of 40%, whereas developed countries like Switzerland, the Netherlands, and Sweden had an average commonality of below 20%. In some months, like August 2004, however, the differences in R^2_{liq} across countries are remarkably small. And during the global financial crisis, like in October 2008, the U.S. was notably among those countries with the highest levels of liquidity commonality (R^2_{liq} around 40%). Exceptions arise, of course, but the correlation of the average commonality in liquidity across our whole sample period with GDP per capita is reliably negative at -0.41. Not only the level, but also the time-series volatility of commonality is higher in less developed countries. The final column of Table 1 shows that the time-series standard deviation of R^2_{liq} ranges from around 2–3% for countries like France, Switzerland, and the U.K., to 9–11% for countries like Brazil, China, and Taiwan.

Our first test involves cross-country regressions of the average R^2_{liq} in a country on a host of proxies for the demand-side and supply-side explanations for commonality in liquidity. The first table in Appendix A (Table A1), gives an overview of the definitions and sources of these variables. Table A2 presents summary statistics and Table A3 contains correlations. We use the average market volatility (the time-series standard deviation of the market returns of a country) and the average local short-term interest rate over the sample period as proxies for a capital market environment in which funding constraints

Table 1
Summary statistics.

This table reports the average market return, market volatility, market-level Amihud (2002) liquidity measure, and market turnover, as well as the mean and the standard deviation of commonality in Amihud liquidity (R^2_{liq}) for 40 countries over the period 1995:01–2009:12. Countries are listed in order of decreasing GDP per capita. The first four columns present the number of unique stocks and stock-month observations in the sample, the first month in the sample, and GDP per capita (in US$) in 2003 for each country, respectively. The screening procedures applied in the selection of the sample are described in Section 3. The next four columns contain the time-series averages (over the period from the first month in the sample to 2009:12) of the value-weighted average of the return (in local currency and in % per month, denoted "% p.m."), volatility (monthly standard deviation of the value-weighted market return), liquidity, and turnover (in % per day, denoted "% p.d.") across the individual stocks in each country. Monthly liquidity for individual stocks is the average of the daily Amihud (2002) measures—computed as the absolute stock return divided by local currency trading volume. The Amihud measure is multiplied by −10,000. Turnover for individual stocks is the average of the ratio of daily volume over the number of shares outstanding. Commonality in liquidity of individual stocks is measured by the R^2 of monthly regressions of the daily innovations in liquidity of individual stocks on the lead, lag, and contemporaneous innovations in market liquidity at the country level. Daily innovations in liquidity are the residuals of filtering regressions in Eq. (4) of each stock's daily Amihud liquidity measure on lagged liquidity, day-of-the-week dummies, and holiday dummies within the month. Daily innovations in market liquidity are the value-weighted average of the daily innovations in the liquidity of each stock within the country, excluding the stock of interest. The final two columns show the time-series average and standard deviation of the equally weighted average of R^2_{liq} across the individual stocks in each country. The final row of the table contains the total number of unique stocks and stock-month observations in the sample.

	# Unique stocks	# Stock-month obs.	First month	GDP per capita (US$)	Market return mean (% p.m.)	Market volatility mean (% p.m.)	Market liquidity mean	Market turnover mean (% p.d.)	R^2_{liq}	
									mean (%)	st.dev. (%)
Japan	3,309	347,161	1995:01	37,549	−0.1112	5.8202	−0.0025	0.2837	23.5152	3.8937
Norway	288	13,294	1995:01	37,165	1.1586	5.9098	−0.0799	0.3844	22.0869	3.6591
United States	2,464	243,415	1995:01	34,590	0.9764	4.7954	−0.0199	0.5210	23.0263	5.0291
Switzerland	317	24,283	1995:01	33,443	0.9062	4.8490	−0.0825	0.3317	20.9378	2.5475
Denmark	245	13,141	1995:01	29,672	0.9596	4.3883	−0.0867	0.2432	22.0185	3.2113
Sweden	580	35,977	1995:01	27,033	0.9983	6.5122	−0.0635	0.4620	21.1269	2.6234
Ireland	61	2,769	2000:07	24,864	0.5093	6.1205	−0.5179	0.2392	23.0045	7.5752
Hong Kong	1,030	70,467	1995:01	24,810	1.3016	7.0394	−0.0858	0.2120	22.2360	3.4070
United Kingdom	2,782	137,039	1995:01	24,423	0.7739	4.6777	−0.2444	0.4368	21.0708	3.3366
Austria	126	7,136	1995:01	23,808	0.7247	4.4241	−0.9535	0.2020	21.8113	3.8683
Netherlands	236	347,161	1995:01	23,300	0.8544	5.4020	−0.1652	0.4657	20.7087	4.3043
Finland	156	13,294	1995:01	23,200	1.7051	8.0065	−0.5476	0.3879	22.0060	4.8980
Canada	1,579	243,415	1995:01	22,966	1.1068	4.1469	−0.7642	0.2690	21.5395	3.1821
Singapore	562	24,283	1995:01	22,767	0.9650	5.5450	−0.9163	0.1845	22.2048	3.1384
Germany	899	13,141	1999:02	22,750	0.2862	6.0894	−1.4422	0.0172	21.9223	3.1484
Belgium	165	11,692	1995:01	22,240	0.8034	4.2412	−0.5343	0.1303	21.5786	4.0555
France	1,091	69,978	1995:01	22,217	0.8976	5.4522	−0.9732	0.3212	20.7443	2.3194
Australia	2,043	98,120	1995:01	20,229	0.9595	3.8487	−0.7237	0.2951	21.1190	2.4761
Italy	403	33,167	1995:01	18,631	0.6906	5.5773	−0.2271	0.4446	22.4207	4.8090
Israel	144	11,075	1995:01	18,257	1.2624	5.7762	−1.5268	0.1386	23.7339	5.3350
Taiwan	807	84,440	1995:01	13,953	0.3964	6.9170	−0.0078	0.6916	27.6853	11.4068
Spain	204	17,847	1995:01	13,861	1.2473	5.3764	−0.1925	0.4020	21.5263	5.0294
New Zealand	164	9,552	1995:01	13,399	0.7909	3.6283	−1.3044	0.1481	21.7540	4.8865
South Korea	862	105,756	1995:01	10,890	0.9561	8.5624	−0.0010	0.7415	24.0081	6.4421
Portugal	92	5,511	1995:01	10,405	0.7955	4.1150	−1.0593	0.2090	22.3993	5.4351
Greece	384	36,241	1995:01	10,265	0.9184	6.8911	−3.6552	0.2059	24.3749	7.8926
Argentina	77	4,264	1995:01	7,927	1.0109	8.8008	−1.0990	0.0614	27.3293	7.2097
Mexico	121	6,823	1995:01	5,934	1.8715	6.7723	−0.0500	0.1484	25.2727	8.5903
Chile	129	6,758	1995:01	4,965	1.1287	4.6136	−0.0029	0.0542	22.9057	4.7546
Poland	352	19,195	1996:02	4,309	0.6721	7.4238	−2.2621	0.1600	22.0391	4.9133
Malaysia	969	79,854	1995:01	3,875	0.6639	5.6286	−1.4381	0.1222	24.1025	4.6989
Brazil	126	3,053	1999:02	3,538	3.3119	7.8037	−0.5487	0.1256	24.1254	9.3835
Turkey	268	32,448	1995:01	2,956	5.0660	12.2407	−9.3088	0.4929	26.5872	7.2375
South Africa	623	28,814	1995:01	2,910	1.2916	5.0255	−0.5563	0.1913	21.5309	3.3715
Thailand	589	34,861	1995:01	2,021	0.4176	7.9954	−0.1643	0.2516	23.3432	4.4399
Philippines	209	9,990	1995:01	991	0.8221	6.5273	−0.1358	0.0771	22.6706	3.9928
China	1,425	122,255	1995:01	856	1.3312	8.5831	−0.0352	0.7478	41.6498	10.1383
Indonesia	355	16,275	1995:01	728	1.7778	8.5203	−0.0031	0.1663	22.1396	4.0551
India	1,090	102,907	1995:02	450	1.5027	7.1664	−0.6239	0.1777	24.7608	7.1431
Pakistan	121	8,346	1995:01	441	1.5577	8.5029	−0.1965	0.9710	25.2564	7.7962
Total	27,447	2,066,000								

may bind more often. We also expect that funding constraints vary across countries with the level of financial sector development, so we include ratios of stock market capitalization to GDP and bank deposits to GDP (Beck, Demirgüç-Kunt, and Levine, 2000) as additional supply-side factors.

A key demand-side factor is the average commonality in turnover (R^2_{turn}) in a country, a measure of the degree of

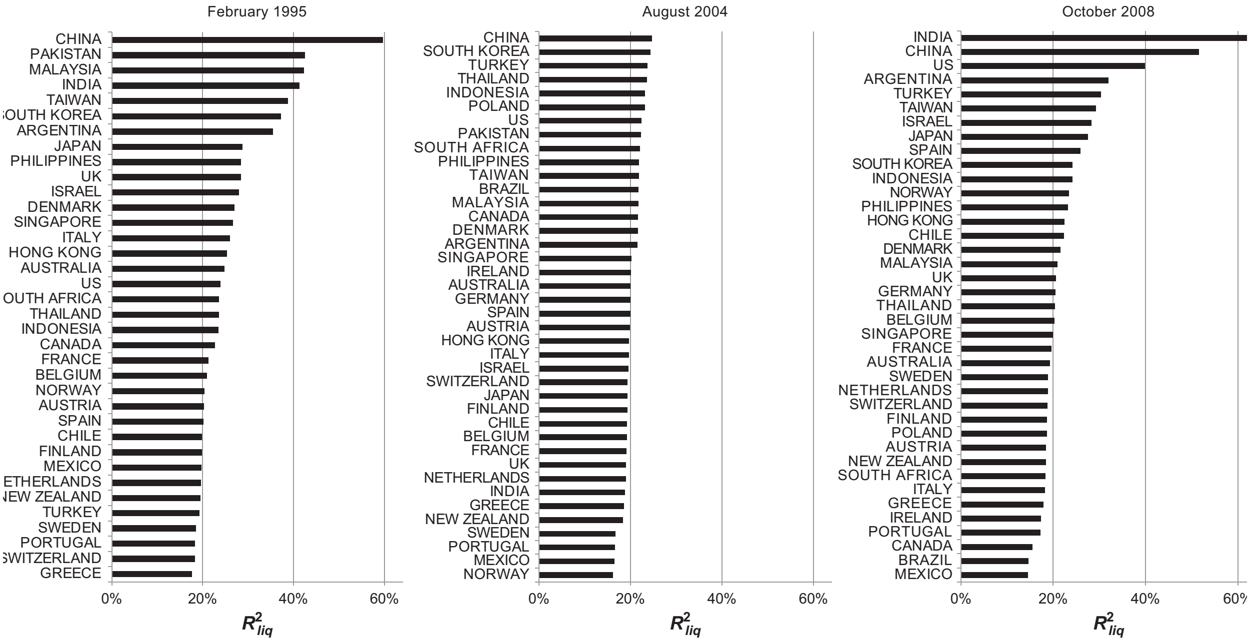

Fig. 1. Cross-country variation in commonality in liquidity. This figure depicts the commonality in liquidity (R^2_{liq}) in 40 countries in select months over the period 1995:01–2009:12. Commonality in liquidity of individual stocks is measured by the R^2 of monthly regressions of the daily innovations in liquidity of individual stocks on the lead, lag, and contemporaneous innovations in market liquidity at the country level. Daily innovations in liquidity are the residuals of filtering regressions in Eq. (4) of each stock's daily Amihud liquidity on lagged liquidity, day-of-the-week dummies, and holiday dummies within the month. Daily innovations in market liquidity are the value-weighted average of the daily innovations in the liquidity of each stock within the country, excluding the stock of interest. For each country, the figure shows the time-series average of the equally weighted average of commonality in liquidity across the individual stocks in that country.

correlated trading in a country. As a proxy for the prevalence of international and institutional investors, we obtain data on the size of the equity mutual fund sector in each country from Khorana, Servaes, and Tufano (2005) and on the fraction of the local equity market capitalization held by foreign institutional investors from Ferreira and Matos (2008). In addition, we obtain monthly data on bilateral capital flows between each of our 39 countries and the U.S. from the U.S. Treasury's Treasury International Capital (TIC) database. These capital flows constitute the gross sales (purchases) of foreign and domestic bonds and stocks by foreigners to (from) U.S. residents. TIC information is collected by the U.S. Treasury from commercial banks and other depository institutions, bank holding companies, securities brokers and dealers, custodians of securities, and nonbanking enterprises in the U.S. As a result, these capital flows most reliably represent activities by institutional investors. We look both at the net flows of foreign equity investments into and from a country (as a percentage of the average of gross sales and purchases), which is a proxy for changes in the presence of foreign institutional investors, and at the gross capital flows between the U.S. and a country as a percentage of that country's GDP, which we use to measure the openness of a country's financial system, in general. Our cross-country regressions include the average over the sample period of both the net equity flows and the gross flows. Following Morck, Yeung, and Yu (2000), we use the good government index—constructed as the sum of three different property rights-related indices from La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998)—as a measure of the quality of legal investor protections. We take financial disclosure (Bushman, Piotroski, and Smith, 2004) as a proxy for the quality of the information environment of firms in different countries.

In each of the cross-sectional regressions, we use seven control variables to capture cross-country variation in, among other things, the general level of economic development, co-movement in firm-level fundamentals, and macroeconomic instability. We use GDP per capita as a measure of the overall economic development of a country. Following Morck, Yeung, and Yu (2000), we include the following additional control variables: the geographical size of the country, the number of stocks in our sample, the time-series volatility of GDP growth (a measure of macroeconomic instability), industry and firm Herfindahl indices (to capture the effect of a few large firms dominating the economies of some countries), and an earnings co-movement index (to capture co-movement in fundamentals).

4.2. Cross-country analysis of commonality in liquidity

Table 2 shows the estimation results of cross-sectional regressions of the average level of commonality in liquidity in a country on the supply-side and demand-side factors. Each model specification adds one variable related to the supply- or demand-side explanations to the base model of control variables. In models (12) and (13), we

Table 2
What drives cross-country variation in commonality in liquidity?

This table reports results of cross-sectional regressions of average commonality in liquidity in 40 countries—denoted by $(R^2_{liq})_m$, computed as the logistic transformation of the time-series average of commonality in liquidity in country m over the period 1995:01–2009:12—on various country characteristics:

$$(R^2_{liq})_m = \alpha + \sum_j \beta_j X^j_m + \sum_k \gamma_k Z^k_m + \varepsilon_m \quad (m = 1,\ldots,40),$$

where X^j_m denotes the cross-sectional supply-side and demand-side factors and Z^k_m denotes the cross-sectional control variables for country m. Variable definitions are in Table A1. We refer to Table 1 for a description of the sample. Intercepts are suppressed to conserve space. Significance at the 1%, 5%, and 10% level (based on standard errors that are robust to heteroskedasticity) is indicated by [a], [b], and [c], respectively. The economic effects in the table represent the effect of a one-standard-deviation (σ) increase in the supply-side/demand-side factor of interest, expressed as a fraction of one standard deviation of the average R^2_{liq} across countries, or $\sigma(R^2_{liq})$.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Supply-side factors													
Market volatility (average)	0.0403[a]												0.0133[c]
Short-term interest rate (average)		−0.0005											
Stock market cap. (mcap)/GDP			−0.0002										
Bank deposits/GDP				−0.0264									
Demand-side factors													
R^2_{turn} (average)					0.7138[a]								0.3046[b]
Equity mutual fund assets/mcap						−0.0016[c]							
Foreign inst. ownership/mcap							−0.0003						
Net % equity flow (average)								0.0073[b]				0.0040[b]	0.0021
Gross capital flow/GDP (average)									0.0001				
Good government index										−0.0217[a]		−0.0137[b]	−0.0020
Financial disclosure											−0.0030[a]	−0.0017[c]	−0.0011
Control variables													
Ln (GDP per capita)	−0.0296	−0.0632	−0.0599	−0.0273[b]	−0.0098	0.0003	−0.0197	−0.0388	−0.0638[c]	0.0428[c]	−0.0204[c]	0.0260	0.0040
Ln (Geographical size)	0.0093	0.0083	0.0048	0.0024	0.0202[a]	0.0022	−0.0020	0.0070	0.0088	0.0011	0.0000	−0.0033	0.0069[b]
Ln (Number of stocks)	−0.0051	−0.0004	0.0045	−0.0153	−0.0044	−0.0078	0.0066	−0.0105	0.0001	0.0023	−0.0080	−0.0065	−0.0120
GDP growth volatility	−0.0068	−0.0058	−0.0060	0.0000	−0.0073[b]	0.0077	−0.0020	−0.0041	−0.0055	−0.0003	0.0024	0.0041	0.0003
Industry Herfindahl index	0.2836	0.3766	0.3071	0.2386	0.1367	0.6344	0.4490	0.2618	0.4214	0.4768	0.0559	0.1506	0.1419
Firm Herfindahl index	−1.4058[c]	−1.1596	−1.1349	−0.4440	−0.3828	−1.3590[c]	−0.5661	−0.7696	−1.1835	−0.5903	−0.4958	−0.2246	−0.4970
Earnings co-movement index	0.0241	0.0367	0.0331	0.0146	0.0014	0.0113	−0.0063	0.0561	0.0386	0.0073	0.0235	0.0356	0.0177
# Obs.	40	40	40	38	40	31	25	39	39	38	37	36	36
Economic effect ($\times \sigma(R^2_{liq})$)	$0.02 \times \sigma$	$-0.01 \times \sigma$	$-0.02 \times \sigma$	$-0.06 \times \sigma$	$0.59 \times \sigma$	$-0.18 \times \sigma$	$-0.01 \times \sigma$	$0.33 \times \sigma$	$0.03 \times \sigma$	$-0.54 \times \sigma$	$-0.09 \times \sigma$		
R^2	0.43	0.32	0.32	0.31	0.82	0.40	0.29	0.38	0.32	0.47	0.53	0.68	0.81

include combinations of key supply- and demand-side factors with the control variables. In addition to the coefficients and the number of observations, the table shows the R^2 of each of the regressions as well as the economic magnitude of the effect of the supply-side or demand-side factor of interest-as measured by the effect of an increase of one standard deviation in the country characteristic, expressed as a fraction of one standard deviation of the average R^2_{liq} across countries.[8] The maximum number of observations in each of these regressions is 40 (the total number of countries in our sample), but most regressions have fewer observations since not all country characteristics are available for all countries.

We find a significant effect of market volatility on R^2_{liq}. The average level of commonality is higher in countries that are characterized by greater average market volatility. This effect is consistent with the funding liquidity hypothesis, as funding constraints are likely to bind more often in these countries. However, it does not rule out other explanations, and its economic magnitude is limited. None of the other supply-side factors (the average local short-term interest rates and our two proxies for financial sector development) is significant in the regressions.

Several of the demand-side factors contribute to explaining cross-country variation in commonality. Table 2 shows a significant coefficient on commonality in turnover (R^2_{turn}), our proxy for common variation in trading activity across the individual stocks in a country. This effect is strong, as reflected by the high R^2 of the regression (0.82) and the large economic effect. A one-standard-deviation increase in R^2_{turn} relative to the mean is associated with an increase in R^2_{liq} of 2.03%, equal to 0.59 times the cross-sectional standard deviation of R^2_{liq}, or $\sigma(R^2_{liq})$. We caution the reader that part of this effect may be mechanical, as Amihud liquidity is defined as the absolute return over the product of a stock's price with its trading volume on a given day and thus shares a component with turnover. Hence, R^2_{liq} and R^2_{turn} could be mechanically related (across countries and in the time-series within a country) if this common component gives rise to correlations between the liquidity and turnover series underlying our commonality measures. However, the mean (median) contemporaneous correlation between daily Amihud liquidity and turnover across all the stocks in the sample is only -0.14 (-0.12), so it seems unlikely that the correlation between R^2_{liq} and R^2_{turn} across countries of 0.83 (see Table A3) stems from a mechanical relation between liquidity and turnover.

Nevertheless, to take further steps to ensure that our results are not driven by a potentially mechanical relation, we carry out robustness tests by extending the filtering regression in Eq. (4) for the liquidity and turnover of individual stocks by adding the lagged values of both variables as well as lagged individual stock returns, market returns, and market volatility as independent variables. Since trading volume is quite persistent at the daily frequency, these extended filtering regressions should help to correct for any mechanical link between the liquidity and turnover of individual stocks. We then reconstruct the commonality measures based on the residuals from the extended filtering regressions and re-run our tests. The results (not tabulated) are very similar.

Besides R^2_{turn}, four of the other demand-side factors have a significant coefficient in the cross-country regressions. Commonality in liquidity tends to be lower in countries in which a greater fraction of the local stock market capitalization is held by equity mutual funds. This finding is inconsistent with the argument that institutional investors contribute to commonality in liquidity, although the statistical relation is rather weak. The coefficient on net equity capital inflows (*Net % equity flow*), one of our other proxies for the international and institutional investors hypothesis, is significantly positive, which is in line with what this hypothesis predicts. Both the statistical and economic significance of this effect are greater than those of the effect of equity mutual fund assets. A one-standard-deviation increase in the average net inflows of foreign capital into the local equity market is associated with an increase in R^2_{liq} of $0.33 \times \sigma(R^2_{liq})$. These findings suggest that, in many countries, it is foreign, rather than domestic, institutional investors who are associated with greater commonality on the local market.

Commonality in liquidity is also greater in countries with weaker investor protection laws and a more opaque information environment. The coefficients on the good government index and on financial disclosure are significantly negative at the 1% level and the corresponding economic magnitudes are considerable, especially for the good government index. A one-standard-deviation increase in these variables is associated with a decrease in R^2_{liq} of $0.54 \times \sigma(R^2_{liq})$ and $0.09 \times \sigma(R^2_{liq})$, respectively. We interpret these results as consistent with the demand-side hypothesis that predicts that weak institutions reduce the incentives to acquire and trade on information about individual stocks, which results in a greater tendency toward index-related or basket trading. This is, in turn, associated with more correlated demand for liquidity and thus greater commonality in liquidity.

The last two columns of Table 2 present the results of cross-sectional regressions that include multiple supply-side and demand-side factors simultaneously. Model (12) shows that the effects of net equity flows, good government, and financial disclosure survive once these variables are introduced side-by-side. (We do not include equity mutual funds assets in these multivariate regressions, as this variable is only available for 31 out of the

[8] Since the dependent variable in the cross-country regressions is the logistic transformations of R^2_{liq}, the impact of a one-standard-deviation (σ) increase in the value of the country characteristic (relative to the mean of the country characteristic μ) on the average R^2_{liq} in a country can be computed using the following expression: $\Delta R^2_{liq} = e^{\alpha+\beta\times(\mu+\sigma)+\gamma\times\lambda}/(1+e^{\alpha+\beta\times(\mu+\sigma)+\gamma\times\lambda}) - e^{\alpha+\beta\times\mu+\gamma\times\lambda}/(1+e^{\alpha+\beta\times\mu+\gamma\times\lambda})$, where α, β, and γ are the intercept, the estimated coefficient on the supply-side or demand-side factor of interest, and the vector of coefficients on the other variables in the cross-sectional model, respectively; μ and λ are the mean of variable of interest and the vector of means of the other variables, respectively. We caution the reader that, because the estimated relation is non-linear, this approach only works well for small changes in the country characteristic.

40 countries in our sample.) In model (13), only market volatility and R^2_{turn} have a significant effect, but this specification faces power problems due to too few degrees of freedom. The control variables have little, if any, statistical power to explain cross-country variation in commonality in any of the regressions. We note that none of the results in Table 2 is driven by the high value of R^2_{liq} in China. In unreported robustness tests, we find similar results when we exclude China.

As the predictions of the funding liquidity hypothesis arguably apply specifically to periods of large market declines—during which funding constraints are more likely to bind—we re-run the cross-country regressions in Table 2 with the average R^2_{liq} of each country during months with large market declines (defined as months in which local market returns are more than one standard deviation below their respective means during our period of analysis) as the dependent variable. Unreported results show that many of the inferences from Table 2 remain in place, although the statistical and economic significance tend to be weaker. Even during large market declines, the demand-side factors show more promise in their contribution to understanding variation in commonality.

In another unreported robustness test, we estimate the regressions in Table 2 separately for less developed and more developed countries (defined as countries with a below- or above-median GDP per capita in 2003). Although we run the risk of exhausting degrees of freedom, we still find a significant effect of R^2_{turn} for both groups of countries and the relation is considerably stronger for less developed countries. There is also evidence of significant effects of net equity flows and good government for both groups of countries, while the significant effect of financial disclosure is limited to less developed countries. None of the supply-side factors has a significant coefficient for either of the country groups.

We view the findings of our cross-country regressions as initial evidence that the demand-side explanations may be more important as a driving force of commonality in liquidity in many countries than the supply-side explanations. Of course, we need to be cautious as our cross-country measures of the funding liquidity of the financial system are coarse. Also, Brunnermeier and Pedersen (2009) and other models predict that commonality arises in times of tight funding constraints; to now, our country characteristics are simply averages over long periods of time that ignore possible dynamics. Our time-series analyses below may be more powerful in evaluating the merits of supply-side and demand-side explanations for commonality.

5. What factors drive commonality in liquidity over time?

In this section, we first discuss the summary statistics of the data used in our time-series analysis of commonality in liquidity. We then present the results of three sets of time-series tests of the supply-side and demand-side hypotheses.

5.1. Summary statistics and correlations

Our monthly time-series of R^2_{liq} allow us to investigate which underlying economic forces generate time-variation in commonality in liquidity. Fig. 2 presents graphs of the monthly variation in commonality in four of the 40 countries in our sample: Japan, Malaysia, Turkey, and the U.S. The figure shows that commonality is substantially larger in some periods than in others. Especially in Malaysia and Turkey, R^2_{liq} is very volatile. The graphs suggest that commonality tends to rise markedly during financial crises. For example, after the start of the Asian crisis in Malaysia with the attack of the Ringgit in July 1997, commonality in liquidity among Malaysian stocks increased from 18% to 31%. Commonality also increased dramatically during the financial crisis in Turkey in November-December 2000 (from 19% in October to 41% in November). In Japan and the U.S., commonality is less volatile. Nevertheless, we observe interesting patterns in the time-variation of R^2_{liq}. For example, commonality in liquidity among U.S. stocks shows a peak during the Asian crisis in late 1997, after the "9/11" terrorist attacks in 2001, and in particular, during the financial crisis of 2008–2009.

The patterns we observe in Fig. 2 could also just be a manifestation of statistical noise in our commonality measures. Also, much of the variation in commonality in Fig. 2 cannot be directly linked to financial crises, so other forces may play a significant role. In this section, we therefore turn to a systematic analysis of the determinants of time-variation in commonality. We run time-series regressions of R^2_{liq} in 40 countries on various country-level variables that proxy for the supply-side and demand-side explanations for commonality. Table A4 in the Appendix provides variable definitions and data sources, Table A5 presents summary statistics, and Table A6 shows average correlations among these variables.

We use the market return, market volatility, and aggregate liquidity and turnover of a country as proxies for the overall capital market conditions. These conditions can influence commonality through various supply-side channels—for example, by affecting the funding liquidity of financial intermediaries—or demand-side channels, such as the degree of correlated trading by institutional investors. Whatever the possible sources, previous empirical research indicates that local market returns and volatility are linked to commonality in liquidity and we likely need to include these proven proxies for changes in the capital market environment, in general, before we can explore the explanatory power of other variables.

We follow Hameed, Kang, and Viswanathan (2010) and examine whether commonality in liquidity arises specifically during large market declines, as opposed to periods of small or large positive market movements. In the models of Kyle and Xiong (2001), Gromb and Vayanos (2002), Morris and Shin (2004), and Brunnermeier and Pedersen (2009), this asymmetric reaction arises from the coincidence of binding funding constraints and the loss in collateral values that force financial intermediaries to reduce the supply of liquidity for many assets at the same time. We define large negative (positive) market returns

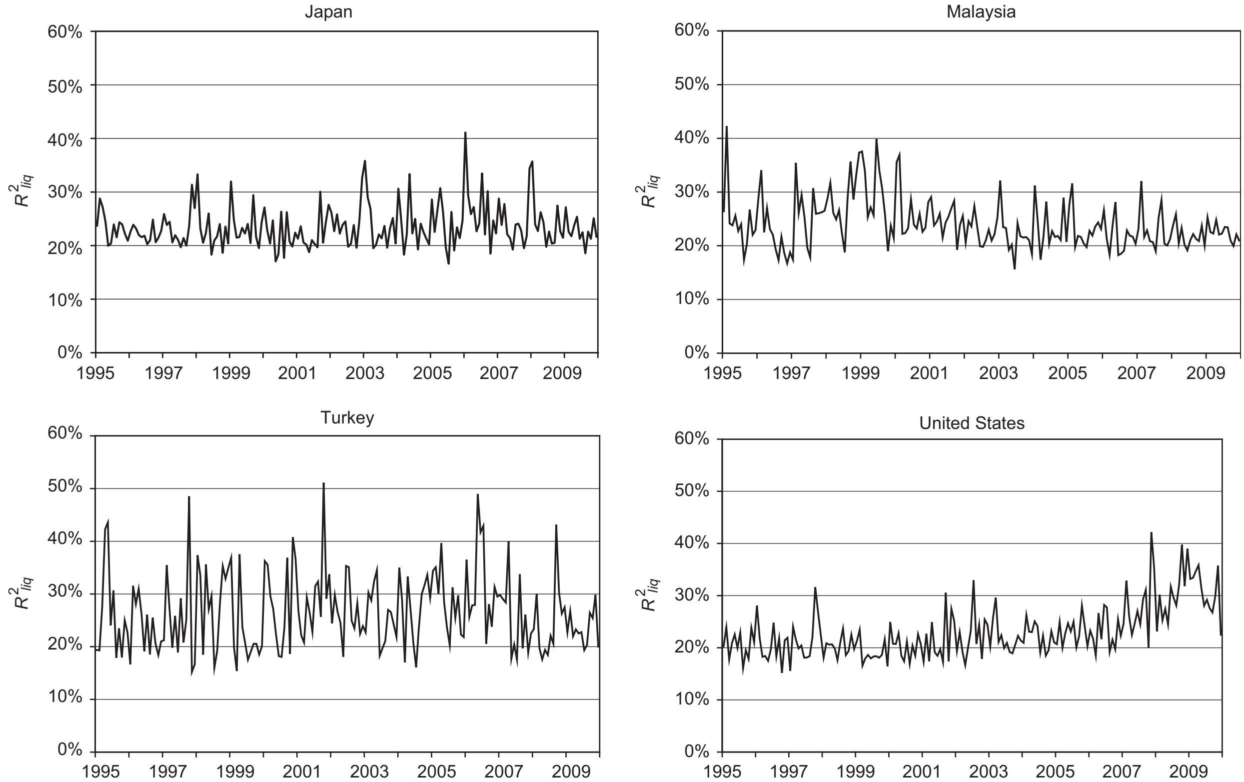

Fig. 2. Time-series variation in commonality in liquidity for select countries. This figure depicts the average commonality in liquidity (R^2_{liq}) in four countries for each month during the sample period 1995:01–2009:12. Commonality in liquidity of individual stocks is measured by the R^2 of monthly regressions of the daily innovations in liquidity of individual stocks on the lead, lag, and contemporaneous innovations in market liquidity at the country level. Daily innovations in liquidity are the residuals of filtering regressions in Eq. (4) of each stock's daily Amihud liquidity on lagged liquidity, day-of-the-week dummies, and holiday dummies within the month. Daily innovations in market liquidity are the value-weighted average of the daily innovations in the liquidity of each stock within the country, excluding the stock of interest. For four of the 40 countries in our sample, the figure shows the time-series development of the equally weighted average of R^2_{liq} across the individual stocks in the country.

as returns that are more than one standard deviation below (above) the mean market return for each country during our period of analysis. We note that, in our sample, the standard deviation of market returns is greater than the mean for all countries.

Our time-series tests include five specific proxies for the local and global funding constraints of financial intermediaries: the short-term interest rate in each country, the U.S. default and commercial paper spreads, and the value-weighted returns on a portfolio of 28 global prime brokers and on the Datastream Banks and Financial Institutions index in each country. The choice for the final three of these variables is based on Hameed, Kang, and Viswanathan (2010), who argue that the commercial paper spread (the difference between 90-day Moody's AA-rated non-financial rates and the 3-month U.S. Treasury bill rate) and the stock returns of financial intermediaries can be interpreted as proxies for aggregate funding liquidity. In unreported analyses, we also examine the U.S. term spread (the difference between 10-year and 3-month U.S. Treasury yields), the TED spread (the difference between the 3-month London Interbank Offer rates and the 3-month U.S. Treasury bill rates), and the amount of NYSE margin debt outstanding as potential funding liquidity proxies. We obtain similar results.

We use eight variables related to the demand-side explanations for commonality: common time-variation in trading activity (monthly time-series of commonality in turnover, or R^2_{turn}, in each country), net equity flows as well as gross capital flows (monthly time-series equivalents of these variables in the cross-country tests, based on TIC data on capital flows between each country and the U.S.), exchange rate changes, the trading volume in exchange-traded country funds (ETFs), and three different sentiment proxies. We orthogonalize R^2_{turn} relative to large market declines as well as to the five supply-side factors described above (local short-term interest rates, U.S. default and commercial paper spreads, and the stock returns of local and global financial intermediaries), to control for any effect of funding constraints on correlated trading activity. We include the change in the exchange rate relative to a trade-weighted basket of major currencies as it may affect the presence and behavior of foreign institutional investors. ETF trading volume (collected from Datastream for ETFs for 28 countries) serves as a measure of index-related trading in each market. The U.S. investor sentiment index of Baker and Wurgler (2006) is the first principal component of six different sentiment proxies, including market trading volume, a dividend premium, closed-end fund discounts, and the number of and first-day returns on initial public offerings. Lower numbers indicate more pessimistic investor sentiment. Lee, Shleifer, and Thaler (1991) argue that fluctuations in closed-end fund discounts are driven by changes in individual investor sentiment. We are able to obtain time-series of 42 closed-end country fund discounts for 27 of the countries in our sample.[9] We also construct a global sentiment indicator as the equally weighted average of the discounts of these country funds. For these variables, lower numbers indicate more optimistic investor sentiment.

5.2. Time-series analysis of commonality in liquidity

Table 3 shows the estimation results of seemingly unrelated regression (SUR) models to relate monthly R^2_{liq} to the supply-side and demand-side factors. Our SUR models restrict the coefficients to be equal across countries. For each specification, the table presents SUR coefficient estimates, the number of observations in the SUR, and the economic magnitude of the effect of the supply-side or demand-side factor of interest. The table also shows the number of (significantly) negative and positive coefficients on the supply- or demand-side factors of interest as well as the average R^2 taken from 40 country-by-country time-series regressions with the same specification as the SUR model. We measure the economic magnitude of the SUR coefficient by the effect of an increase of the average across countries of the standard deviation in the time-series variable of interest, expressed as a fraction of the average across countries of the time-series standard deviation of R^2_{liq}.[10] To be conservative in our modeling, we include the market return, market volatility, and aggregate liquidity and turnover as control variables in all models. Each model specification adds one variable related to the supply- or demand-side explanations to the base model of control variables. In models (8) and (17), we include combinations of key supply- and demand-side factors with the control variables.

All models in Table 3 include a linear time trend as an additional independent variable. Unreported trend tests based on Vogelsang (1998) indicate a significantly negative trend in R^2_{liq} for 17 of the 40 countries and a significantly positive trend for just one country. The time trend has a significantly negative coefficient in all of the SUR models of around -0.0006, which suggests that on average, the R^2_{liq} in the countries in our sample has decreased by 0.84% (equal to 0.16 times the average across countries of the standard deviation of R^2_{liq}) per year over our sample period, which represents a considerable decline.

Model (1) in Table 3 shows a strong effect of market volatility on commonality. This variable has a positive coefficient that is significant at the 1% level in the SUR model and has a (significant) coefficient of the same sign in 31 (18) of the country-by-country regressions. The economic impact of market volatility on commonality is substantial. An increase of one standard deviation in volatility relative to the mean is associated with a rise in R^2_{liq} of 1.01%, equal to 0.20 times the average across countries of the standard deviation of R^2_{liq}, which we, for simplicity, again denote by $\sigma(R^2_{liq})$. Model (1) also shows that R^2_{liq} is positively related to the aggregate turnover in a country.

Hameed, Kang, and Viswanathan (2010) argue that, if financial crises lead to greater commonality through an effect on the wealth and the collateral of traders and financial intermediaries, commonality should increase during episodes of large market declines. In other words, the effect of volatility on R^2_{liq} should be asymmetric. Model (2) shows a strong negative relation between R^2_{liq} and large negative market returns, which implies that R^2_{liq} tends to increase during large market declines. There is also evidence that R^2_{liq} increases when the market goes up, but this effect is smaller and less consistent in the country-by-country regressions. The finding that R^2_{liq} increases most dramatically when there is a large decline in the market can be interpreted as evidence in favor of the supply-side funding liquidity explanation for commonality. However, it can also be consistent with other explanations, most notably the behavior of institutional investors or shifts in investor sentiment during these episodes.[11]

Models (3)–(8) include more direct proxies for the funding liquidity of financial intermediaries. R^2_{liq} is not significantly related to short-term interest rates or the U.S. default spread. The U.S. commercial paper spread is significantly negatively related to R^2_{liq}. If this variable can be viewed as a proxy for the funding liquidity of financial intermediaries active in the 40 countries in our sample,

[9] The list of 42 closed-end country funds is obtained from Tarun Ramadorai and we are grateful for his help and advice. They are compiled from Table 1 of Froot and Ramadorai (2008) and Table 1 of Jain, Xia, and Wu (2008). The prices and net asset values are obtained directly from Bloomberg.

[10] The impact of a one-standard-deviation (σ) increase in the value of a country-level time-series variable (relative to its mean) on R^2_{liq} can be computed using the following expression: $\Delta R^2_{liq} = e^{\alpha+\beta\times(\mu+\sigma)+\gamma\times\lambda}/(1+e^{\alpha+\beta\times(\mu+\sigma)+\gamma\times\lambda}) - e^{\alpha+\beta\times\mu+\gamma\times\lambda}/(1+e^{\alpha+\beta\times\mu+\gamma\times\lambda})$, where α, β, and γ are the intercept, the estimated coefficient on the time-series variable of interest, and the vector of coefficients on the other time-series variables in the SUR model, respectively; μ and λ are the mean of the time-series variable of interest and the vector of means of the other time-series variables, respectively. For μ and λ, we take the average across countries of the time-series mean of these variables. For σ, we take the average across countries of the time-series standard deviation of the variable of interest. To express the economic significance as a fraction of one standard deviation of the commonality measures, we compute the average across countries of the time-series standard deviation of R^2_{liq}.

[11] In a separate experiment, we perform a robustness check of these results for the U.S. market following Hameed, Kang, and Viswanathan (2010). We use intraday quote data from the NYSE Trades and Automated Quotations (TAQ) and the Institute for the Study of Securities Markets (ISSM) data sets over 1995–2009 to construct a monthly time-series of commonality in spreads based on the daily proportional quoted spread for individual stocks. We offer two tests: (1) the R^2 measure of commonality in liquidity based on spreads has a large and statistically significant correlation with R^2_{liq} of 0.65, and (2) the results of regressions of both commonality measures on large negative, small, and positive market returns are similar. We conclude that our measure of commonality in liquidity based on the Amihud liquidity measure displays similar patterns of time-series variation as a measure of commonality in liquidity based on detailed transaction-level data for the U.S.

Table 3

What drives time-series variation in commonality in liquidity?

This table reports results of time-series regressions of monthly commonality in liquidity in 40 countries—denoted by $(R^2_{liq})_{m,t}$, computed as the logistic transformation of commonality in liquidity in country m in month t—over the period 1995:01–2009:12 on various country-level time-series variables:

$$(R^2_{liq})_{m,t} = \alpha + \sum_j \beta_j X^j_{m,t} + \sum_k \gamma_k Z^k_{m,t} + \delta t + \varepsilon_{m,t}$$
$$(m = 1,\ldots,40;\ t = 1995:01,\ldots,2009:12),$$

where $X^j_{m,t}$ denotes the time-series supply-side and demand-side factors, $Z^k_{m,t}$ denotes the time-series control variables (market return, volatility, liquidity, and turnover—to capture general variation in capital market conditions) for country m in month t, and t is a linear time trend. Variable definitions are in Table A4. We refer to Table 1 for a description of the sample. The coefficients in the table are taken from seemingly unrelated regression (SUR) models estimated jointly for all 40 countries (coefficients are restricted to be the same for all countries). Intercepts are suppressed to conserve space. Significance at the 1%, 5%, and 10% level is indicated by [a], [b], and [c], respectively. The economic effects in the table represent the effect of a one-standard-deviation (σ) increase in a supply-side or demand-side factor of interest, expressed as a fraction of one σ of R^2_{liq} (except $R_m^{Down,Large}$, which has no meaningful σ). Equity/capital flow data are only available to/from the U.S., so models with these variables exclude the U.S.; ETF volume and local country fund discount data are only available for 28 and 27 countries, respectively. The final three rows of the table show the number of (significantly) negative and positive coefficients on a supply-side/demand-side factor of interest and the average R^2 taken from 40 country-by-country time-series regressions (instead of SUR models) with the same specification.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Capital market conditions								
Market return	−0.0370		−0.0420	−0.0392	−0.0585	−0.0388	−0.1097	−0.1118[c]
Market volatility	0.0759[a]		0.0744[a]	0.0782[a]	0.0741[a]	0.0760[a]	0.0762[a]	0.0773[a]
Market liquidity	9.4953		11.8897	9.3371	−24.1053	9.4785	9.3667	11.2339
Market turnover	15.1292[a]		15.1002[a]	14.9889[a]	14.3345[a]	15.1285[a]	15.0852[a]	14.9011[a]
Time trend	−0.0007[a]	−0.0005[a]	−0.0007[a]	−0.0006[a]	−0.0007[a]	−0.0007[a]	−0.0007[a]	−0.0007[a]
Large/small up/down market returns								
$R_m^{Down,Large}$		−0.4972[a]						
R_m^{Small}		−0.1280						
$R_m^{Up,Large}$		0.3196[a]						
Supply-side factors								
Short-term interest rate			0.0005					0.0004
U.S. default spread				−0.0094				−0.0101
U.S. commercial paper (CP) spread					−0.0333[c]			
Global prime broker returns						0.0003		
Local bank returns							0.0008[c]	0.0007[c]
# Obs.	6,988	6,988	6,955	6,988	5,963	6,988	6,988	6,955
Supply-side factor of interest	*Market volatility*	$R_m^{Down,Large}$	*Short-term interest rate*	*U.S. default spread*	*U.S. CP spread*	*Prime broker returns*	*Local bank returns*	*Short-term interest rate*
Economic effect ($\times\sigma(R^2_{liq})$)	$0.20\times\sigma$	NA	$0.01\times\sigma$	$-0.03\times\sigma$	$-0.03\times\sigma$	$0.00\times\sigma$	$0.03\times\sigma$	$0.01\times\sigma$
# Coefficients $<$ 0 (# significantly <0)	9 (1)	29 (13)	23 (4)	14 (5)	24 (6)	21 (2)	16 (3)	25 (4)
# Coefficients $>$ 0 (# significantly >0)	31 (18)	11 (1)	17 (2)	26 (8)	16 (2)	19 (2)	24 (3)	15 (1)
Average R^2	0.14	0.08	0.15	0.15	0.15	0.15	0.15	0.17

Table 3 (*continued*)

Model	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Model	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Capital market conditions									
Market return	−0.0753	−0.0352	−0.0328	−0.0390	0.0627	−0.0883	−0.0488	0.0222	−0.0806
Market volatility	0.0645[a]	0.0768[a]	0.0754[a]	0.0769[a]	0.0748[a]	0.0836[a]	0.0791[a]	0.0775[a]	0.0665[a]
Market liquidity	4.5006	20.5289[b]	21.0578[b]	9.2680	17.0251[c]	13.2367	10.0904	18.4230	16.5215[c]
Market turnover	15.4641[a]	13.0638[a]	12.8697[b]	15.0766[a]	−5.9731[a]	11.3903[a]	15.0969[a]	4.8239[a]	13.4841[a]
Time trend	−0.0007[a]	−0.0008[a]	−0.0007[a]	−0.0007[a]	−0.0005[a]	−0.0007[a]	−0.0007[a]	−0.0006[a]	−0.0007[a]
Demand-side factors									
R^2_{turn} (orthogonalized to supply-side factors)	0.1388[a]								0.1328[a]
Net % equity flow		0.0002[b]							0.0001[b]
Gross capital flow/GDP			−0.0002[a]						−0.0002[a]
Exchange rate				−0.0014[c]					
ETF volume					−0.0000				
U.S. sentiment index						−0.0053			
Global country fund (cf) discount							−0.0027[a]		−0.0017[b]
Local country fund (cf) discount								−0.0004[c]	
# Obs.	6,955	6,657	6,664	6,988	4,231	6,034	6,988	3,848	6,624
Demand-side factor of interest	R^2_{turn}	*Net % equity flow*	*Gross capital flow*	*Exchange rate*	*ETF volume*	*U.S. sentiment*	*Global cf discount*	*Local cf discount*	R^2_{turn}
Economic effect ($\times\,\sigma(R^2_{liq})$)	$0.13\times\sigma$	$0.02\times\sigma$	$-0.02\times\sigma$	$-0.01\times\sigma$	$-0.00\times\sigma$	$-0.01\times\sigma$	$-0.05\times\sigma$	$-0.02\times\sigma$	$0.13\times\sigma$
# Coefficients $<$ 0 (# significantly <0)	2 (0)	14 (3)	29 (5)	25 (7)	13 (2)	25 (6)	15 (6)	12 (5)	1 (0)
# Coefficients $>$ 0 (# significantly >0)	38 (32)	25 (1)	11 (3)	15 (1)	15 (2)	15 (2)	25 (3)	15 (2)	38 (31)
Average R^2	0.19	0.13	0.14	0.15	0.12	0.16	0.165	0.16	0.20

the coefficient has the opposite sign from what the supply-side hypothesis predicts. The stock returns of a portfolio of global prime brokers appear to have little influence on liquidity commonality. The coefficient on local bank returns is significantly positive at the 10% level, which runs counter to the prediction of the funding liquidity hypothesis. Unreported results show that separating global prime broker and local bank returns into large negative, small, and large positive returns does not yield stronger results. Model (8) indicates that the effect of local bank returns does not change when this variable is included side-by-side with the short-term interest rate and the U.S. default spread. We do not include the U.S. commercial paper spread in model (8) since it is only available since January 1997. Following Hameed, Kang, and Viswanathan (2010), we also run additional tests in which we include interaction terms of large market declines with our five funding liquidity proxies in the time-series models. The results of these tests are not supportive of the hypothesis that the observed increase in commonality during large market declines can be attributed to tightening funding constraints. Overall, the evidence that our proxies for funding liquidity can explain the dynamics of commonality in liquidity among the 40 countries in our sample is weak.

Models (9)–(17) suggest that our measures of demand-side explanations for commonality are more reliably significant in explaining time-series variation in commonality in liquidity. The coefficient on R^2_{turn} (orthogonalized relative to the supply-side factors) is significant at the 1% level in the SUR and positive (and significant) in 38 (32) of the 40 country-by-country regressions. The economic magnitude of the effect is considerable. A one-standard-deviation increase in R^2_{turn} is associated with an increase in R^2_{liq} of 0.68%, or 0.13 $\times$ $\sigma(R^2_{liq})$.

The coefficient on net equity flows is positive and significant, showing that net equity flows from the U.S.—which we associate with a greater presence of foreign institutional investors—increase the intensity of commonality on the local market. Interestingly, commonality decreases significantly with the size of gross capital flows relative to GDP, our measure of capital market openness. A one-standard-deviation increase in net equity flows (gross capital flows) is accompanied by a change in R^2_{liq} of 0.10% ($-$0.08%), or 0.020 ($-$0.016) times $\sigma(R^2_{liq})$. The economic effects of capital flows on commonality seem modest, but explaining time-series variation in R^2_{liq} is harder than explaining cross-country variation in the time-series average of R^2_{liq} (as we did in Section 4.2). Moreover, our SUR models include five control variables that have substantial explanatory power. It is also important to note that we compute the average effect across countries of the time-series mean and standard deviation of the different explanatory variables to gauge the overall economic significance. The effects may well be more pronounced for individual countries.

There is some indication that currency appreciations tend to be accompanied by greater commonality in liquidity, although the economic and statistical significance of this effect are relatively weak. Models (13) and (14) indicate that there is little evidence that ETF trading volume and the U.S. sentiment index help to explain time-variation in commonality. However, the coefficients on both global and local country fund discounts are significantly negative, with a one-standard-deviation increase in global (local) country fund discounts associated with a decrease in R^2_{liq} of 0.05 (0.02) times $\sigma(R^2_{liq})$. These findings suggest that commonality in liquidity increases with more optimistic investor sentiment. The statistical and economic significance of the coefficients on R^2_{turn}, net equity flows, gross capital flows, and the global country fund discount remain intact in model (17).

Overall, our time-series analyses uncover a number of determinants of time-variation in commonality in liquidity. That commonality increases during times of high local market return volatility and asymmetrically on the downside is a finding consistent with the predictions of supply-side explanations related to funding liquidity constraints (e.g., Brunnermeier and Pedersen, 2009). However, we show in supplemental tests that the predictive power of various direct proxies for potential funding constraints, such as short-term interest rates, U.S. default and commercial paper spreads, and the financial health of global prime brokers or local financial institutions, is weak. We find stronger evidence in favor of demand-side explanations that link commonality in liquidity to changes in the level of correlated trading activity, to globalization and the overall presence of foreign investors, and to investor sentiment.

These findings challenge those of recent studies that emphasize the key role of the funding liquidity channel on U.S. markets, especially during the recent financial crisis. In unreported supplementary tests, we attempt to study this contrast in more detail by separating out the U.S. from the other 39 countries and by allowing the coefficients on the supply- and demand-side factors to vary across the period before and during the financial crisis of 2008–2009. We take the "quant crisis" in August 2007 as the starting point of the financial crisis (following Khandani and Lo, 2011). To facilitate comparison with other studies (e.g., Hameed, Kang, and Viswanathan, 2010), we also build a commonality in liquidity measure for the U.S. based on daily bid-ask spreads using intraday quote data. These tests reveal a strong effect of volatility that is asymmetric for the 39 countries as well as the U.S. But, interestingly, the asymmetry disappears during the recent crisis, as large market increases have a positive effect on commonality after August 2007 that is comparable in magnitude to the effect of large market declines. Moreover, we find that our demand-side factors play an important role not only for the 39 countries, but also for the U.S. (most notably R^2_{turn} and gross capital flows relative to GDP for our R^2_{liq} measure based on spreads), while there is little evidence that supply-side forces have become more economically important during the recent crisis, even for the U.S.

5.3. *Analysis of differences in the dynamics of commonality in liquidity within the cross-section of stocks*

The supply-side and demand-side hypotheses offer different predictions for the time-variation of commonality within the cross-section of stocks. The funding liquidity hypothesis suggests that the relation between

Table 4

What drives time-series variation in commonality in liquidity of size-volatility portfolios?

This table reports results of a time-series regression of monthly commonality in liquidity of four size-volatility (2×2) sorted portfolios in 40 countries—denoted by $(R^2_{liq})_{m,p,t}$, computed as the logistic transformation of the equally weighted commonality in liquidity of the stocks in portfolio p in country m in month t—over the period 1995:01–2009:12 on various country-level time-series variables:

$$(R^2_{liq})_{m,p,t} = \alpha_p + \sum_j \beta_{p,j} X^j_{m,t} + \sum_k \gamma_{p,k} Z^k_{m,t} + \delta t + \varepsilon_{m,p,t}$$
$$(m=1,\ldots,40;\ p=1,\ldots,4;\ t=1995:01,\ldots,2009:12),$$

where $X^j_{m,t}$ denotes the time-series supply-side and demand-side factors, $Z^k_{m,t}$ denotes the time-series control variables (market return, market volatility, market liquidity, and market turnover—to capture general variation in capital market conditions) for country m in month t, and t is a linear time trend. Variable definitions are in Table A4. We refer to Table 1 for a description of the sample. The portfolios (p) are based on independent sorts on size (market capitalization at the end of the previous year) and volatility (standard deviation of daily returns over the previous year) for each country m. The coefficients in the table are taken from a single seemingly unrelated regression (SUR) model estimated jointly for all four portfolios in all 40 countries (where coefficients are restricted to be the same for all countries, but are allowed to differ across portfolios). The table also reports results of Wald tests on the equality of the coefficients across the four portfolios. The model in this table excludes the U.S., since equity/capital flow data are only available to/from the U.S. Intercepts are suppressed to conserve space. Significance at the 1%, 5%, and 10% level is indicated by [a], [b], and [c], respectively.

Model	(1)				
Portfolio	Small cap, low volatility	Small cap, high volatility	Large cap, low volatility	Large cap, high volatility	*Wald test for equality of coefficients*
Capital market conditions					
Market return	−0.2001[a]	−0.2120[a]	−0.1698[a]	−0.2909[a]	*14.28[a]*
Market volatility	0.0616[a]	0.0731[a]	0.0717[a]	0.0966[a]	*184.58[a]*
Market liquidity	11.4985[b]	19.3282[a]	31.4452[a]	29.5671[a]	*27.86[a]*
Market turnover	15.3665[a]	15.0543[a]	16.8594[a]	17.2458[a]	*11.54[a]*
Time trend	−0.0008[a]	−0.0007[a]	−0.0009[a]	−0.008[a]	*19.53[a]*
Supply-side factors					
Short-term interest rate	−0.0005[b]	−0.0005[c]	0.0008[a]	0.0001	*45.39[a]*
U.S. default spread	0.0054	−0.0095[b]	0.0052	−0.0071	*45.97[a]*
Local bank returns	0.0010[a]	0.0007[b]	0.0006[c]	0.0024[a]	*69.19[a]*
Demand-side factors					
R^2_{turn} (orthogonalized to supply-side factors)	0.1332[a]	0.1492[a]	0.1544[a]	0.1665[a]	*24.36[a]*
Net % equity flow	0.0000	0.0001[c]	0.0002[a]	0.0004[a]	*58.77[a]*
Gross capital flow/GDP	−0.0002[a]	−0.0002[a]	−0.0002[a]	−0.0002[a]	*10.71[b]*
Global country fund discount	−0.0013[b]	−0.0003	−0.0017[b]	−0.0005	*18.82[a]*
# Obs.		26,179			

R^2_{liq} and the supply-side factors should be stronger for more volatile stocks. The demand-side hypothesis related to international and institutional investors predicts a stronger relation of R^2_{liq} with R^2_{turn} and with net equity flows for large cap stocks. The sentiment proxies should have a stronger effect for smaller and more volatile stocks.

Our third test of the supply-side and demand-side hypotheses is therefore based on time-series regressions of the commonality in liquidity of size-volatility portfolios on the supply-side and demand-side factors. To obtain commonality in liquidity at the portfolio level, we carry out an independent sort of the stocks in each country in each year into four (2×2) portfolios based on their market capitalization at the end of the previous year and the standard deviation of their daily returns over the previous year.[12] We compute the commonality in liquidity of each portfolio in each country as the equally weighted average R^2_{liq} across the stocks within the portfolio. We then estimate the SUR models of the time-series of commonality of all four portfolios in all 40 countries, where we allow the coefficients on the supply- and demand-side factors to differ across the four portfolios. The results are in Table 4. To save space, we do not present the results of all individual model specifications in Table 3, but rather we estimate one all-encompassing SUR model that includes the proxies for overall capital market conditions (market return, volatility, liquidity, and turnover) as well as several key supply-side and demand-side factors. These factors are the short-term interest rate, the U.S. default spread, and local bank returns as supply-side factors (see model (8) in Table 3) and R^2_{turn} (also computed at the portfolio level for this test), net equity flows, gross capital flows, and the global country fund discount as demand-side factors (see model (17) in Table 3). In addition to the coefficient estimates and the number of observations in this SUR model, Table 4 presents the results of Wald tests on the equality of the coefficients across the four size-volatility portfolios.

[12] In computing the standard deviation of the daily stock returns of individual firms, we set daily returns to missing if $(1+R_{i,d})(1+R_{i,d-1})-1 \le 0.5$, where $R_{i,d}$ and $R_{i,d-1}$ are the stock returns of firm i on day d and $d-1$, respectively, and at least one is greater than or equal to 100% (following Ince and Porter, 2006).

There is a significantly negative time trend in the commonality in liquidity series of each of the four size-volatility portfolios. We thus uncover little evidence of the finding of Kamara, Lou, and Sadka (2008) that commonality in liquidity has increased for large cap stocks in the U.S. holds internationally over our sample period. In fact, if anything, the downward trend is slightly more pronounced for large cap stocks than for small cap stocks.

Consistent with the funding liquidity hypothesis, the effect of market volatility on R^2_{liq} is greater for high volatility than for low volatility stocks. The Wald test indicates that these differences are statistically significant. However, the coefficient on market volatility is greater by a similar amount for large cap relative to small cap stocks, which is not among the predictions of Brunnermeier and Pedersen (2009) and other models of funding liquidity. Moreover, market volatility is a variable that may also, in part, capture common variation in the demand for liquidity. More specific tests based on the supply-side factors yield little support for the funding liquidity hypothesis. Contrary to the prediction of this hypothesis, we observe the strongest effect of the short-term interest rate for the portfolio of large cap, low volatility stocks. In fact, the coefficient on short-term interest rate is either insignificant or significant with a negative sign for the other three portfolios. It is equally difficult to see a pattern in the coefficients on the U.S. default spread and local bank returns that is consistent with the supply-side explanation.

We again find more reliable evidence for the demand-side explanations for commonality. Not only the level of aggregate turnover, but also commonality in turnover has a significant effect for all portfolios and has a significantly stronger impact on R^2_{liq} for large cap stocks. We also find that the impact of net equity flows into a country on R^2_{liq} is significantly greater for large cap stocks. These findings reinforce our earlier conclusion that the correlated trading behavior of foreign and institutional investors is an important driving force of commonality, since these investors are more active in large cap stocks (e.g., Kang and Stulz, 1997; Gompers and Metrick, 2001). In line with Table 3, the coefficient on the global country fund discount is negative for all four size-volatility portfolios, but the effect is strongest for small and large cap stocks with low volatility. This runs contrary to the finding of Baker and Wurgler (2006) that small and volatile stocks are more prone to changes in sentiment.

Overall, the results in Table 4 are more consistent with the predictions of the demand-side hypotheses regarding differences in the time-variation in commonality within the cross-section of stocks than with the predictions of the supply-side hypothesis.

5.4. Analysis of differences in the dynamics of commonality in liquidity across countries

In our fourth test, we examine whether commonality in liquidity in different groups of countries is differentially affected by supply- and demand-side factors. This is more than just a robustness check of the previous findings because we showed earlier (in Table 2) that several country characteristics (including the averages of market volatility, commonality in turnover, and net equity inflows over the sample period) are significantly related to the average *level* of commonality in liquidity in a country. If these findings can indeed be attributed to underlying supply-side and demand-side forces, we would expect the susceptibility of stocks to the supply-side and demand-side shocks to differ in a systematic way across groups of countries sorted on these characteristics.

Table 5 reports the estimation results of SUR models of R^2_{liq} in all 40 countries in which the coefficients of the supply- and demand-side factors are allowed to differ across different groups of countries. We separate countries into two groups along the following four dimensions: the level of economic development (measured by GDP per capita), the average local market volatility, the average R^2_{turn}, and the average net equity capital inflows over the sample period. For each of these four country classifications, Table 5 shows the coefficients estimates in the SUR model for both groups of countries, the number of observations in the SUR, and the results of a Wald test on the equality of the coefficients across the two groups of countries. As in Table 4, each of the four SUR models includes a combination of key supply-side and demand-side factors with the control variables that proxy for general variation in capital market conditions.

Model (1) shows that the positive effect of market volatility on R^2_{liq} is more pronounced for less developed countries. The Wald test indicates that the difference is statistically significant at the 1% level. Commonality in liquidity thus increases more dramatically during periods of high market volatility in less developed countries. We also find that R^2_{liq} is negatively related to market returns in less developed markets, but not in more developed countries. These results seem to suggest that the funding liquidity explanation is more prominent for less developed countries, which we would expect if financial intermediaries are more likely to face binding funding constraints in such markets. However, the coefficients on the supply-side factors indicate that, if anything, the funding liquidity explanation is more powerful for developed countries, as the coefficient on the short-term interest rate is significantly positive only for these countries. Moreover, there is a significantly negative effect (at the 10% level) of local bank returns for developed countries. For less developed countries, the coefficients on the U.S. default spread and local bank returns are significant with the opposite sign of what the supply-side explanation predicts. The U.S. default spread enters the model with a positive sign for less developed countries, but the significance is weak and the Wald test shows that the effect is not statistically different across both groups of countries. The coefficients on commonality in turnover and net equity flows do not differ significantly across less and more developed countries. Remarkably, for less developed countries, capital market openness is associated with greater commonality in liquidity, which suggests that stock markets may not benefit from financial openness when they have not reached a certain

Table 5
What drives time-series variation in commonality in liquidity in different groups of countries?

This table reports results of time-series regressions of monthly commonality in liquidity in two different country groups g among the 40 countries in our sample—denoted by $(R^2_{liq})_{m,t}$, computed as the logistic transformation of commonality in liquidity in country m in month t—over the period 1995:01–2009:12 on various country-level time-series variables:

$$(R^2_{liq})_{m,t} = \alpha_g + \sum_j \beta_{g,j} X^j_{m,t} + \sum_k \gamma_{g,k} Z^k_{i,t} + \delta t + \varepsilon_{m,t}$$
$$(m = 1,\ldots,40; \quad g = 1,2; \quad t = 1995:01,\ldots,2009:12),$$

where $X^j_{m,t}$ denotes the time-series supply-side and demand-side factors, $Z^k_{m,t}$ denotes the time-series control variables (market return, market volatility, market liquidity, and market turnover—to capture general variation in capital market conditions) for country m in month t, and t is a linear time trend. Variable definitions are in Table A4. We refer to Table 1 for a description of the sample. The coefficients in the table are taken from seemingly unrelated regression (SUR) models estimated jointly for all 40 countries. The estimated coefficient on each independent variable is allowed to be different for different groups (g) of countries. We categorize countries into two groups in the following ways: less/more developed countries (defined as countries with a below/above-median GDP per capita in 2003) in model (1); low/high market volatility (below/above-median average market volatility over 1995:01–2009:12) in model (2); low/high commonality in turnover (below/above-median average R^2_{turn} over 1995:01–2009:12) in model (3); and low/high net equity inflows (below/above-median average net % equity inflows over 1995:01–2009:12) in model (4). For each of the four models, the table presents the estimated coefficients for both groups of countries as well as the results of Wald tests on the equality of the coefficients across the two groups of countries. The models in this table exclude the U.S., since equity/capital flow data are only available to/from the U.S. Intercepts are suppressed to conserve space. Significance at the 1%, 5%, and 10% level is indicated by [a], [b], and [c], respectively.

Model	(1)			(2)		
Country group	Less developed countries	More developed countries	*Wald test for equality of coefficients*	Low market volatility countries	High market volatility countries	*Wald test for equality of coefficients*
Capital market conditions						
Market return	−0.4289[a]	0.0982	*25.03[a]*	0.0439	−0.2753[a]	*8.34[a]*
Market volatility	0.0819[a]	0.0314[a]	*45.55[a]*	0.0451[a]	0.0605[a]	*3.94[b]*
Market liquidity	15.9267[c]	8.0975	*0.05*	−38.4058	21.5310[b]	*3.40[c]*
Market turnover	18.3259[a]	−9.0218[a]	*105.81[a]*	−7.9217[a]	16.8292[a]	*69.89[a]*
Time trend	−0.0011[a]	−0.0003[b]	*42.33[a]*	−0.0004[a]	−0.0010[a]	*20.02[a]*
Supply-side factors						
Short-term interest rate	−0.0012[a]	0.0034[b]	*9.94[a]*	0.0007	0.0001	*0.29*
U.S. default spread	0.0172[c]	0.0037	*2.17*	−0.0041	0.0176[c]	*5.61[b]*
Local bank returns	0.0024[a]	−0.0009[c]	*17.32[a]*	0.0006	0.0006	*0.00*
Demand-side factors						
R^2_{turn} (orthogonalized to supply-side factors)	0.1353[a]	0.1453[a]	*0.28*	0.1248[a]	0.1550[a]	*2.47*
Net % equity flow	0.0001	0.0002[c]	*0.76*	0.0000	0.0001	*0.49*
Gross capital flow/GDP	0.0007[b]	−0.0000	*4.01[b]*	−0.0001[a]	−0.0001[a]	*0.43*
Global country fund discount	−0.0026[b]	−0.0004	*3.14[c]*	0.0001	−0.0040[a]	*11.26[a]*
# Obs.		6,624			6,624	

Model	(3)			(4)		
Country group	Low R^2_{turn} countries	High R^2_{turn} countries	*Wald test for equality of coefficients*	Low net equity inflow countries	High net equity inflow countries	*Wald test for equality of coefficients*
Capital market conditions						
Market return	−0.0357	−0.2812[a]	*5.63[b]*	0.0131	−0.3274[a]	*10.07[a]*
Market volatility	0.0236[a]	0.0699[a]	*40.35[a]*	0.0594[a]	0.0683[a]	*1.43*
Market liquidity	0.2454	19.0643[b]	*0.25*	30.0721	15.2802[c]	*0.14*
Market turnover	−9.8566[a]	18.1015[a]	*104.68[a]*	−21.8549[a]	20.4095[a]	*266.70[a]*
Time trend	−0.0004[a]	−0.0007[a]	*4.43[b]*	−0.0002	−0.0011[a]	*46.31[a]*
Supply-side factors						
Short-term interest rate	0.0060[a]	−0.0004	*40.12[a]*	0.0069[a]	−0.0013[a]	*62.82[a]*
U.S. default spread	0.0176[b]	−0.0103	*10.78[a]*	−0.0034	0.0131	*3.11[c]*
Local bank returns	−0.0002	0.0017[a]	*5.65[b]*	0.0001	0.0013[b]	*2.19*
Demand-side factors						
R^2_{turn} (orthogonalized to supply-side factors)	0.1537[a]	0.1372[a]	*0.76*	0.1228[a]	0.1549[a]	*2.76[c]*
Net % equity flow	0.0000	0.0002[b]	*1.89*	0.0001	0.0001	*0.00*
Gross capital flow/GDP	0.0000	−0.0003[a]	*31.81[a]*	0.0000	−0.0003[b]	*4.86[b]*
Global country fund discount	−0.0009	−0.0007	*0.03*	0.0002	−0.0037[a]	*10.26[a]*
# Obs.		6,624			6,624	

threshold level of development. The effect of the global country fund discount is stronger for less developed countries. Interestingly, the negative trend in commonality in liquidity is also significantly more pronounced for less developed countries.

Model (2) indicates that the effect of market volatility on R^2_{liq} is significantly greater in countries with greater average market volatility over the entire sample period. These countries also experience a high level of commonality when market returns are low, and market liquidity and turnover are high. Yet, there is only weak evidence that these findings can be attributed to the supply-side hypothesis, as only the positive coefficient on the U.S. default spread (significant at the 10% level) is in line with the predictions of this hypothesis. The coefficients on the demand-side factors are generally more pronounced for high-volatility countries, though only the coefficient of the global country fund discount is significantly different across both groups of countries.

If our earlier finding that the average level of R^2_{liq} is positively related to the average level of R^2_{turn} across countries is due to demand-side forces, we would expect the effects of the demand-side factors in the SUR to be greater in countries with greater average levels of R^2_{turn}. Model (3) of Table 5 shows some evidence that this is the case. Commonality in liquidity is significantly related to net equity flows and gross capital flows for high R^2_{turn} countries, while the coefficients on these variables are not statistically significant for low R^2_{turn} countries. The difference in the coefficients across both groups of countries is significant for gross capital flows. Commonality in liquidity in high R^2_{turn} countries is also more susceptible to market volatility, but less to the short-term interest rate, which does not accord well with a potential supply-side explanation for the positive relation between R^2_{liq} and R^2_{turn} across countries.

Model (4) shows that countries that experienced greater capital inflows over the sample period are characterized by a significantly stronger response of commonality in liquidity to R^2_{turn}, gross capital flows, and the global country fund discount. Consequently, the most plausible explanation for our finding that the average R^2_{liq} is higher in countries with large net equity inflows is that commonality in liquidity in countries with a greater presence of foreign investors is more sensitive to demand-side shocks, consistent with the demand-side hypothesis.

The results of the analyses of differences in the dynamics of commonality in liquidity across different groups of countries are perhaps less clear-cut than those of our other tests, but, by and large, they also point in the direction of demand-side rather than supply-side forces for understanding commonality in liquidity. The supply-side factors are rarely significant with the direction that the funding hypothesis predicts, and there is only weak evidence that they matter more in high volatility countries in which funding constraints can be expected to bind more often. However, the demand-side factors are more reliably significant across different groups of countries, and they matter more in high R^2_{turn} and high net equity flow countries, for which we expect the demand-side forces to be stronger.

6. Additional analysis: alternative methodology and endogeneity tests

Our time-series results thus far show that commonality in liquidity tends to be high during times of high market volatility (especially on the downside), highly correlated trading activity, large equity capital inflows, and low levels of financial market openness. As we estimate these effects contemporaneously at the monthly frequency, an important issue is the extent to which we can make statements about the causal direction of the relations among these variables. For at least several of the variables in our SUR models, our results so far do not rule out that the causality may in fact run the other way. For example, market volatility may just as easily arise as a consequence of recent waves of illiquidity across stocks as it is the cause of it.

To furnish a better understanding of the joint dynamics of commonality in liquidity, capital market conditions, and our supply- and demand-side factors, this section reports the results of three additional experiments. First, we re-run our time-series tests in Table 3 with one-month lagged (instead of contemporaneous) explanatory variables. Unreported results show that many of our inferences remain in place. The positive coefficient on market volatility is still statistically and economically significant, although it is smaller than in the contemporaneous regressions. The asymmetric effect associated with large market declines disappears, however. Among the supply-side factors, the positive impact of short-term interest rates remains, but the negative coefficients on the U.S. default and commercial paper spreads disappear. Among the demand-side factors, we no longer find a positive effect of R^2_{turn}, but the positive impact of net equity flows and the negative impact of gross capital flows are just as strong as in Table 3. And we now obtain a significant effect of one of the other demand-side variables: namely, the local country discount. Its coefficient is negative, which suggests that greater optimism about local markets predicts higher commonality in the subsequent month. The overall explanatory power of the model with lagged variables is considerably lower. We conclude that, although the effects of several key demand-side factors related to the institutional and international investor hypothesis remain significant when they are included with a one-month lag, in many countries a substantial fraction of the impact of our supply-side and demand-side variables manifests itself at short horizons of one month or less.

As our monthly time-series of R^2_{liq} are based on regressions of daily liquidity innovations within the month, this methodology does not allow us to investigate these relations at higher frequencies. Indeed, one potential problem is that the effects of various supply-side or demand-side factors may "average out" at the lower monthly frequency though they may be vital at the higher weekly frequency. Therefore, we conduct a second experiment based on the approach of Hameed, Kang, and Viswanathan (2010) to evaluate common variation in the liquidity of individual stocks based on "liquidity betas" estimated using weekly data. We follow several steps to run this test. First, we aggregate daily innovations in liquidity for each stock (obtained from Eq. (4) in Section 3.2) across days within a given week to obtain average weekly liquidity innovations for each stock in the sample. We do the same for innovations in aggregate market liquidity. We then estimate regressions of the weekly liquidity innovations of individual stocks on weekly market liquidity innovations. The slope coefficient in these regressions (the "liquidity beta") is an alternative measure of the commonality in liquidity. Subsequently, we introduce interactions of weekly market liquidity innovations with dummy variables for contemporaneous and one-week lagged (large) market declines to examine whether liquidity betas increase during current and in response to recent past market declines. Following Hameed, Kang, and Viswanathan (2010), we also include the following control variables: four weekly lagged values of liquidity innovations of the stock, the stock return and market return in the current week, the current and one-week lagged standard deviations of the stock and the market returns, and the one-week lagged change in the weekly average of the daily turnover of the stock.

We estimate three different models and analyze the results across all stocks in all 40 countries in the sample, and separately for the U.S. only in order to facilitate comparison with the findings of Hameed, Kang, and Viswanathan (2010). One model includes only an interaction of weekly market liquidity innovations with a dummy variable indicating market declines in the same week. A second model features interactions with dummy variables for both small and large market declines in the same week. And our third model allows for interactions with dummies for both small and large market declines in the current week and in the previous week.

Unreported estimation results show evidence of significant commonality in liquidity at the weekly frequency, both in the U.S. (average liquidity beta of 0.2782) and in all 40 countries (average liquidity beta of 0.5058). On average, commonality in liquidity is greater outside the U.S., in line with our results based on R^2_{liq} in Table 1 and in Fig. 1. We also show that commonality is greater in weeks in which local market declines are large (average liquidity betas increase by 0.5171 for the U.S. and by no less than 1.8886 for all countries). The effect of market declines is thus also more pronounced outside the U.S., although the statistical significance is weak, which indicates that there is substantial variation in these effects across the individual stocks in the countries in our sample. Finally, our third model suggests that the relation between liquidity commonality and large market declines is quite short-lived, especially for the U.S. where this effect dies out within one week. For all countries combined, we still find a statistically significant effect of large market declines in the previous week on commonality in the current week. The economic effect (an average liquidity beta increase of 0.1900) is considerable, although it is relatively small compared to the effect of large market declines in the current week. In sum, these findings suggest that our key results on the existence of commonality in liquidity and its exacerbation during large market declines are similar when we use a different methodology to evaluate commonality. Moreover, the finding that, for all countries jointly, there is still a significant effect of large market declines on commonality in liquidity after one week provides some indication that the causality in this relation is unlikely to run in the other direction. At the same time, most of the interaction takes place within the weekly frequency. As only intraday data would allow us to look at even higher frequencies, we need to be careful to avoid strong directional statements.

In a third experiment, we model the joint dynamics of commonality in liquidity with capital market conditions in a vector autoregression (VAR) analysis. Such a test allows R^2_{liq} to respond to the impact of past innovations in the proxies for capital market conditions as well as those proxies to respond to past innovations in R^2_{liq}. For each country, we estimate a five-equation VAR with R^2_{liq} and market returns, volatility, liquidity, and turnover as endogenous variables, allowing for up to two monthly lags. As exogenous variables, we add the three supply-side factors and the four demand-side factors that are also included in the SUR models in Tables 4 and 5. We then perform zero-block exclusion tests of the null hypothesis that lagged values of market returns, volatility, liquidity, and turnover, as well as its own lagged values of R^2_{liq} have no predictive power for future R^2_{liq}. We also compute impulse responses (using Cholesky decomposition based on a pooled VAR estimated for all countries simultaneously) to evaluate the impact of unit shocks to one variable for the responses of that and the other four variables. We find that R^2_{liq} is not highly autoregressive and the responses of R^2_{liq} to lagged market return shocks are positive, but weak (no more than four countries show a significantly positive effect), and those to lagged market volatility, liquidity, and turnover shocks are similarly weak, both in the zero-block exclusion tests and in the impulse responses tests. More interesting is the fact that the responses of R^2_{liq} to innovations in short-term interest rates remain reliably positive in 31 countries and those for R^2_{turn} are reliably positive in all 40 countries, while other variables are weaker.

Overall, our additional tests in this section underline that we need to be cautious with making strong causal statements. Many of the effects that we document in Tables 3–5 appear to take place at quite short horizons. At the same time, several of our key findings also obtain when we allow for a one-month lag in the propagation of shocks in our supply- and demand-side factors, when we evaluate commonality in liquidity with a different methodology at the weekly frequency, and when we control for the dynamic interaction between R^2_{liq} and our variables capturing capital market conditions. These additional experiments give us confidence that our main conclusions survive when we try to address the endogeneity of the variables central to our tests.

7. Conclusions

This paper uncovers new empirical findings that help to understand cross-country and time-series variation in commonality in the liquidity of individual stocks in 40 stock markets around the world. With these findings, we evaluate several alternative hypotheses on why commonality exists and why it varies across countries and over time. We derive testable hypotheses that stem either from supply-side forces related to the funding liquidity of financial intermediaries or from demand-side forces related to the trading behavior of international and institutional investors, to the incentives to trade individual securities, and to changing investor sentiment. Although our tests point at a potentially significant role for supply-side sources of commonality in liquidity that are related to the funding constraints of financial intermediaries, our overall evidence is more reliably consistent with demand-side explanations for commonality.

Our study contributes in several important ways to the growing literature on commonality in liquidity and it has implications for market regulation and policy. First, we uncover important, new cross-country and time-series patterns in commonality in liquidity. The finding that commonality in liquidity is empirically linked to a number of market-wide characteristics (such as the quality of legal protection for investors and transparency) and to changing capital market conditions may help us to understand better why and how pervasive market liquidity shocks arise and how they affect investor behavior and asset prices.

Second, we evaluate alternative supply- and demand-side hypotheses for why commonality in liquidity exists and why it varies across countries and over time. Recent studies emphasize the role of funding constraints of financial intermediaries as a driver of the supply of market liquidity (most notably, Brunnermeier and Pedersen, 2009; Hameed, Kang, and Viswanathan, 2010). Although funding liquidity may be a key driver of commonality in liquidity in U.S. equity markets, our evidence indicates that institutional and foreign investor involvement, information acquisition incentives, investor sentiment, and correlated trading activity, in general, contribute more to explaining the level and dynamics of commonality in liquidity in a large number of other countries. More theoretical and empirical research is needed to uncover the specific mechanics and to assess the relative importance of these demand-side sources of commonality in liquidity in different market settings.

Third, policy makers may be able to draw important implications from our analysis. Improving investors' property rights and enhancing transparency may lead to lower commonality in liquidity, thereby reducing the susceptibility of a country's financial system to a drying up of liquidity across many securities during periods of market stress. Where supply-side factors are important, central banks concerned about pervasive drops in market liquidity during periods of large market declines may be able to minimize the risk of liquidity crises by boosting the funding of financial intermediaries. At the same time, market regulators in many markets in which demand-side factors matter should be interested in our finding that increasing the capital market openness of a country can mitigate commonality in liquidity among the securities traded on their local market.

Appendix A.

See Tables A1–A6.

Table A1
Definitions of cross-sectional variables.

Variable	Description	Source
Supply-side factors		
Market volatility (average)	For each country, this variable is calculated as the average over 1995:01–2009:12 of the standard deviation (in %) of the daily market return of a country within a month. Daily market returns are computed as the value-weighted average of the returns of all individual stocks in each country on a given day	Own computations
Short-term interest rate (average)	For each country, this variable is calculated as the average over 1995:01–2009:12 of the short-term interest rate (in % per annum). For most countries, we take the short-term Treasury Bill rate (3-months). If that is not available, we use the money market rate, the short-term deposit rate, or the lending rate	International Monetary Fund's (IMF) International Financial Statistics/ Datastream
Stock market capitalization/GDP	Stock market capitalization to GDP. Average over 1999–2003	World Bank's World Development Indicators
Bank deposits/GDP	Demand, time, and saving deposits in deposit money banks as a share of GDP. Average over 1995–2004	Beck, Demirgüç-Kunt, and Levine (2000)
Demand-side factors		
R^2_{turn} (average)	Average commonality in turnover of the individual stocks within a country. For each country, this variable is calculated as the average over 1995:01–2009:12 of the equally weighted average of R^2_{turn} across the individual stocks in each country. In the regressions, we take the logistic transformation of this variable	Own computations
Equity mutual fund assets/market cap	The size of a country's equity mutual funds' assets under management as of 2002, expressed as a percentage of the aggregate local market capitalization	Khorana, Servaes, and Tufano (2005)
Foreign inst. ownership/market cap	Foreign institutional ownership as of December 2005, expressed as a percentage of the aggregate local market capitalization	Ferreira and Matos (2008)
Net % equity flow (average)	For each country, this variable is calculated as the average over 1995:01–2009:12 of the difference of "Gross sales of foreign stocks by foreigners to U.S. residents" and "Gross purchases of foreign stocks by foreigners from U.S. residents"; computed as a percentage of the sum of gross sales and purchases of foreign stocks by foreigners to/from U.S. residents. A positive net % equity flow indicates that U.S. residents are net buyers of foreign stocks	Treasury International Capital (TIC)

Table A1 (*continued*)

Variable	Description	Source
Gross capital flow/ GDP (average)	For each country, this variable is calculated as the average over 1995:01–2009:12 of the sum of "Gross sales of long-term domestic and foreign securities by foreigners to U.S. residents" and "Gross purchases of long-term domestic and foreign securities by foreigners from U.S. residents"; computed as a percentage of the country's gross domestic product in current U.S. dollars in the same year	Treasury International Capital (TIC)
Good government index	Following Morck, Yeung, and Yu (2000), the good government index is defined as the sum of the following three indices from the International Country Risk Guide (each ranging from zero to ten): (i) government corruption, (ii) the risk of expropriation of private property by the government, and (iii) the risk of the government repudiating contracts. Lower scores for each index indicate less respect for private property	La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998)
Financial disclosure	Assessment of the prevalence of disclosures concerning research and development (R&D) expenses, capital expenditures, product and geographic segment data, subsidiary information, and accounting methods, on the basis of Center for Financial Analysis and Research's (CIFAR) 1995 *International Accounting and Auditing Trends*. Lower scores indicate less disclosure	Bushman, Piotroski, and Smith (2004)
Control variables		
GDP per capita	Gross domestic product per capita (in US$) in 2003	World Bank's World Development Indicators
Ln (Geographical size)	Logarithm of the surface area of the countries in square kilometers	United Nations Environmental Indicators
Ln (Number of stocks)	Logarithm of the total number of stocks for each country in our sample	Table 1
GDP growth volatility	Following Morck, Yeung, and Yu (2000), the standard deviation of the growth in each country's gross domestic product in the period 1995–2004 is used to measure macroeconomic stability	IMF World Economic Outlook
Industry Herfindahl index	Following Morck, Yeung, and Yu (2000), the industry Herfindahl index of country j is defined as $H_j = \sum_k h_{k,j}^2$, where $h_{k,j}$ is the combined value of the sales of all country j firms in industry k as a percentage of those of all country j firms	Own computations
Firm Herfindahl index	Following Morck, Yeung, and Yu (2000), the firm Herfindahl index of country j is defined as $\Gamma_j = \sum_i \gamma_{i,j}^2$, where $\gamma_{i,j}$ is the sales of firm i as a percentage of the total sales of all country j firms	Own computations
Earnings co-movement index	Following Morck, Yeung, and Yu (2000), the earnings co-movement index of country j is obtained as the average R^2 of annual regressions of the return on assets (ROA) of individual firms on the value-weighted average ROA of all firms in the same country (excluding firm j). In the regressions, we take the logistic transformation of this variable	Own computations

Table A2
Summary statistics of cross-sectional variables.

This table shows summary statistics for the country characteristics used in the cross-sectional regressions reported in Table 2. Variable definitions are in Table A1. We refer to Table 1 for a description of the sample. The columns present the mean, median, minimum, maximum, standard deviation, and number of observations for each country characteristic.

Variable	Mean	Median	Min	Max	St.dev.	# Obs.
Supply-side factors						
Market volatility	6.24	5.87	3.63	12.24	1.78	40
Short-term interest rate	7.13	4.17	0.26	46.37	7.72	40
Stock market cap./GDP (%)	86.49	62.90	14.30	361.00	68.92	40
Bank deposits/GDP	0.66	0.63	0.22	2.09	0.35	38
Demand-side factors						
R^2_{turn}	26.88	25.90	22.23	43.78	4.01	40
Equity mutual fund assets/market cap	17.11	11.50	0.10	76.80	17.90	31
Foreign inst. ownership/market cap	13.43	11.30	6.00	30.80	6.94	25
Net % equity flow	6.94	4.90	−5.72	25.86	8.26	39
Gross capital flow/GDP	56.98	18.11	1.02	403.29	86.56	39
Good government index	24.27	25.47	12.94	29.96	4.85	38
Financial disclosure	85.19	92.75	44.57	100.00	16.84	37
Control variables						
Ln (GDP per capita)	9.15	9.68	6.09	10.53	1.29	40
Ln (Geographical size)	12.66	12.72	6.52	16.12	2.18	40
Ln (Number of stocks)	5.98	5.87	4.11	8.10	1.06	40
GDP growth volatility (%)	10.98	10.22	1.28	27.62	5.30	40
Industry Herfindahl index (%)	11.35	11.23	3.99	28.72	5.05	40
Firm Herfindahl index (%)	5.16	4.75	0.38	14.99	3.35	40
Earnings co-movement index (%)	17.25	16.42	1.50	40.22	9.62	40

Table A3
Cross-country correlations of commonality in liquidity in 40 countries with cross-sectional variables.

This table presents cross-sectional correlations between the logistic transformation of the time-series average of commonality in liquidity (R^2_{liq}) in 40 countries over the period 1995:01–2009:12 and various country characteristics. Commonality in liquidity for individual stocks is measured by the R^2 of monthly regressions of the daily liquidity of individual stocks on the lead, lag, and contemporaneous market liquidity at the country level. Definitions of the country characteristics are in Table A1. Correlations in bold face are statistically significant at the 5% level.

	Market volatility	Short-term interest rate	Stock market cap/GDP	Bank deposits/GDP	R^2_{turn}	Equity mutual fund assets/mcap	Foreign inst. ownership/mcap	Net % equity flow	Gross capital flow/GDP	Good government index	Financial disclosure	Ln (GDP per capita)	Ln (Geographical size)	Ln (Number of stocks)	GDP growth volatility	Industry Herfindahl index	Firm Herfindahl index	Earnings co-movement index
R^2_{liq}	**0.53**	0.22	−0.26	**−0.38**	**0.83**	**−0.38**	−0.22	**0.47**	−0.19	**−0.62**	**−0.66**	**−0.43**	0.29	0.06	−0.06	−0.05	−0.19	0.06
Market volatility	1	**0.66**	−0.21	**−0.32**	**0.50**	**−0.45**	0.33	**0.45**	−0.20	**−0.62**	**−0.60**	**−0.50**	0.17	−0.10	0.18	0.16	0.08	0.06
Short-term interest rate		1	**−0.33**	**−0.45**	0.16	−0.28	−0.14	**0.33**	−0.26	**−0.55**	**−0.47**	**−0.52**	**0.31**	−0.23	0.15	0.11	0.03	0.02
Stock market cap./GDP			1	**0.70**	−0.20	0.01	0.07	−0.18	**0.45**	**0.39**	**0.32**	**0.40**	**−0.44**	**0.33**	−0.21	−0.26	−0.18	−0.12
Bank deposits/GDP				1	−0.02	0.22	−0.08	−0.26	**0.47**	**0.45**	0.26	**0.45**	**−0.69**	0.30	−0.19	−0.05	0.01	0.00
R^2_{turn}					1	−0.24	−0.34	**0.32**	−0.19	**−0.52**	**−0.43**	**−0.42**	0.04	−0.01	0.13	0.01	−0.12	0.10
Equity mutual fund assets/market cap						1	−0.26	−0.21	0.04	**0.38**	0.12	0.31	0.04	0.22	−0.15	−0.20	−0.11	0.09
Foreign inst. ownership/market cap							1	−0.23	0.27	0.36	0.32	0.12	−0.10	**−0.47**	−0.17	0.15	**0.46**	0.14
Net % equity flow								1	−0.27	**−0.42**	**−0.32**	**−0.51**	0.28	0.22	0.00	−0.12	**−0.35**	**−0.37**
Gross capital flow/GDP									1	**0.37**	**0.34**	**0.49**	**−0.45**	0.11	**−0.31**	−0.17	−0.02	−0.09
Good government index										1	**0.60**	**0.86**	**−0.31**	0.28	**−0.37**	−0.12	0.08	0.12
Financial disclosure											1	**0.51**	−0.12	0.21	−0.25	−0.28	0.02	0.14
Ln (GDP per capita)												1	**−0.34**	0.25	**−0.34**	−0.15	0.09	0.22
Ln (Geographical size)													1	0.17	0.16	−0.21	−0.25	−0.06
Ln (Number of stocks)														1	−0.15	**−0.51**	**−0.55**	−0.03
GDP growth volatility															1	0.00	−0.02	−0.05
Industry Herfindahl index																1	**0.74**	0.03
Firm Herfindahl index																	1	0.19

Table A4
Definitions of country-level time-series variables.

Variable	Description	Source
Capital market conditions		
Market return/market liquidity/market turnover	Value-weighted average of, respectively, the return (in % per month), the monthly Amihud (2002) measure—computed as the average over the month of the daily absolute stock return divided by local currency trading volume (multiplied by −10,000 to rescale and to arrive at a variable that is increasing in liquidity), and the turnover (in % per day) of all individual stocks in each country in a given month	Own computations
Market volatility	Standard deviation (in %) of the daily market return of a country within a month. Daily market returns are computed as the value-weighted average of the returns of all individual stocks in each country on a given day	Own computations
$R_m^{Down,Large}/R_m^{Small}/R_m^{Up,Large}$	Large negative (positive) market returns $R_m^{Down,Large}$ ($R_m^{Up,Large}$) are defined as returns that are more than one standard deviation below (above) the unconditional mean market return for each country, and zero otherwise. Small market returns R_m^{Small} are defined as market returns that are within one standard deviation of the unconditional mean market return	Own computations
Supply-side factors		
Short-term interest rate	Short-term interest rate (% per annum). For most countries, we take the short-term Treasury Bill rate (3-months). If that is not available, we use the money market rate, the short-term deposit rate, or the lending rate	IMF's International Financial Statistics/Datastream
U.S. default spread	Percentage difference between Lehman corporate BAA and AAA yields	Datastream
U.S. commercial paper spread	Difference between the percentage 90-day AA nonfinancial commercial paper interest rate and the three-month T-Bill rate	Federal Reserve
Global prime broker returns	Equally weighted average percentage stock returns of 28 major publicly traded global brokers, directly or by means of a bank holding company. The list of prime brokers is obtained from the annual survey by PrimeBrokerageGuide.com, a Web site of the Prime Brokerage Association, and includes Barclays Capital, BNP Paribas, Goldman Sachs, JP Morgan, Lehman Brothers, Credit Suisse, Morgan Stanley, HSBC, Deutsche Bank, Citigroup, UBS, Chase, CIBC, among others. Returns are measured in excess of U.S. market returns to control for general market movements	Datastream/Own computations
Local bank returns	Percentage local currency return on Datastream Banks and Financial Institutions index for each country	Datastream
Demand-side factors		
R^2_{turn} (orthogonalized to supply-side factors)	For each country, this variable is calculated as the equally weighted average of R^2_{turn} across the individual stocks in that country. We orthogonalize this variable by taking the residual of a time-series regression of R^2_{turn} on supply-side factors (short-term interest rate, U.S. default spread, global prime broker returns, and local bank returns) as well as on $R_m^{Down,Large}$. In the regressions, we take the logistic transformation of this variable	Own computations
Net % equity flow	For each country, this variable is calculated as the difference of "Gross sales of foreign stocks by foreigners to U.S. residents" and "Gross purchases of foreign stocks by foreigners from U.S. residents"; computed as a percentage of the sum of gross sales and purchases of foreign stocks by foreigners to/from U.S. residents. A positive net% equity flow indicates that U.S. residents are net buyers of foreign stocks	Treasury International Capital (TIC)
Gross capital flow/GDP	For each country, this variable is calculated as the sum of "Gross sales of long-term domestic and foreign securities by foreigners to U.S. residents" and "Gross purchases of long-term domestic and foreign securities by foreigners from U.S. residents"; computed as a percentage of the country's gross domestic product in current U.S. dollars in the same year	Treasury International Capital (TIC)
Exchange rate	Monthly % return in the value of each country's national currency relative to the SDR (or special drawing right), a basket of major currencies used as a unit of account by the IMF. A positive exchange rate return indicates a depreciation of the currency relative to the SDR	IMF's International Financial Statistics
ETF volume	Dollar trading volume in exchange traded country funds for 28 countries traded on U.S. markets; computed as a percentage of the dollar market capitalization of each country. Of the 28 funds, 21 are iShares Morgan Stanley Capital International (MSCI) index funds	Datastream/Yahoo Finance
U.S. sentiment index	Sentiment index in Baker and Wurgler (2006) and obtained from the Web site of Jeff Wurgler; based on first principal component of six (standardized) sentiment proxies, where each of the proxies has first been orthogonalized with respect to a set of macroeconomic conditions. Lower scores indicate more pessimistic investor sentiment	Baker and Wurgler (2006)

Table A4 (*continued*)

Variable	Description	Source
Global country fund discount	Equally weighted average percentage discount of 41 closed-end country funds for 27 of the countries in our sample obtained from Froot and Ramadorai (2008); the discount of individual funds is computed as ln(NAV/P), which implies that a positive number implies a discount of fund price relative to net asset value. Greater discounts have been linked to more pessimistic investor sentiment	Bloomberg/Froot and Ramadorai (2008)
Local country fund discount	Percentage closed-end country fund discount for 27 individual countries obtained from Froot and Ramadorai (2008); for countries with more than one closed-end country fund, we take the equally weighted average across funds; the discount of individual funds is computed as ln(NAV/P), which implies that a positive number implies a discount of fund price relative to net asset value. Greater discounts have been linked to more pessimistic investor sentiment	Bloomberg/Froot and Ramadorai (2008)

Table A5
Summary statistics of country-level time-series variables.

This table depicts summary statistics for the country-level time-series variables used in the regressions reported in Tables 3–7. The columns present the average across 40 countries of the time-series mean, median, minimum, maximum, and standard deviation of each time-series variable over the period 1995:01–2009:12 as well as the number of countries for which data for this variable are available. Summary statistics of the time-series control variables (market return, market volatility, market liquidity, and market turnover-to capture general variation in capital market conditions) are in Table 1. For the U.S default spread, the U.S. commercial paper spread, global prime broker returns, the U.S. sentiment index, and the global country fund discount, the summary statistics concern a single time-series. Definitions of the country-level time-series variables are in Table A4. We refer to Table 1 for a description of the sample.

Variable	Mean	Median	Min	Max	St.dev.	# Countries
Supply-side factors						
Short-term interest rate	7.13	6.30	1.92	27.58	4.16	40
U.S. default spread	1.12	0.86	0.13	4.77	0.80	1
U.S. commercial paper spread	0.35	0.30	0.05	1.40	0.29	1
Global prime broker returns	0.29	0.21	−22.96	19.21	4.38	1
Local bank returns	1.27	1.13	−34.11	42.92	9.69	40
Demand-side factors						
R^2_{turn}	26.88	25.88	15.51	51.16	5.92	40
Net % equity flow	6.94	4.73	−101.23	117.79	38.35	39
Gross capital flow/GDP	56.98	51.17	15.59	184.65	31.40	39
Exchange rate	0.22	0.04	−8.31	16.45	2.80	40
ETF volume	232.11	82.12	0.49	1410.55	298.80	28
U.S. sentiment index	0.20	0.07	−0.92	2.54	0.64	1
Global country fund discount	9.31	9.86	−1.57	23.34	5.32	1
Local country fund discount	11.56	12.19	−17.62	31.40	9.92	27

Table A6

Time-series correlations of commonality in liquidity in 40 countries with country-level time-series variables.

This table presents the time-series correlations between the logistic transformation of monthly commonality in liquidity (R^2_{liq}) and the time-series supply-side and demand-side factors and the time-series control variables (market return, market volatility, market liquidity, and market turnover-to capture general variation in capital market conditions) in 40 countries over the period 1995:01–2009:12. Correlations in the table are the average correlations across all countries for which both variables are available. Definitions of the country-level time-series variables are in Table A4.

	Market return	Market volatility	Market liquidity	Market turnover	Short-term interest rate	U.S. default spread	U.S. commercial paper spread	Global prime broker returns	Local bank returns	R^2_{turn} (orthog. to supply-side factors)	Net % equity flow	Gross capital flow/ GDP	Exchange rate	ETF volume	U.S. sentiment index	Global country fund discount	Local country fund discount
R^2_{liq}	−0.03	0.16	−0.03	0.03	0.09	0.00	0.04	−0.03	−0.02	0.23	0.02	−0.04	−0.01	−0.01	0.05	0.05	0.00
Market return	1	−0.27	0.10	0.02	−0.10	−0.09	−0.15	0.38	0.76	0.02	0.11	−0.06	−0.11	−0.11	−0.14	−0.15	−0.04
Market volatility		1	−0.28	0.34	0.12	0.36	0.37	−0.15	−0.22	0.20	−0.10	0.07	0.15	0.23	0.19	0.29	0.02
Market liquidity			1	0.15	−0.17	−0.20	−0.05	0.03	0.07	−0.01	−0.02	0.06	−0.05	0.04	−0.05	−0.19	−0.05
Market turnover				1	−0.17	0.22	0.16	−0.05	0.01	0.06	−0.04	0.13	0.00	0.31	−0.06	−0.06	−0.09
Short−term interest rate					1	−0.34	0.36	− −0.05	−0.07	0.00	0.13	−0.12	0.06	−0.09	0.20	0.03	−0.03
U.S. default spread						1	−0.07	0.01	−0.07	0.00	−0.15	0.15	−0.02	0.20	0.27	0.39	0.01
U.S. commercial paper spread							1	−0.15	−0.13	0.07	−0.05	0.03	0.10	0.28	0.21	0.10	0.19
Global prime broker returns								1	0.41	0.00	0.07	−0.05	−0.08	−0.14	0.03	−0.01	−0.01
Local bank returns									1	0.00	0.10	−0.05	−0.13	−0.11	−0.07	−0.10	−0.03
R^2_{turn} (orthog. to supply−side factors)										1	0.04	−0.04	0.01	0.07	−0.04	−0.01	−0.03
Net % equity flow											1	−0.07	−0.06	−0.03	−0.08	−0.14	−0.03
Gross capital flow/GDP												1	0.02	0.11	0.10	0.11	−0.02
Exchange rate													1	0.00	0.06	0.05	−0.01
ETF volume														1	−0.12	−0.21	−0.21
U.S. sentiment index															1	0.59	0.21
Global country fund discount																1	0.40

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