DIMITRIOS VAGIAS

Liquidity, Investors and International Capital Markets

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Liquiditeit, investeerders, en internationale kapitaalmarkten

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Dimitrios Vagias
born in Athens, Greece

ERASMUS UNIVERSITEIT ROTTERDAM

Doctoral Committee

Promotor:
Prof.dr. M.A. van Dijk

Other members:
Prof.dr. G.M. Constantinides
Prof.dr. J.J.A.G. Driessen
Prof.dr. M.J.C.M. Verbeek

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Chapter 1
Introduction

The main concept this dissertation builds upon is that of liquidity. Market liquidity, typically defined as the ability to transact with the minimum possible cost, is a concept that is easily identifiable but notoriously challenging to measure. In that respect, the market microstructure literature has been quite successful in developing a considerable number of measures that have managed to capture several of liquidity's salient features (Amihud, 2002; Hasbrouck, 2006; Goyenko, Holden, and Trzcinka, 2009). In addition, asset pricing studies have demonstrated beyond doubt that differences in stock liquidity or in the sensitivity to liquidity risk can generate predictable dispersion in the cross-section of expected stock returns (e.g. Amihud and Mendelson, 1986; Pastor and Stambaugh, 2003; Acharya and Pedersen, 2005). Hence, both liquidity and liquidity risk have been already identified as priced state variables, and are thus viewed as important determinants of a stock's required rate of return.

One drawback of the aforementioned studies however is their limited focus in the U.S. market. As a result, extant literature offers little guidance when it comes to the relative importance of liquidity in the context of integrated financial markets that are able to accommodate extensive flows of capital with next to minimum costs. Moreover, although research to date provides a detailed account of liquidity's role in an asset pricing context, only few studies have been investigating its broader implications with respect to international capital mobility, the type and availability of financing options, its role in mitigating agency frictions within firms, and the transmission of financial shocks across markets otherwise distant. In that respect, my effort in this dissertation has been to adopt a global perspective over a scope that extends beyond the one traditionally considered by previous studies, and particularly furnish a better understanding over liquidity's implications in the decision-making process of investors, managers and regulators alike. The benefits of such an encompassing approach are demonstrated in greater detail in the chapters that will follow.

This dissertation consists of four empirical studies that seek to shed more light over liquidity's role in international capital markets going beyond the dimensions traditionally considered in the asset pricing literature. Chapter 2 investigates the interplay between foreign portfolio flows and domestic market liquidity. Using a VAR framework we explore the time-series properties as well as the differences in the cross-section of stocks over the interaction between capital flows and liquidity and try to identify periods of distinguishing importance in that respect. Another issue this chapter is concerned with corresponds to the role of domestic institutions in explaining the cross-sectional heterogeneity of liquidity's responsiveness over foreign investment. In Chapter 3 we show that market liquidity weighs considerably, both in the decision to issue equity as well as in the respective type of the offering. Our main argument is that liquidity conditions determine the slope of a firm's demand curve for its stock and thus equity issuance becomes more costly during periods of deteriorating liquidity. Hence, as liquidity abates firms are expected to favor equity offerings less as a means of raising capital. In Chapter 4, we provide empirical evidence in support of a positive link between bank stock liquidity and operating efficiency, explore its implications, and try to identify the underlying mechanisms through which it operates. Among the set of alternative explanations, our analysis lends support to an agency based interpretation, but also identifies market discipline as another mechanism advanced by stock liquidity. In Chapter 5 I investigate the extent of liquidity contagion within as well as across particular geographic regions. In addition to evaluating the relative importance of regional over global factors in transmitting contagion, I also investigate a number of empirical predictions regarding the type of stocks that are expected to be more susceptible to adverse liquidity shocks originating from abroad. Interestingly, my analysis shows that liquidity contagion is more pronounced in "high" rather than "low quality" stocks. I also find that the holdings of international investors can provide a mechanism for transmitting liquidity shocks from one market to another. In the remainder of this chapter I will provide a more detailed account of my motivation as well as of the respective contribution of the aforementioned studies.

1.1 Market Liquidity and International Investors

With the liberalization of most markets in the early 1990s, one of the most important policy issues that has emerged concerns the extent to which foreign portfolio investment exposes markets to the risk of sudden outflows and as such can reinforce crises with otherwise minor economic impact to episodes of widespread panic. This chapter is particularly concerned with the implications of foreign equity flows on local liquidity conditions. We conjecture that there are at least three different channels through which foreign investors could affect local market liquidity. On the one hand, if foreign investors are better informed than local investors, extensive foreign presence can be associated with increased adverse selection costs for local traders, thus undermining market liquidity. On the other hand, if foreign investors are less well informed, they may act as "noise" traders and thus improve market liquidity. Empirical evidence to date however, has been at best inconclusive (Kang and Stulz, 1997; Grinblatt and Keloharju, 2000; Seasholes, 2004; Dvorak, 2005; Froot and Ramadorai, 2008). Second, foreign investors can diminish local market liquidity if they behave as positive feedback traders, generating as a result excessive order imbalances and/or market volatility (e.g. Choe, Kho, and Stulz, 1999). Third, sophisticated institutional investors may enhance local liquidity when their trading strategies are designed to reap liquidity premia in foreign markets (e.g. Agarwal, Fung, Loon, and Naik, 2007; Stulz, 2007, Brophy, Paige, and Sialm, 2009; Cao, Chen, Liang, and Lo, 2009).

Our baseline empirical approach involves the estimation of an unrestricted VAR model at four different levels of aggregation: all countries, developed vs. emerging countries, six different geographic regions, and country-by-country. We also estimate the VARs separately for small and large cap stocks, and for liquidity crisis as opposed to "normal" periods. We later extend our basic model to include a variety of exogenous variables. Our results indicate that foreign investors are positive feedback traders. Capital inflows strongly respond to past local market returns both for developed and emerging markets, for all six regions, and for many individual countries. We also confirm prior evidence that capital inflows are associated with higher future local market returns. Both of these effects are economically and statistically significant for many regions and countries. In addition, market liquidity seems to be an important determinant of cross-border portfolio flows, although this effect is more pronounced in our set of Developed countries.

Our analysis demonstrates that liquidity conditions in the home market are also important in their own right. In particular, we find that foreign investors tend to invest in local markets that have seen their liquidity improve during periods when there is ample liquidity in the home market. We interpret this finding as evidence that foreign investors seek return in other markets when their home market is awash with liquidity, but also avoid investing in these markets when they become illiquid. Next we run a separate analysis distinguishing between small and large cap stocks. Although capital flows respond more strongly to large cap returns, there is little indication that they are more sensitive to large cap liquidity than to small cap liquidity.

Finally, we try to explain the cross-sectional heterogeneity in the responsiveness of liquidity on foreign flows by running cross-sectional regressions on proxies for a country's economic and financial development, regulatory and information environment, openness, and market risk. We find that the response of liquidity to flows is significantly more positive in countries with greater transparency and in countries with less developed financial markets. The first effect suggests that in transparent countries it is less likely that foreign investors aggravate adverse selection problems on local financial markets. In other words, they are more likely to act as noise traders that provide liquidity. The second effect is consistent with the view that more developed financial markets are more resilient to the trading behavior of foreign investors.

1.2 Equity Issuance and Market Liquidity

Two of the most popular corporate finance theories explaining security issuance, namely the tradeoff theory (Kraus and Litzenberger, 1973) and the pecking order theory (Myers and Majluf, 1984) posit that liquidity conditions should be irrelevant when it comes to the decision of when and what type of security to issue. When raising capital, companies decide the appropriate type of the security offered solely on the basis of optimizing their capital structure, or minimizing adverse selection costs. The aforementioned theories however fall short in providing a convincing explanation of certain empirical regularities, one of them being that companies issue equity when market valuations are high (Baker and Wurgler, 2002). In other words, equity offerings are usually decided when the anticipated cost to current shareholders is the lowest possible.

In this chapter we investigate the hypothesis that security issuance is inversely related to illiquidity and provide strong evidence that firms are less likely to issue equity when the liquidity of equity markets worsens. In terms of the economic significance of our findings we show that liquidity innovations explain as much of the aggregate variation in equity issuance as stock returns. Our main result survives a large number of alternative specifications that control, among other things, for prevailing capital market conditions, investor sentiment, the state of economic activity, the (expected) opportunity set, and the time-series variation in the aggregate level of information asymmetry.

Our findings suggest that the role of liquidity conditions in equity issuance cannot be attributed to liquidity serving as a proxy for future economic growth or market sentiment. In further support of such an interpretation we show that the relation between equity issuance and liquidity is more pronounced for decreases in liquidity rather than increases. We next take a step forward and investigate the potential relation between liquidity and the particular type of equity offering decided. Consistent with intuition we show that the fraction of private to public equity issues increases as liquidity worsens. Our interpretation is that market liquidity becomes less relevant in the case of private equity offerings since they typically do not increase the supply of traded shares in the short run due to selling restrictions typically accompanying such shares. We believe our findings lend further support to the view that in imperfectly liquid markets, the demand for shares is downward-sloping and that corporations take into account the slope of the demand curve for their shares in their financing decisions. Finally, we show that postponements and cancellations of such offerings are also negatively related to liquidity innovations, which lends further supports to our hypothesis that firms tend to postpone or cancel equity issues during times of deteriorating liquidity and decreasing valuations.

1.3 Bank Operating Efficiency and Market Monitoring

In this chapter we contribute to the banking literature by investigating the influence exerted by equity markets on bank operating efficiency, risk-taking, and performance from a perspective that has not been addressed to date, namely that of stock liquidity. To be able to discipline bank managers, investors need to be able to transact in a secondary market with the minimum possible frictions. Since high liquidity typically translates to low transaction costs, we expect that investors will be more effective in their monitoring when the secondary market of a bank's securities is more active. Thus, our conjecture is that banks with a liquid stock are subject to more rigorous monitoring by shareholders, and as a result are forced to operate more efficiently.

To assess the role of liquidity, we compile a detailed dataset with balance sheet information for more than 1,100 banks, spanning 31 countries around the world. Given that stock liquidity is an elusive concept that is notoriously difficult to quantify, we choose to perform our analysis employing three of the most commonly used indicators, namely the (modified) Amihud ratio, the (proportional) quoted spread, and stock turnover. We also construct several indicators of risk-taking and alternative measures of bank performance

Our key findings can be summarized as follows. First, we document a positive relation between bank stock liquidity and Tobin's Q. We interpret this finding as an early confirmation of our hypothesis that banks subject to more intense investor monitoring are able to generate more value from their investments. The same applies for banks that have low dependence on non-core funding, hold more cash on their balance sheet, are better capitalized, and have bigger size. Next, we decompose Tobin's Q into three components, namely a factor accounting for investor sentiment, another for leverage, and a proxy for operating profitability. We find that differences in liquidity do not generate variation in investor sentiment, but, consistent with the market discipline interpretation, are significantly associated with profitability (positive) and leverage (negative). In further support of our hypothesis, we document that banks with higher stock liquidity operate closer to the efficient frontier, demonstrate lower credit risk, and have lower probability of default.

Finally, we try to shed more light on the particular mechanism through which the liquidity channel operates. An information-based interpretation would suggest that improved liquidity encourages the participation of informed investors in the price discovery process, thus rendering market monitoring more efficient. We investigate this explanation by creating portfolios of bank stocks differing over the extent of information-driven trading, but find no evidence of a positive relation with liquidity. Our empirical analysis is, however, more supportive of an agency-based interpretation. For example, when we distinguish banks' on the basis of their susceptibility to principal-agent type of conflicts we find that the liquidity effects is significantly more pronounced in the group that ranks higher in that respect. We also present evidence that the monitoring exerted by debt holders and depositors is significantly more effective in the case of banks with more liquid stock. This is reflected in the increasing responsiveness of both deposit growth and debt costs to bank risk-taking in banks that belong to the top of the liquidity spectrum.

1.4 Liquidity Contagion across Markets

As demonstrated in the chapters above, liquidity is a multifaceted concept with implications that extend beyond the price discovery process, affecting functions as distant and important as the type of security issuance, the market for corporate control, and the efficient allocation of capital across different economic sectors (Tadesse, 2004). Yet, to the detriment of investors and regulators alike, there are times when liquidity simply disappears across many markets simultaneously. Such episodes, although rather infrequent, are typically accompanied by pervasive price distortions, and thus carry substantial costs both for investors and the economy. This chapter is thus concerned with the circumstances behind these episodes as well as the potential mechanism through which adverse liquidity shocks propagate from one market to another. To the best of our knowledge, this is the first study to pursue such a task.

In this chapter we therefore embark on a number of challenging tasks. First, we investigate the extent of clustering of adverse liquidity shocks within and across particular geographic regions. Second, we try to assess the relative importance of different channels in explaining liquidity contagion both for the aggregate market as well as across subsets of the cross-section organized on the basis of different stock characteristics. This way we try to evaluate a number of empirical predictions regarding the type of stocks that are more susceptible to adverse liquidity shocks originating abroad.

Our analysis produces a number of interesting results. First, we show that the likelihood of an adverse liquidity shock increases when other markets within the same region experience similar shocks. In addition, deteriorating liquidity conditions in systemically important markets exert, in certain cases, a disproportionate impact over foreign markets even after controlling for own region developments. When we try to identify the liquidity factors with the greatest explanatory power over the likelihood of a liquidity exceedance, investor sentiment combined with aggregate volatility stand out as the ones with the most pronounced effect. Interestingly, even though global aggregates are important in their own right, regional aggregates demonstrate a leading role when it comes to explain the extent of contagion in the same region.

Next, we investigate the extent of cross-sectional heterogeneity in the clustering of adverse liquidity shocks across markets based on a number of different stock characteristics. For this purpose we sort stocks on the basis of their market capitalization, idiosyncratic volatility, the extent of information-motivated order flow, and their sentiment induced overreaction. Contrary to initial expectations we show that liquidity contagion is actually more pronounced in "high" rather than "low quality" stocks. In other words, during periods of market distress liquidity drops are more correlated across stocks of "high quality". Consistent with previous studies (e.g. Brunnermeier, and Pedersen, 2009) our analysis demonstrates that commonality in liquidity becomes particularly pronounced in periods of deteriorating global funding conditions as well as downbeat investor sentiment. Finally, we also show that cross-border portfolio investment by international investors can aggravate the clustering of negative liquidity shocks across markets that benefit disproportionately from such flows.

Chapter 2
International Capital Flows and Liquidity

2.1 Introduction

How do foreign investors affect local capital markets? This question has been the subject of intense debate in both academic and policy circles. Research to date provides mixed evidence on the impact of capital flows on local financial markets. On the one hand, foreign investors are often alleged to exacerbate financial crises on local markets (e.g., Radelet and Sachs, 1998; Kim and Wei, 2002; Kaminsky, Lyons, and Schmukler, 2004). In line with this argument, a recent paper by the IMF (2010) argues that controls on capital inflows may reduce a country's financial fragility. On the other hand, several studies show that an increase in foreign portfolio flows is associated with a decrease in local systematic risk (Chari and Henry, 2004) and a reduction in the local cost of equity capital (Bekaert, Harvey, and Lumsdaine, 1999, 2002; Kim and Singal, 2000). Choe, Kho, and Stulz (1999) provide evidence that the actions of foreign investors did not contribute to destabilizing the Korean stock market during the Asian financial crisis.

In this paper, we assess the impact of foreign investors on local financial markets from a perspective that – to the best of our knowledge – has not been investigated to date: we study how cross-border capital flows interact with local market liquidity. Our purpose is to address the following questions. Do foreign investors provide or consume liquidity in local financial markets? Do cross-border capital flows exacerbate liquidity crises? Simultaneously, we examine whether capital flows respond to the liquidity in the host and/or the home market. We also investigate whether the interaction between capital flows and liquidity varies across different regions or countries, across different categories of stocks, and across crisis and "normal" periods.

There are at least three different channels through which foreign investors could affect local market liquidity. First, market microstructure research emphasizes the importance of asymmetric information as a determinant of liquidity. If foreign investors are on average better informed than local investors, extensive foreign presence can be associated with increased adverse selection costs for local traders, undermining market liquidity. On the other hand, if foreign investors are less well informed, they may act as liquidity (or "noise") traders that improve market liquidity. Empirical evidence on whether foreign investors have an informational advantage is mixed. On one side, Seasholes (2004) shows that foreign investors in Taiwan tend to buy (sell) before positive (negative) earnings surprises. Grinblatt and Keloharju (2000) find that foreign investors are better informed than domestic investors in Finland. Froot and Ramadorai (2008) use data on closed-end country fund flows for 25 countries to provide evidence that is also supportive of the hypothesis that foreign investors are better informed. On the opposite side, Brennan and Cao (1997) argue that U.S. investors, because they are at an informational disadvantage, extrapolate past performance when investing abroad. Kang and Stulz (1997), Choe, Kho, and Stulz (2005), and Dvorak (2005) find that local investors have an informational advantage in Japan, Korea, and Indonesia, respectively.

Second, even in the absence of systematic differences in how well foreign and local investors are informed, the trading behavior of foreign investors can diminish local market liquidity to the extent that it is associated with increased order imbalances and/or market volatility. Regarding the former, previous studies find evidence of herd behavior by foreign investors (e.g., Choe et al, 1999). If market makers and other providers of liquidity face capital constraints (as suggested by, e.g., Brunnermeier and Pedersen, 2009), excess buying or selling initiated by foreign investors can exert substantial pressure on inventory limits and therefore adversely affect liquidity. Blume, MacKinlay, and Terker (1989) show that S&P stocks declined more compared to non-S&P stocks on "Black Monday" because the market was not able to absorb the selling pressure on the former. More generally, Chordia, Roll, and Subrahmanyam (2002) show that market-wide order imbalances on the NYSE are associated with reduced liquidity, although the effect seems to be short-lived on this market. Regarding the latter, if foreign investors tend to be positive feedback traders and if their trades move prices (as suggested by, e.g., Froot, O'Connell, and Seasholes, 2001), their actions can influence volatility and (perceived) inventory risk for market makers and thus the costs of providing liquidity. Boyer, Kumagai, and Yuan (2006) report evidence that the presence of foreign investors in local stock markets contributes to the global spreading of stock market crises, with likely consequences for local market liquidity.

Third, sophisticated institutional investors may enhance liquidity when their trading strategies are designed to provide liquidity in foreign markets and reap liquidity premia. For example, it is widely believed that hedge funds provide liquidity to financial markets (see, e.g., Fung, Hsieh, and Tsatsaronis, 2000; Agarwal, Fung, Loon, and Naik, 2007; Stulz, 2007, Brophy, Paige, and Sialm, 2009). Hendershott, Jones, and Menkveld (2010) show that algorithmic trading, which is generally done by sophisticated investors, enhances liquidity on the NYSE. Cao, Chen, Liang, and Lo (2009) find that emerging markets hedge funds invest in relatively illiquid securities and display significant liquidity timing ability. However, Stulz (2007) argues that hedge funds may withdraw liquidity in the presence of a systemic shock. In line with this view, Ben-David, Franzoni, and Moussawi (2010) provide evidence that hedge funds withdrew from the U.S. equity market during the crisis in 2008. It is thus possible that foreign investors tend to provide liquidity during normal times but consume liquidity during crises.

Conversely, there are good reasons to believe that liquidity affects capital flows. It is well-documented that equity flows respond positively to (past) local market returns (e.g., Clark and Berko, 1996; Brennan and Cao, 1997; Choe et al., 1999; Froot, O'Connell, and Seasholes, 2001; Kim and Wei, 2002; Griffin, Nardari, and Stulz, 2004). It seems plausible that foreign investors are also attracted by favorable local liquidity conditions. Poor liquidity not only impedes efficient pricing, but also undermines investors' ability to materialize potential gains quickly and at low cost. Alternatively, foreign investors could be drawn to markets with relatively low market liquidity with the intention to exploit the higher expected returns of securities with a low level of liquidity and/or a high level of liquidity risk. This effect is likely to be stronger during times when financial markets at home are flush with liquidity and investors have an incentive to seek return in other markets.
Our empirical approach is to construct monthly time-series of capital flows (equity portfolio flows from and to the U.S. obtained from Treasury International Capital), local stock market liquidity (Amihud, 2002, liquidity computed based on Datastream data for 42,905 different individual stocks), and local stock returns (total returns in local currency from Datastream) for 46 countries from January 1995 to December 2008. Our baseline model is an unrestricted vector autoregression (VAR) with three endogenous variables: flows, liquidity, and returns. We estimate the VAR at four different levels of aggregation: all countries, developed vs. emerging countries, six different regions, and country-by-country. We also estimate the VARs separately for small and large cap stocks, for liquidity crisis periods and "normal" periods, and with a variety of exogenous variables.

Consistent with previous studies, we find that foreign investors are positive feedback traders. Capital inflows strongly respond to past local market returns for both developed and emerging markets, for all six regions, and for many individual countries. We also confirm prior evidence that capital inflows are associated with higher future local market returns. Both of these effects are economically and statistically significant for many regions and countries.

Even after controlling for the interaction between flows and returns, market liquidity is an important determinant of cross-border portfolio flows. Local market liquidity positively predicts future capital inflows for developed countries, especially in Europe and Asia/Pacific. For emerging countries, it seems that local market liquidity may be a second-order concern (relative to, for example, political risk) in investment decisions by foreigners.

Moreover, capital flows to developed and emerging Europe and emerging Asia increase when U.S. market liquidity improves. The economic magnitude of these effects is substantial. Foreign investors thus condition their decision to invest in stocks in various regions not only on local liquidity, but also on the liquidity in the home market. In particular, they tend to invest in local markets that have seen their liquidity improve, in periods when there is ample liquidity in the home market. We interpret these findings as evidence that foreign investors seek return in other markets when their home market is flush with liquidity, but they are careful to avoid investing in these markets when they are illiquid.

We present evidence that is consistent with the view that foreign investors have an impact on local market liquidity. Liquidity shows a positive and significant response to an increase in capital inflows for the group of developed countries, for four of the six regions (developed America, developed Europe, and developed and emerging Asia/Pacific), and for a substantial number of individual countries. A one standard deviation (1SD) shock in flows is associated with an increase in local market liquidity of on average around 0.30SD over the next six months. Although we do not provide direct evidence that foreign investors provide instead of consume liquidity on local markets, these findings suggest that an increased presence of foreign investors helps rather than hurts local liquidity.

As several studies (e.g., Kang and Stulz, 1997; Van Nieuwerburgh and Veldkamp, 2009) argue that foreign investors face constraints in trading small stocks, we run a separate analysis that distinguishes between small and large cap stocks. Although capital flows respond more strongly to large cap returns than to small cap returns, there is little indication that they are more sensitive to large cap liquidity than to small cap liquidity. And the positive response of liquidity to capital inflows over the next six months (discussed above) is mainly driven by small cap stocks. This finding indicates that the liquidity of small caps is more sensitive to capital flows than the liquidity of large caps and/or that foreign investors (for example, hedge funds in the later part of our sample period) are more active in small caps than previous studies suggest.

An important policy issue concerns the extent to which foreign investors exacerbate financial crises on local markets. If foreign investors destabilize markets, policy makers should reassess the net benefits of opening up local markets to investors from other countries. We investigate this issue by analyzing the magnitude and direction of flows as well as the relation between flows and liquidity separately for liquidity crisis periods and normal periods. We find no convincing evidence that foreign investors destabilize local stock markets by undermining market liquidity. First, the data show little systematic tendency of foreign investors to actively withdraw from local markets during crises. Second, there is no significant short-term response of liquidity to flows during crises.

We try to identify the determinants of the variation in the impact of flows on liquidity across individual countries by running cross-sectional regressions on proxies for a country's economic and financial development, regulatory and information environment, openness, and market risk. We find that the response of liquidity to flows is significantly more positive in countries with greater transparency and in countries with less developed financial markets. The first effect suggests that in transparent countries it is less likely that foreign investors aggravate adverse selection problems on local financial markets. In other words, they are more likely to act as noise traders that provide liquidity. The second effect is consistent with the view that more developed financial markets are more resilient to the trading behavior of foreign investors. The economic magnitude of both of these effects is substantial.

2.2 Data description

In this section, we describe the data sources and the screening procedures we use to construct our sample. We also discuss the summary statistics of the main variables in our analysis.

2.2.1 Data sources and variable definitions

Since information on bilateral portfolio flows among countries is not publicly available at a high frequency, we restrict our analysis to U.S. transactions in foreign stocks. We obtain monthly data on cross-border equity portfolio flows (expressed in million US$) from the U.S. Treasury International Capital (TIC) reporting system for 46 countries for the period starting in January 1995 until December 2008. These data consist of financial transactions of at least $50 million (gross purchases and sales of foreign stocks) between U.S and foreign residents. U.S. residents include branches or subsidiaries of foreign entities that are located in the U.S. Branches of U.S. companies incorporated outside the U.S. are considered foreign residents. Consequently, transactions that are initiated by foreign-based firms on behalf of domestic investors are not recorded by the TIC database (Tesar and Werner, 1994, 1995). Additionally, direct cross-border investment activities are not included in the data. A limitation of the TIC data is that they only include transactions in which U.S. investors are involved. However, U.S. investors constitute by far the most important group of investors worldwide. Portes and Rey (2005) report that almost 60% of the aggregate equity transactions in their dataset of annual bilateral equity flow data between 14 major developed countries over 1989-1996 involve U.S. investors. Ferreira and Matos (2008) document that foreign institutions held on average 13.5% of the local equity market capitalization in 26 developed and emerging countries outside the U.S. at the end of 2005, and that U.S. institutions accounted for 7.4%, or over half of this fraction. Another potential drawback is that the TIC equity flow data are only available at a monthly frequency. It is possible that the impact of foreign investors on local market liquidity can only be observed at a higher frequency. At the same time, regulators that want to assess whether foreign investors help or hurt local market liquidity are probably interested in the long-term effects. From that perspective, any relation between capital flows and liquidity that does not show up in an analysis of monthly data may be considered immaterial.

We calculate net equity portfolio inflows by subtracting gross sales of foreign equity by U.S. investors from gross U.S. purchases of foreign equity for each country in our sample. Consistent with the approach adopted in Froot et al. (2001), Bekaert et al. (2002), and Griffin et al. (2004), we scale net portfolio flows by the aggregate local market capitalization (taken from Datastream):

$$FLOW_{k,t} = \frac{F_{k,t}^{buy} - F_{k,t}^{sell}}{MCAP_{k,t}}, \tag{2.1}$$

where $FLOW_{k,t}$ is the (scaled) net equity inflow from the U.S. to country k in month t, $F^{buy}{}_{k,t}$ denotes the gross purchases by U.S. investors of equity in country k in month t, $F^{sell}{}_{k,t}$ denotes the gross sales by U.S. investors of equity in country k in month t, and $MCAP_{k,t}$ is the aggregate market capitalization of all stocks in country k at the beginning of month t. For the U.S., we calculate the net equity inflow as aggregate gross purchases of U.S. equity by foreigners from U.S. investors minus gross sales of U.S. equity by foreigners from the remaining 45 countries, scaled by aggregate U.S. market capitalization.

We use Datastream to collect the daily adjusted price (*P;* closing price in local currency, which is adjusted for splits and dividends), the daily total return index (*RI*), trading volume at a monthly frequency (*VO*; expressed in 1,000 shares), the monthly market capitalization (*MV*; expressed in millions of local currency), the monthly market dividend yield index (*DY*), and the daily number of shares outstanding (*NOSH*; expressed in thousands of shares) for all individual stocks in the 46 countries. In line with Karolyi, Lee, and van Dijk (2009) we restrict our sample to stocks from major exchanges. These are the exchanges on which the majority of each country's stocks are listed. In the case of U.S., we only use data from the NYSE, since trading volume definitions are different for NASDAQ. Countries for which we collect data from more than one stock exchange are China (Shenzen and Shanghai), Japan (Osaka and Tokyo), and Germany (Frankfurt and Xetra). Datastream reports that the volume definitions applied by the different exchanges in these countries are the same. We exclude stocks with special features such as depository receipts (DRs), real estate investment trusts (REITs), closed-end funds, and preferred stocks (following Chordia, Roll, and Subrahmanyam, 2001; Pastor and Stambaugh, 2003). To avoid survivorship bias, we include dead and delisted stocks in our sample.

We collect monthly exchange rates of domestic currencies against the U.S. dollar (from WM/Reuters) from Datastream. Interest rate data are also from Datastream. Following Bekaert et al. (2002), we construct the world interest rate as the average of the short-term interest rates of the *G-7* countries weighted by each country's GDP in the previous year.

Using the classification by the International Finance Corporation (IFC), we categorize the 46 countries in our sample into different groups based on their economic development and their geographic location. 22 countries are classified as developed, whereas 24 are emerging. Our final sample includes 42,905 stocks from markets in developed Europe (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Norway, Spain, Sweden, Switzerland, and the U.K.), emerging Europe (Cyprus, Czech Republic, Greece, Hungary, Israel, Poland, Portugal, and Turkey), developed Asia/Pacific (Australia, Hong Kong, Japan, New Zealand, and Singapore), emerging Asia (China, India, Indonesia, Malaysia, Pakistan, Philippines, South Korea, Taiwan, and Thailand), developed America (Canada and the U.S.), and emerging America (Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela).

2.2.2 Liquidity measure and data screens

The literature has developed a number of different measures of liquidity. However, there is no consensus on which is the most appropriate, in part because different measures capture different aspects of liquidity. Since arguably the most refined of these measures (e.g., the quoted and effective bid-ask spread and the transaction-by-transaction market impact) are based on detailed microstructure data that are generally not available for markets outside the U.S., we adopt the Amihud (2002) price impact measure as a proxy for liquidity. The Amihud proxy is designed to capture the marginal impact of a unit of trading volume (in local currency) on the stock price. It is computed as the daily ratio of the absolute stock return over the local currency volume of the stock. This measure stays close to the intuitive description of liquid markets as those that accommodate trading with the least effect on price. Amihud (2002) shows that this measure is strongly positively related to microstructure estimates of illiquidity for the U.S. stock market. Hasbrouck (2006) and Goyenko, Holden, and Trzcinka (2009) show that the Amihud measure performs well relative to other proxies in capturing high-frequency measures of transaction costs based on U.S. data. Lesmond (2005) reports a high correlation between the Amihud measure and bid-ask spreads in 23 emerging markets. Many recent empirical studies use the Amihud proxy to measure stock market liquidity, both for the U.S. and for other countries. Examples include Acharya and Pedersen (2005), Spiegel and Wang (2005), Avramov, Chordia, and Goyal (2006), Kamara, Lou, and Sadka (2008), Watanabe and Watanabe (2008), and Karolyi et al. (2009).[1]

We follow other studies (e.g., Karolyi et al., 2009) and take the logarithm of one plus the Amihud liquidity proxy. We multiply the result by -1 to obtain a measure that is increasing with liquidity. The liquidity of stock *i* on day *d* is thus defined as follows:

$$LIQ_{i,d} \equiv -\log\left(1+\frac{|R_{i,d}|}{P_{i,d}VO_{i,d}}\right), \tag{2.2}$$

where $LIQ_{i,d}$ is the Amihud liquidity measure, $R_{i,d}$ is the return, $P_{i,d}$ is the adjusted closing price, and $VO_{i,d}$ is the trading volume of stock *i* on day *d*.

To mitigate the effect of reporting errors, we perform several screens. First, we discard non-trading days. We follow Karolyi et al. (2009) and identify these as days on which 90% or more of the stocks listed on a given exchange have a zero return.

[1] We refer to Hasbrouck (2006), Korajczyk and Sadka (2008), and Goyenko, Holden, and Trzcinka (2009) for a detailed discussion of different liquidity measures.

Second, we exclude stocks for which the number of zero-return days is more than 80% in a given month. Third, we follow Ince and Porter (2006) and set daily returns to missing if the following condition is satisfied:

$$(1+R_{i,d})(1+R_{i,d-1}) \leq 1.5, \tag{2.3}$$

where $R_{i,d}$ and $R_{i,d-1}$ are the stock returns of firm i on day d and $d-1$, respectively, with at least one being greater than or equal to 100%. Fourth, 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. Fifth, we discard stock-day observations with a daily return or liquidity in the top or bottom 0.1% of the cross-sectional distribution within a country and with daily trading volume ($VO_{i,d}$) greater than the corresponding number of shares outstanding ($NOSH_{i,d}$).

We construct monthly liquidity time-series for individual stocks by calculating the equally-weighted average of the daily stock liquidity. We create monthly return index and price series by taking the end-of-month values for the return index and the adjusted price from our daily data. For monthly returns, we again adopt the screen proposed by Ince and Porter (2006), and thus exclude stock-month observations that satisfy the following condition:

$$(1+R_{i,t})(1+R_{i,t-1}) \leq 1.5, \tag{2.4}$$

where $R_{i,t}$ and $R_{i,t-1}$ are the stock returns of firm i in months 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. We exclude stock-month observations with a monthly stock price or return in the top or bottom 2.5% or liquidity in the top or bottom 2.5% of the cross-sectional distribution within a country. Finally, we limit the effect of outliers in our monthly time-series by winsorizing the values that fall below the bottom 1% and above the top 99% of the distribution to the aforementioned percentiles, respectively.

We construct monthly time-series of market-wide liquidity ($LIQ_{k,t}$) and returns ($R_{k,t}$; in local currency) for each country by taking the value-weighted average across all stocks in that country for that month. We carry out robustness checks with equally-weighted liquidity and return series as well as with U.S. dollar instead of local currency returns.

2.2.3 Descriptive statistics

Table 2.1 provides summary statistics on our time series of net portfolio inflows, Amihud liquidity, market returns, EGARCH(1,1) volatility, and aggregate market capitalization for each of the 46 countries in our sample, grouped by region. Returns 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. Flows are expressed as a percentage of local stock market capitalization at the beginning of the month. A positive number for the mean flow in Table 2.1 indicates that the country on average experienced capital inflows from the U.S. over our sample period. The table also reports the time period that our sample covers and the total number of distinct individual stocks for each country. For several countries, the sample period starts later than 1995. For Brazil, the sample period starts in February 1999 due to a change in trading volume definitions. For Belgium, Cyprus, Czech Republic, Ireland, and Luxembourg, the sample period is shorter because of insufficient observations for one of the time-series.

On average, emerging countries have higher and more volatile market returns than developed countries. We note that a direct comparison between the liquidity levels of different countries is not possible due to differences in trading volume definitions and currency units across countries. However, this measurement issue does not affect our empirical analysis, since we first standardize all the country time-series to have zero mean and unit standard deviation (as described below).
Many markets, especially in emerging economies, experience positive net capital inflows over the sample period. The most striking example is China, with mean flows of 1.65%. Colombia and the Czech Republic are the only emerging markets that saw U.S. investors recede over the sample period. During our sample period, we observe a total of $632.8bn. of net equity portfolio flows from the U.S. to the remaining 45 countries. Emerging markets received $136.2bn., whereas the remaining $496.6bn. went to developed markets. U.S. gross purchases of equity in emerging markets peaked in 2007, reaching a total of approximately $237.2bn. In 2008, the direction of aggregate net flows reversed with $52.7bn. ($7.3bn.) worth of net equity flows fleeing developed (emerging) markets to the U.S. Figure 2.1 shows the cumulative net portfolio inflows for each of the six regions (where the countries within each region are equally-weighted). Emerging Asia (plotted using the secondary y-axis on the right) is by far the leading region in terms of monthly net inflows, with developed America, emerging America, and developed Europe competing for second place. Aggregate net inflows into emerging America turn negative during the period 1998-1999 (currency crisis in Brazil), and remain at

relatively low levels during 2001-2005 (economic crisis in Argentina). However, in 2006 and 2007 we observe a boom in net stock purchases by U.S. investors in the region. The same applies for developed Asia/Pacific. Aggregate flows into Europe, both developed and emerging, remain stable for most of the sample period. Unreported results show that capital flows exhibit significant persistence in 40 out of the 46 countries. Average first-order autocorrelations of net flows within each region range from 0.15 to 0.25.

Figure 2.2 displays the local currency equity market returns for each of the six regions (where the countries within each region are equally-weighted). After stellar returns from 2003 to early 2007, stock markets in all regions show a steep decline from the second half of 2007 and onwards. The effects of the 1997-1998 Asian crisis are clearly visible for emerging Asia, and to a lesser extent for the other regions. Two distinctive dates on which markets across almost all regions display significant drops are August/September 1998 (LTCM collapse) and September 2001 (terrorist attacks in the U.S.).

Figure 2.3 shows the aggregate market liquidity series for each of the six regions (where the countries within each region are equally-weighted). Since the level of Amihud liquidity is not comparable across countries, we standardize the series before we aggregate within each region. As with the return series, there are some clear common patterns in the liquidity series for the different regions. This is not surprising, as previous research (Brockman, Chung, and Perignon, 2009) documents the importance of global commonality in liquidity across different countries. Periods of widespread liquidity declines tend to accompany dramatic market events with global implications. In our sample, such periods include 1997 and 1998 (Asian and LTCM crises, respectively), 2001 until 2003 (terrorist attacks and burst of the "dot-com" bubble in the U.S.; Argentinean crisis), and the 2007-2008 global financial crisis. With respect to the latter crisis, it is noteworthy that its impact on equity market liquidity in America and emerging Asia appears to be relatively minor, in contrast to the dramatic effect that is evident in Europe and in developed Asia/Pacific.[2] Our liquidity time-series exhibit significant persistence in almost all the countries in our sample. Unreported results indicate that average first-order autocorrelations of market liquidity within each region range from 0.51 to 0.92.

To save space, we do not report correlation matrices for flows, liquidity, and returns. Correlations between flows are generally negligible across regions, whereas within regions they range from -0.31 to 0.30. With respect to market returns and liquidity, correlations are also generally higher within regions than

[2] In the case of developed America, the substantial decline in market liquidity we observe in the U.S. is counterweighted by the much lesser drop observed in Canada. As a result, the aggregate effect is modest.

across regions (consistent with Bae, Karolyi, and Stulz, 2003). Return correlations are especially high between countries in developed Europe.

Because many of our time-series display long-term trends, we formally test for stationarity by performing the augmented Dickey-Fuller test for each of the series, at the country-level. We allow both for an intercept and a time trend under the alternative hypothesis, and use the Hannan-Quinn information criterion to decide for the appropriate augmentation lags. In unreported analyses, we find that for a substantial number of countries we cannot reject the null hypothesis of a unit root at conventional significance levels for the time-series of market liquidity, dividend yield, volatility, and turnover, as well as for the world interest rate. To eliminate non-stationarity, we adjust these time-series by following the example of other papers (e.g., Baker and Stein, 2004; Griffin et al., 2007) and stochastically detrend them for all the countries. We carry out the detrending by subtracting the moving average over the previous six months from the current value.

2.3 Methodology

Our goal is to investigate the interaction between capital flows and market liquidity. Since previous studies identify an important relation of both variables with market returns, we control for any endogenous interaction with returns in all our analyses. Several papers document that past market performance is an important determinant of portfolio flows. Brennan and Cao (1997) attribute this trend chasing behavior to differences in the information endowments between domestic and foreign investors. Choe et al. (2005) show that foreign investors buy (sell) from domestic individuals before an abnormal drop (increase) in the price of a stock. In turn, flows may affect returns. Froot et al. (2001) and Griffin et al. (2004) provide evidence that flows into emerging markets predict local returns. Possible explanations for this finding include informed trading and transitory price pressure. Griffin et al. (2004) find no evidence for the view that informed trading can explain the predictability. Froot and Ramadorai (2008) use data on closed-end country fund flows to distinguish between both explanations and conclude that their evidence is most consistent with the information hypothesis.

The relation between market returns and liquidity is also the subject of a large body of research. Amihud and Mendelson (1986) show that illiquid stocks on average have higher returns. Pastor and Stambaugh (2003) and Acharya and Pedersen (2005) find that market liquidity is a priced risk factor. Bekaert et al. (2007) and Lee (2010) provide international evidence. Among others, Chordia, Huh, and Subrahmanyam (2006) document a relation between absolute returns and trading activity in the U.S. Griffin et al. (2007) establish a link between past returns and trading activity in 24 out of the 46 countries in their sample. In addition, market microstructure research suggests a direct link between trading activity and liquidity, so these patterns may result in an effect of market returns on liquidity. More directly, Chordia, Roll, and Subrahmanyam (2001) and Hameed, Kang, and Viswanathan (2008) report evidence that market liquidity declines during down markets.

Since we want to avoid imposing a priori restrictions on the dynamic interaction of flows, liquidity, and returns, we adopt a vector autoregression (VAR) methodology. The general form of an unrestricted VAR model of order p with m endogenous variables and n exogenous factors can expressed as follows:

$$Y_t = A + \sum_{l=1}^{p} \Phi_l Y_{t-l} + \Psi X_t + \varepsilon_t, \quad t = 1,2,\ldots,T \tag{2.5}$$

where $Y_t=(y_{1,t,}, y_{2,t}, \ldots, y_{m,t})'$ is an $m\times T$ matrix of jointly determined dependent variables assumed to be covariance stationary, $X_t=(x_{1,t}, x_{2,t}, \ldots, x_{n,t})'$ is an $n\times T$ vector of exogenous variables, A is an $m\times 1$ vector of intercepts, and Φ_l ($l=1,2,\ldots,p$) and Ψ are the $m\times m$ and $m\times n$ coefficient matrices to be estimated. In our case, Y_t consists of three variables (defined for each country k): monthly net flows as a percentage of market capitalization ($FLOW_{k,t}$), monthly market returns ($R_{k,t}$), and stochastically detrended monthly Amihud liquidity ($LIQ_{k,t}$). Suppressing exogenous factors, our country-specific VAR model can be expressed as follows:

$$\begin{bmatrix} FLOW_{k,t} \\ LIQ_{k,t} \\ R_{k,t} \end{bmatrix} = \begin{bmatrix} \alpha_k^{FLOW} \\ \alpha_k^{LIQ} \\ \alpha_k^{R} \end{bmatrix} + \sum_{l=1}^{p} \begin{bmatrix} \phi_{11}^l & \phi_{12}^l & \phi_{13}^l \\ \phi_{21}^l & \phi_{22}^l & \phi_{23}^l \\ \phi_{31}^l & \phi_{32}^l & \phi_{33}^l \end{bmatrix} \begin{bmatrix} FLOW_{k,t-l} \\ LIQ_{k,t-l} \\ R_{k,t-l} \end{bmatrix} + \begin{bmatrix} \varepsilon_{k,t}^{FLOW} \\ \varepsilon_{k,t}^{LIQ} \\ \varepsilon_{k,t}^{R} \end{bmatrix},$$
$$\begin{bmatrix} \varepsilon_k^{FLOW} \\ \varepsilon_k^{LIQ} \\ \varepsilon_k^{R} \end{bmatrix} \sim N[0,\Sigma_k], \quad \Sigma_k = \begin{bmatrix} (\sigma_k^{FLOW})^2 & \sigma_k^{FLOW,LIQ} & \sigma_k^{FLOW,R} \\ \sigma_k^{LIQ,FLOW} & (\sigma_k^{LIQ})^2 & \sigma_k^{LIQ,R} \\ \sigma_k^{R,FLOW} & \sigma_k^{R,LIQ} & (\sigma_k^{R})^2 \end{bmatrix}. \tag{2.6}$$

The diagonal elements φ^l_{11}, φ^l_{22}, φ^l_{33} of the coefficient matrix Φ_l represent the conditional persistence in flows, liquidity, and returns for country i.

Besides our endogenous variables, we take several external factors into consideration. We include market volatility (using the EGARCH specification of Nelson, 1991, to account for asymmetries between positive and negative returns) because of its relation to stock returns (e.g., Whitelaw, 1994) and liquidity (e.g., Chordia et al., 2002; Chordia, Sarkar, and Subrahmanyam, 2005). Given the substantial correlations of capital flows within regions, we account for spillover effects by including regional flows (*FLOW_REG*; the equally-weighted average of monthly flows for the remaining countries within the region). Following Bekaert et al. (2002), we include the local market dividend yield (*DY*; the ratio of the total dividend payments to aggregate market capitalization) as a proxy for the domestic cost of capital, changes in which affect a country's attractiveness for foreign investment. We also account for changes in global macroeconomic conditions by including the world interest rate (*WIR*). For example, a drop in the world interest rate can spur cross-country portfolio flows as foreign investors from developed countries can borrow at low cost in their home currency and invest in riskier and potentially higher yielding assets abroad. We also include U.S. market returns (*R_US*) and market liquidity (*LIQ_US*) as exogenous factors in our VAR specifications. U.S. investors may well condition their cross-border investment decisions on domestic returns or liquidity conditions. Finally, we directly control for trading activity by including aggregate local market turnover (*TURN*; the number of shares traded divided by the total number of shares outstanding) as an exogenous factor.

Prior research identifies differences in the behavior of capital flows, market returns, and market liquidity that depend on geographic location and economic development (e.g., Froot et al., 2001; Bekaert et al., 2002, 2007; Griffin et al., 2007; Brockman et al., 2009). To infer how these attributes affect the interaction among our endogenous variables, we use a top-down approach by estimating the VARs at four different levels of aggregation: all countries simultaneously, developed and emerging countries separately, six regions defined based on geographic location and economic development (see section 2.2.1), and country-by-country.

We follow Froot et al. (2001) and Froot and Ramadorai (2001) and constrain the parameters in equation (2.6) to be equal for all countries within each group. Before estimation, we standardize all country-level variables to have zero mean and unit standard deviation. In that way, we allow for country fixed effects, while eliminating the disparity in liquidity and turnover across countries due to differences in trading volume definitions and/or currency units. In line with Griffin et al. (2004), we restrict the variance-covariance and coefficient matrices to be block diagonal. To decide upon the optimal lag length p, we use the Hannan-Quinn Information Criterion (HQC) for the country-specific VARs. Consistent with previous studies, we find an optimal lag length equal to one month for the majority of the countries.[3] Consequently, for the sake of parsimony we use a lag length of

[3] Griffin et al. (2007) find an optimal lag length between 2 and 5 weeks in a model that describes the relation between turnover and market return for 46 countries. Froot et al. (2001) use 40 daily lags in a bivariate VAR of capital flows and returns for 44 countries.

one month in all VARs. We use a pooled feasible generalized least squares (FGLS) procedure to estimate the variance-covariance and coefficient matrices. That is, we first estimate the coefficient matrices using maximum likelihood, then estimate the residuals' variance-covariance matrix and repeat this procedure until convergence. The results are identical when we use GMM.

In line with Griffin et al. (2007), we use the generalized impulse response functions (GIRs) proposed by Koop, Pesaran, and Potter (1996) and Pesaran and Shin (1998) to measure the long-term response of our endogenous variables to innovations in these variables and to evaluate the economic significance. The typical approach in calculating impulse responses (IRs) involves orthogonalizing the endogenous shocks based on a Cholesky decomposition of the cross-equation covariance matrix Σ. However, this approach imposes an arbitrary structure on the contemporaneous correlations between the endogenous variables and it makes the IRs depend on the ordering of the variables in the VAR. GIRs do not suffer from these drawbacks. It is important to note that they do not only reflect the isolated impact of an innovation in a single variable, but rather the accumulated effect implied by the contemporaneous interaction between the endogenous variables. Pesharan and Shin (1998) define the GIR of y_t at horizon n as follows:

$$GIR^{y}\left(n,\delta_j,\Omega_{t-1}\right)=E\left(y_{t+n} \mid \varepsilon_{jt}=\delta_j,\Omega_{t-1}\right)-E\left(y_{t+n} \mid \Omega_{t-1}\right) \quad (2.7)$$

where Ω_{t-1} denotes the known economic history up to time $t-1$ and δ_j a shock to the j^{th} factor. To evaluate the statistical significance of the GIRs we compute upper and lower 95% confidence bounds using standard Monte Carlo simulations.

2.4 Results

2.4.1 VARs for all countries and for developed vs. emerging countries

Table 2.2 reports the results of our baseline VAR estimated for all countries (Panel A) and for developed and emerging countries separately (Panel B and C, respectively). The table presents results based on both equally-weighted and value-weighted liquidity and return series and based on both local currency and U.S. dollar returns. As all series in the VARs are standardized to have zero mean and unit standard variation, the coefficients can be interpreted as the effect (after one month) of a one standard deviation (1SD) shock in the right hand side variable

expressed as a fraction of one SD of the left hand side variable. As in Griffin et al. (2007), we assess the long-term impact of a 1SD shock to one of the endogenous variables in the baseline VAR on the other variables using the generalized impulse response functions (GIRs). We focus on the cumulative response after six months, as most GIRs level off after that horizon. To save space, we only present the GIRs for the regional and country-by-country VARs in the paper, but we discuss some of the other GIR results in the text. The full set of GIRs is available from the authors.
Consistent with the large body of research on positive feedback trading by foreign investors (e.g., Clark and Berko, 1996; Brennan and Cao, 1997; Choe et al., 1999; Froot et al., 2001; Kim and Wei, 2002; Griffin et al., 2004), we find that local returns in the current month positively and significantly predict next month's net equity inflows for both developed and emerging markets. The effect is somewhat weaker for emerging markets, and insignificant in the emerging markets specification with the equally-weighted series and local currency returns. This finding suggests that positive feedback trading by foreign investors in emerging markets is driven by large cap stocks. We find no evidence of an effect of flows on future local currency returns at the monthly horizon when we use value-weighted series. There is a significant effect (at the 10% level) for the equally-weighted series for developed markets, which suggests that price pressure or informed trading has a greater impact on small cap stocks in those markets. In developed markets, there is also a significantly positive relation (at the 1% level) between current flows and next month's U.S. dollar returns, an effect that can potentially be explained by the effect of a currency appreciation driven by portfolio inflows. The long-term effects of returns on flows and flows on returns are remarkably similar across developed and emerging markets. The (unreported) GIRs suggest that a 1SD shock to current returns (flows) is associated with a cumulative response in flows (returns) of close to 0.15SD (0.23SD) over the next six months. These effects are significant at any conventional confidence level.

The coefficients in the aggregate VARs indicate that liquidity positively predicts capital flows (with the exception of the equally-weighted specification for emerging markets). The coefficient is only statistically significant for developed countries (where it is a bit stronger when we use dollar returns and/or equally-weighted variables). A 1SD shock to current liquidity predicts a change in future flows of up to 4.6% of the SD of flows, an effect that is relatively small. However, the GIRs suggest that the long-term effects can be substantial. A 1SD shock to current liquidity is associated with a cumulative response of capital flows of up to 0.29SD over the next six months, which is statistically significant at the 1% level in all specifications for both developed and emerging countries. The coefficients on flows in the liquidity equations in Table 2.2 are not significant. But for developed markets, the GIRs show a significant cumulative impact of flows on liquidity after six months (close to 0.30SD as a response to a 1SD shock to flows). The long-term effect of flows on liquidity in emerging markets is also statistically significant, but small in economic terms (around 0.03SD).

Future liquidity is positively and significantly associated with current returns at the 1% level in all specifications and both at the one-month and the six-month horizon, consistent with Bekaert et al. (2007). The relation between future returns and current liquidity is less clear-cut. There is a negative relation in the equally-weighted local currency returns specification for emerging markets, but a positive relation in both the value-weighted and the equally-weighted dollar returns specification for developed markets.

In all three panels and in all four specifications in each panel, the endogenous variables show strong persistence. The VARs do a much better job in capturing the dynamics of liquidity (R^2 of 18% to 47%) than of flows and returns (R^2 of around 5%).

An advantage of the aggregate VARs in Table 2.2 is their potentially large statistical power. However, the drawback of aggregating over many different countries is that we ignore cross-country heterogeneity and that contrasting interactions among the endogenous variables in the VARs for different countries may cancel out. We therefore turn to VARs estimated at lower level of aggregations in the next subsections.

2.4.2 VARs for six different regions

Table 2.3 presents the results of VARs estimated for six different groups of countries based on their economic development and their geographic location: developed Europe (Panel A), emerging Europe (Panel B), developed Asia/Pacific (Panel C), emerging Asia (Panel D), developed America (Panel E), and emerging America (Panel F). The table presents only the results for the value-weighted liquidity and return series and only for local currency returns. Next to the baseline VAR specification results (presented in the first row of the flows, liquidity, and returns equations), Table 2.3 also includes the results of VARs that include the following exogenous variables: regional flows (*FLOW_REG*), local market volatility (*VOL*), the local market dividend yield (*DY*), the world interest rate (*WIR*), U.S. market returns and liquidity (*R_US* and *LIQ_US*), and local market turnover (*TURN*). We present the regional GIRs in Figure 2.4 (developed and emerging Europe), Figure 2.5 (developed and emerging Asia/Pacific), and Figure 2.6 (developed and emerging America). To conserve space, we only present GIRs of flows to a shock in returns and liquidity, and GIRs of returns and liquidity to a shock in flows.

For developed Europe (see Panel A), future flows are positively related to current liquidity and returns in the baseline VAR and in the majority of other specifications. Figure 2.4 suggests that the long-term effects are substantial. A 1SD shock in liquidity (returns) is associated with an increase in flows of around 0.25SD (0.18SD) during the next six months (both are statistically significant). The flows equation also shows a significant effect of regional flows, and of market liquidity in the U.S. The latter effect seems to dominate the effect of local market liquidity, with a 1SD increase in U.S. liquidity predicting a 0.16SD increase in flows to developed Europe in the next month (significant at the 1% level). This finding is consistent with the view that U.S. investors seek return in developed Europe in times of abundant liquidity in the U.S. market. Future liquidity is positively related to current local returns, local liquidity, U.S. returns, and local turnover, and negatively to local volatility and the local dividend yield. The VAR coefficients show no significant effect of last month's flows on current liquidity, but the GIRs in Figure 2.4 suggest that there is a significant long-term effect; the cumulative response to a 1SD shock in flows amounts to almost 0.20SD after 6 months. Local returns in developed Europe are also strongly persistent, and are significantly related to regional flows, the dividend yield, the world interest rate, U.S. returns, and turnover. Capital inflows do not have a direct effect on returns after 1 month, but a 1SD shock in flows leads to an increase of 0.10SD in cumulative market returns after half a year.

The most striking result in the flows equation for emerging Europe is the strong effect of U.S. market liquidity (see Panel B of Table 2.3). A positive shock to current U.S. liquidity equal to 1SD is associated with 0.16SD greater capital flows to emerging Europe in the next month. There is no evidence of a significant short-term or long-term response of flows to local market liquidity, as reflected in the GIRs in Figure 2.4. Conversely, we also find no effect of flows on liquidity for emerging Europe. However, regional flows are a strong predictor of future liquidity in the domestic market, as a 1SD shock to regional flows is associated with 0.18SD change in future liquidity. Consistent with, e.g., Froot et al. (2001), we find that flows respond positively to local returns (a 0.18SD effect after six months) and future returns are positively related to current flows (a 0.21SD effect after six months).

For developed countries in Asia/Pacific, only the coefficients on past flows and past returns are significant in the flows equation (see Panel C). The positive feedback trading effect is strong both at the monthly horizon and in the long-term. The GIRs in Figure 2.5 show a cumulative effect of flows of no less than 0.40SD in response to a 1SD shock in returns. Interestingly, the long-term effect of local liquidity on capital inflows is almost as large, and also statistically significant. The positive effects of flows on liquidity and returns can also only be observed at the longer horizons, but the GIRs indicate that these effects are economically large and statistically significant.

Panel D reports our findings for emerging Asia. Again, we find a strong interaction between flows and returns, especially at longer horizons. There is no impact of local market liquidity on flows at either the one-month or the longer horizons. However, in line with the results for developed and emerging Europe, an improvement in U.S. market liquidity is associated with greater subsequent capital flows to the region. A 1SD increase in U.S. liquidity is associated with a ceteris paribus increase of 0.05SD in next months' capital flows. The long-term response of local market liquidity to capital inflows is positive and significant, although the economic magnitude of the effect (around 0.10SD after six months) is smaller than for developed Europe and developed Asia/Pacific. Regional flows have an impact on local liquidity that is at least as big, with a 0.09SD liquidity response after one month.

The VAR estimation results for developed America are in Panel E.[4] Flows respond significantly to returns and returns to flows – although the latter effect is only significant for longer horizons. The coefficients on flows in the liquidity equations are not significant, but the long-term effect in Figure 2.7 is large. A 1SD shock to flows is associated with a 0.40SD increase in liquidity over the next six months. Flows do not significantly respond to local liquidity at any horizon.
For emerging America (Panel F), we once more find a strong and significant long-term response of flows to returns, and vice versa. There is no significant interaction between flows and liquidity. And with one exception, none of the exogenous factors show up significantly.

Overall, we find that future flows respond significantly to a shock in current returns and current flows significantly affect future returns in all six regions. Local liquidity positively affects future flows in developed countries in Europe and Asia/Pacific. In addition, we find evidence that the liquidity conditions in the U.S. market have an effect on flows to developed and emerging Europe and to emerging Asia. Flows to all of these regions increase when U.S. liquidity improves. Local liquidity in developed Europe, developed and emerging Asia/Pacific, and developed America shows a positive long-term response to an increase in capital inflows. This result suggests that foreign investors tend to provide rather than consume local market liquidity in these regions.

[4] For the VAR specification that includes U.S. returns and U.S. liquidity, we exclude the U.S and only keep Canada in the sample for this region.

2.4.3 VARs for six different regions: Small cap vs. large cap stocks

Our analysis thus far considers the interaction of capital flows with market-wide liquidity for all the stocks in our sample, irrespective of firm size. However, previous studies suggest that foreign investors tend to refrain from trading small capitalization stocks due to, among other things, liquidity constraints, information costs, or client mandates. For example, Kang and Stulz (1997) and Van Nieuwerburgh and Veldkamp (2009) argue that foreign investors overweight large stocks to reduce the impact of information asymmetries associated with less visible stocks. Dvorak (2005) shows that foreign trading is more pronounced among the largest stocks in Indonesia. Ferreira and Matos (2008) document that foreign investors have a strong preference for large companies with a dispersed investor base. Evidence provided by Seasholes (2004) suggests that foreign investors in Taiwan outperform local investors in the trading of large caps. The interaction of capital flows with market liquidity may thus differ across large cap and small cap stocks. Table 2.4 presents the results of a VAR estimated with the average market liquidity and returns of large cap stocks and of a VAR with the liquidity and returns of small cap stocks. We classify stocks in the top 35% (bottom 35%) of the cross-sectional market capitalization distribution by country as large caps (small caps). Table 2.4 also contains the six-month cumulative GIRs of flows (liquidity) to a 1SD shock in liquidity (flows), expressed as a fraction of 1SD of flows (liquidity). For brevity, we do not report the other GIRs.

Consistent with the view that foreign investors primarily trade large caps, we find that flows are more strongly related to large cap returns than to small cap returns. The VAR coefficients suggest that flows respond significantly to large cap returns for developed Europe, Asia/pacific, and America, and emerging Asia. There are no such effects for small cap returns. The coefficient on returns in the liquidity equation is significantly positive for all six regions in the large cap VAR, and for five of the six regions in the small cap VAR.

For large cap stocks, the coefficient on liquidity in the flows equation is positive and significant for developed Europe. The six-month GIR of flows to a shock in large cap liquidity is also significant for this region, consistent with the result in Figure 2.4 for large and small caps combined. For small cap stocks, there is no significant coefficient on liquidity in the flows equation, but again we find a significantly positive GIR for developed Europe. The long-term effect of liquidity on capital flows to developed Europe is actually stronger for small caps than for large caps (0.33SD vs. 0.20SD).

The coefficient on flows in the liquidity equation is positive for the majority of the regions, and significantly so for large caps in developed America and small caps in emerging Asia. However, the significant six-month GIRs are concentrated in the small cap VARs. The GIRs indicate a significantly positive long-term effect of flows on small cap liquidity for developed America, Europe, and Asia/Pacific, and emerging Asia. The economic magnitudes of these effects are substantial, at 0.22SD to 0.42SD of liquidity. The significance of the GIRs of liquidity to a shock in flows for these regions in Figures 2.4-2.6 for large and small caps combined is thus driven by small caps. Hence, the liquidity of small cap stocks seems to be more sensitive to the behavior of foreign investors than the liquidity of large caps. Somewhat surprisingly, we thus find little indication that flows respond more strongly to large cap liquidity than to small cap liquidity. A potential explanation is that even though foreign investors primarily invest in large and liquid stocks, they are relatively more concerned about the liquidity of any small cap investments they make. It could also be that foreign investors are more active in small stocks than the studies discussed above suggest. For example, Cao et al. (2009) provide evidence that hedge funds – at least those investing in emerging markets – focus on relatively illiquid securities. Hedge funds have become more prominent in the later part of our sample period. An alternative reason might be that capital inflows and the liquidity of small cap stocks share a business cycle component (Naes, Skjeltorp, Ødegaard, 2010, show that the liquidity of U.S. small caps is procyclical) that is not captured by our baseline VAR model. At the same time, Table 2.3 suggests that the inclusion of business cycle variables such as the local dividend yield and the world interest to the baseline model do not considerably alter our findings.

2.4.4 VARs for six different regions: Liquidity crises vs. "normal periods"

In this subsection, we investigate whether the interaction between flows and liquidity is different during liquidity crisis periods than during "normal" periods. We are especially interested in whether domestic markets become more responsive to flows – and thus more vulnerable to foreign trading – when market liquidity evaporates. We define liquidity crises as the months in the bottom 30% of the liquidity distribution within each country. (We obtain qualitatively similar results when we define market crises based on the bottom 30% of the return distribution.)

Before we analyze the interaction between flows and liquidity during crises, we examine whether the magnitude and direction of flows differs across crisis and normal periods. Do foreign investors withdraw from local markets during crises? Stulz (2007) argues that hedge funds may withdraw liquidity under adverse market conditions. Ben-David et al. (2010) and Cao et al. (2009) show that hedge funds (especially global macro funds) adjust their equity holdings in favor of more liquid stocks during periods of low market liquidity. Anand, Irvine, Puckett, and Venkataraman (2010) report similar findings for institutional investors on the NYSE. We compute the average dollar flows and the fraction of months with net outflows for all six regions for crisis months versus all other months. The results are not tabulated, but they are available from the authors. As shown in Figure 2.1, all regions experience substantial capital inflows over our sample period. But the descriptive statistics of flows across crisis and normal periods suggest that inflows are considerably attenuated during crises for most regions. For example, emerging America sees average capital inflows of $56.7m. per month in normal periods and only $10.7m. during liquidity crises. Similarly, average monthly inflows during normal periods (liquidity crisis periods) are equal to $94.5m. ($73.2m.) for developed Europe, $15.6m. ($7.9m.) for emerging Europe, $408.6m. (-$12.5m.) for developed Asia/Pacific, $56.9m. ($44.2m.) for emerging Asia, and $3237.0m. ($2508.1m.) for developed America. The number of months with outflows is also greater during crisis periods as compared to normal periods for most regions, but the difference is relatively small. Averaged across regions, 44.7% of the crisis months show outflows, versus 39.8% of the normal months. (Differences between crisis and normal periods are somewhat more pronounced when we base our crisis definition on returns rather than liquidity.) There is thus some indication that foreign investors tend to reduce their investments in local stock markets during financial crises. But, with the possible exception of developed Asia/Pacific, we do not observe a significant amount of capital leaving local markets.

Even though we do not observe large capital outflows during crisis periods for any region (for developed Asia/Pacific, the number is negative but small relative to inflows in normal months), it is still possible that foreign investors destabilize markets if their trading behavior has a different impact on local markets during crises than during normal periods. Local market conditions are likely to be more fragile during crisis periods, which may imply that local liquidity is more responsive to changes in asymmetric information, order imbalances, and/or inventory risk as a result of the trading behavior of foreign investors. Hence, the response of liquidity to a given shock to capital flows could differ across crisis and normal periods. We investigate this possibility by estimating models of flows and liquidity in which the independent variables are interacted with dummy variables for liquidity crisis periods and normal periods. These interactions force us to abandon the VAR framework, as VARs cannot handle endogenous variables that are interacted with a dummy variable. Instead, we estimate separate panel models for the flows and liquidity equations. We also include the liquidity and returns on the U.S. market as independent variables, as they show up significantly in a number of the specifications in Table 2.3. As in the VARs, we constrain all coefficients to be the same for all countries within each region and assume independence across regions.

The results are in Table 2.5. The main conclusion is that there is no significant response of liquidity to flows during crisis periods. A drawback of the panel models is that we cannot construct impulse response functions. On the other hand, for foreign investors to destabilize local markets during crisis, we would expect a strong short-term effect of flows on liquidity during crisis periods. Table 2.5 suggests that the short-term effects are small and statistically insignificant. In sum, no convincing case can be made that foreign investors destabilize local equity markets through an adverse impact on liquidity.

Table 2.5 shows a number of other results. Both flows and liquidity tend to be highly persistent during both crisis and normal periods. For developed America, we find a positive short-term effect of local liquidity on inflows, but only during normal periods. Consistent with Table 2.3, U.S. liquidity tends to have a positive effect on flows to other regions. These effects are even stronger once we allow for differences across crisis and normal periods. Interestingly, the impact of U.S. liquidity on flows is somewhat more pronounced during local liquidity crises.

2.4.5 VARs for individual countries

We now turn to the results of our baseline VAR estimated at the individual country-level. An advantage of this approach is that we can fully explore the heterogeneity in the relation between flows, liquidity, and returns across countries. A drawback is that explaining time-series variation in flows, liquidity, and returns is challenging, so the loss of power may be an important concern. To save space, we do not present the estimation results of the VARs, but we present the 3, 6, and 12-month cumulative GIRs of flows to liquidity (and vice versa) in Figures 2.7 and 2.8. (Black bars indicate GIRs that are statistically significant at the 5% level.) The other GIRs are available on request. Unreported results show a GIR of flows to returns that is positive for 39 out of 46 countries, and significant for 13 of these countries (for at least one of the horizons). The GIR of returns to flows is positive for 39 countries, and significantly so for 16 countries.

Figure 2.7 shows the cumulative GIRs of flows after 3, 6, and 12 months to a 1SD shock in liquidity. We find a positive response for 30 countries, of which 11 show an effect that is significant at the 5% level (for at least one of the horizons). None of the GIRs is significantly negative. For most of these countries, the effect is also economically significant. The effect is especially large for Canada, Denmark, Japan, Malaysia, the Netherlands, Sweden, and the U.K, each of which show a response of inflows to local liquidity that is greater than 0.50SD. We carry out Granger causality tests (not tabulated) and find that local market liquidity Granger causes capital inflows (at the 10% level) in nine countries. Interestingly, flows to the US respond negatively to local market liquidity, an effect that could reflect the role of the U.S. as a safe haven during global financial crises. The effect is quite large, but not statistically significant.

Figure 2.8 shows the cumulative GIRs of liquidity to a 1SD shock in flows. The response is positive for 30 countries, and significantly so for 12 countries. There is some heterogeneity across countries, but none of the GIRs is significantly negative. Most markets experience a substantial improvement in liquidity following capital inflows. We observe responses greater than 0.20SD for many countries and greater than 0.50SD in several cases. Unreported Granger causality tests show that capital inflows Granger cause local market liquidity in eight countries.

Lack of power may prevent us from making statistically reliable statements for some of the individual countries. But, overall, the results confirm our findings at higher levels of aggregations that more liquid equity markets tend to be associated with greater capital inflows and that capital inflows tend to help rather than hurt local market liquidity.

2.4.6 Why does the impact of flows on liquidity differ across countries?

Our results thus far suggest that capital flows tend to positively affect local market liquidity in most regions and countries. In this subsection, we try to identify the cross-country determinants of the impact of flows on liquidity by regressing the six-month cumulative GIR of liquidity to a 1SD shock in flows on several country characteristics. This analysis is not only interesting from a policy perspective, but can also shed light on the relative importance of the different channels through which foreign investors can affect local market liquidity (discussed in the introduction).

We use proxies that account for a country's economic and financial development, regulatory environment, information environment, openness, and market risk. We measure financial/economic development using the logarithm of stock market capitalization to GDP (*MKTCAP_GDP*), GDP per capita (*GDP_CAPITA*), and a dummy variable for emerging markets (*EMERGING*). The ratio of domestic credit provided by commercial banks over GDP (*BANK_CREDIT_GDP*) is a proxy for the development of the banking sector, which illustrates the importance of financial intermediation as a driver of domestic growth (Levine, and Zervos, 1998). *TURNOVER* proxies for the intensity of trading on each market. We expect the impact of flows on liquidity to be smaller in countries with more developed economies and a more sophisticated financial sector, as the capacity of domestic intermediaries and investors to absorb foreign order imbalances (the second channel through which foreign investors can affect liquidity, as discussed in the introduction) is larger in these countries.

We use anti-director rights (*AD_RIGHTS*), rule of law (*RULE_OF_LAW*), corruption in government (*CORRUPTION*), and a dummy variable that indicates whether shorting is common practice (*SHORT_SALES*) as proxies for a country's regulatory environment. We expect that a stronger regulatory environment increases a country's resilience to capital inflows. Also, Morck, Yeung, and Yu (2000) argue that better investor protection is associated with more informed stock prices, so foreign investors are arguably less likely to have superior information in countries with better investor protection (the first channel through which foreign investors can affect liquidity, as discussed in the introduction).

Accounting standards (*ACCOUNT_STAND*), the average number of analysts following large firms (*ANALYST*), and the extent of media penetration in a country (*MEDIA_DEVELOP*) are our measures of a country's information environment. These variables are most closely related to the first channel through which foreign investors can affect local liquidity, which is through their impact on information asymmetries in the local market. We expect that the greater the transparency of the information environment, the less likely it is that foreign investors possess superior information and therefore the less adverse their impact on liquidity.

In addition, it seems reasonable to assume that foreign investors have better access to information in more open economies. To control for market openness, we use indices for international capital controls (*CAP_CONTROLS*), as well as for the freedom to trade internationally (*TRADE_FREEDOM*). We also include a measure of the presence of foreign banks in the local market (*FOREIGN_BANKS*). Following Kaniel, Li, and Starks (2009), we use the average monthly volatility (*VOL*) of market returns within each country as a measure of risk in equity markets.

We expect the impact of the trading behavior of foreign investors to be greater in more volatile equity markets.

Table 2.6 reports the result of the regressions of the GIR of liquidity to a shock in flows on various combinations of these country characteristics. We limit the number of explanatory variables in each regression, because many of the characteristics are related to each other and because the number of degrees of freedom is limited.

The most prominent result in Table 2.6 is the effect of accounting standards (*ACCOUNT_STAND*). The coefficient on this variable is positive and significant at the 1% level in all specifications. This result suggests that the impact of foreign investors on local market liquidity is more positive in countries with greater transparency, consistent with the argument that foreign investors are more likely to act as liquidity or noise traders that improve market liquidity in these countries – as opposed to informed traders that worsen adverse selection problems (first channel). The economic magnitude of the effect of accounting standards is large. A 1SD improvement in accounting standards is associated with an increase of approximately 0.65SD in the response of liquidity to flows.

In four of the nine specifications, we find evidence that the impact of flows on liquidity is smaller in countries with more developed financial markets (as proxied by *MKTCAP_GDP*). Again, the economic effect is substantial. A 1SD increase in *MKTCAP_GDP* is associated with a reduction of the impact of flows on liquidity of around 0.40SD. This finding is in line with our hypothesis that the trading behavior of foreign investors (second channel) has a smaller impact in more developed markets. We find no significant effects for the variables related to a country's regulatory environment, openness, and market risk

2.5 Conclusions

This paper investigates the interaction of international capital flows with local and U.S. market liquidity for 46 countries from January 1995 to December 2008. We estimate unrestricted vector autoregressions (VARs) – with flows, liquidity, and returns as endogenous variables – at four different levels of aggregation: all countries, developed vs. emerging countries, six different regions, and country-by country.

We present evidence of significant interactions between capital flows and liquidity, although there are important differences across regions and countries. For two of the three developed regions (Europe and Asia/Pacific), capital inflows respond positively to local market liquidity. For three regions (developed and emerging Europe and emerging Asia), there is a positive response of inflows to U.S. market liquidity. Foreign investors thus seem to have a preference for favorable liquidity conditions on the host market, but they are inclined to seek return in other markets when the home market is flush with liquidity.

For four out of the six regions (developed America, Europe, and Asia/Pacific, and emerging Asia), capital inflows positively predict local market liquidity. Establishing causality in the interaction between flows and liquidity is hard, but it seems implausible that foreign investors systematically time their purchases of local securities before an improvement in local market liquidity. Hence, our interpretation of these results is that foreign investors tend to provide rather than consume liquidity on local markets.

The interaction between flows and liquidity is stronger for small cap stocks than for large cap stocks. When we examine liquidity crises separately, we find little support for the view that foreign investors destabilize local financial markets through an adverse impact on liquidity. We do not observe systematic and large capital outflows during liquidity crises, and there is also no significant short-term impact of capital flows on local market liquidity during these periods.

The response of local liquidity to capital inflows is more positive in countries with greater transparency and less developed financial markets. In more transparent countries, foreign investors are more likely to act as noise traders than as traders with superior information. In less developed financial markets, the impact of the trading behavior of foreign investors is greater.

Our results should help investors to develop trading strategies that take into account the interaction of capital flows with market liquidity and regulators to assess and affect the impact of foreign investors on local markets.

Table 2.1: Summary statistics

This table reports summary statistics of our monthly time-series of equity portfolio flows, local stock market liquidity, and local stock returns for each of the 46 countries in our sample over the period 1995-2008. The countries are organized in six groups based on their economic development and geographic location: developed Europe, emerging Europe, developed Asia/Pacific, emerging Asia, developed America, and emerging America. The first three columns present the country name, the time period, and the total number of distinct individual stocks in the sample. The next three columns contain the time-series average, median, and standard deviation of aggregate net equity portfolio flows scaled by local market capitalization at the beginning of each month (expressed as %). The following three columns contain the time-series average, median, and standard deviation of monthly market liquidity. We construct monthly liquidity time-series for individual stocks as the average of the daily Amihud (2002) measures; aggregate market liquidity is the value-weighted average of monthly liquidity across individual stocks, with weights are based on the market value at the beginning of each month. The next three columns contain the time-series average, median, and standard deviation of market returns (expressed as % per month). We construct market returns as the value-weighted average of monthly total returns (in local currency) across individual stocks, again with weights based on the market value at the beginning of the month. The last two columns report the time-series average of market volatility (based on an EGARCH(1,1) specification fit to monthly market returns and expressed as % per month), and the aggregate market capitalization of each country (in millions of U.S. dollars).

Country	Dates	# Stocks	Flows			Liquidity (x10^7)			Returns			Volatility	Mcap ($m.)
			mean	median	st.dev.	mean	median	st.dev.	mean	median	st.dev.	mean	mean
Panel A: Developed Europe													
Austria	1995:2008	208	-0.022	0.003	0.125	-41.023	-26.379	41.495	0.62	1.106	5.613	5.383	67,191
Belgium	2001:2008	307	-0.017	-0.019	0.228	-484.372	-210.29	482.866	0.102	1.38	4.815	4.755	226,107
Denmark	1995:2008	360	0.009	0.012	0.1	-2.157	-1.839	1.954	0.891	1.568	4.566	4.472	108,887
Finland	1995:2008	232	0.021	0.016	0.125	-34.893	-32.368	20.42	1.294	1.433	7.681	7.774	165,389
France	1995:2008	1,891	0.018	0.013	0.053	-50.521	-39.781	31.836	0.709	1.392	5.049	4.901	1,200,130
Germany	1995:2008	2,859	0.003	0.004	0.072	-167.095	-87.337	215.494	0.581	1.491	5.792	5.737	1,003,035
Ireland	2000:2008	90	-0.022	0.075	0.344	-237.158	-100.658	451.56	-0.198	1.444	6.254	5.522	93,938
Italy	1995:2008	643	0.008	0.006	0.064	-6.841	-5.489	4.881	1.2	1.198	6.622	6.377	579,600
Luxembourg	2001:2008	28	-0.079	-0.095	0.892	-17.17	-13.07	14.153	0.185	1.242	6.312	5.534	30,323
Netherlands	1995:2008	306	-0.021	-0.02	0.08	-12.969	-6.044	18.843	0.699	1.748	5.212	5.022	542,878
Norway	1995:2008	483	-0.002	-0.003	0.158	-3.709	-2.29	3.764	0.979	1.824	6.213	6.027	109,541
Spain	1995:2008	285	-0.003	-0.004	0.09	-3.452	-2.744	2.576	0.578	0.947	4.904	4.879	447,968
Sweden	1995:2008	903	0.011	0.005	0.22	-9.946	-5.195	11.197	0.79	1.216	6.036	5.877	272,733
Switzerland	1995:2008	438	0.01	0.007	0.075	-3.579	-2.333	3.194	0.798	1.274	4.133	4.06	695,308
U.K.	1995:2008	3,921	0.053	0.066	0.158	-0.14	-0.105	0.163	0.736	1.031	4.19	4.125	2,323,410

Table 2.1 continued

Country	Dates	# Stocks	Flows			Liquidity (x10^7)			Returns			Volatility	Mcap ($m.)
			mean	median	st.dev.	mean	median	st.dev.	mean	median	st.dev.	mean	mean
Panel B: Emerging Europe													
Cyprus	2006:2008	121	0.185	0.192	0.935	-1145.616	-242.27	995.908	-0.648	0.375	10.867	10.829	18,929
Czech Republic	1995:2002	146	-0.049	0.002	0.554	-8.399	-6.781	7.436	0.153	0.951	7.945	5.949	11,525
Greece	1995:2008	476	0.015	0.004	0.094	-55.332	-49.012	46.986	0.814	0.868	9.258	9.102	82,228
Hungary	1995:2008	86	0.027	0	0.194	-0.884	-0.681	0.829	1.565	2.124	8.888	9.272	18,474
Israel	1995:2008	866	0.106	0.083	0.28	-36.851	-36.19	16.826	0.979	1.48	5.973	5.953	54,432
Poland	1995:2008	579	0.053	0.01	0.154	-59.209	-15.429	104.126	0.64	0.893	7.619	7.617	46,509
Portugal	1995:2008	179	0.042	0.01	0.275	-138.815	-106.195	106.246	0.68	0.524	5.548	5.731	63,060
Turkey	1995:2008	369	0.071	0.018	0.265	-82.274	-10.513	196.013	3.949	3.869	14.099	14.675	70,773
Panel C: Developed Asia/Pacific													
Australia	1995:2008	2,677	0.029	0.024	0.081	-87.325	-65.717	52.539	2.795	3.492	3.725	3.691	495,587
Hong Kong	1995:2008	1,238	0.034	0.018	0.195	-7.436	-6.211	6.156	0.625	1.268	8.226	8.077	603,908
Japan	1995:2008	2,800	0.038	0.023	0.082	-0.061	-0.049	0.043	-0.158	-0.271	4.718	4.792	3,284,467
New Zealand	2001:2008	232	0.013	-0.032	0.261	-70.503	-49.846	33.252	0.609	0.943	3.658	3.971	16,086
Singapore	1995:2008	935	0.007	0.02	0.304	-88.672	-62.72	86.744	0.172	0.72	5.184	5.394	162,986
Panel D: Emerging Asia													
China	1995:2008	1,666	1.651	0.269	4.913	-0.054	-0.035	0.065	0.798	0.128	8.866	8.8	14,052
India	1995:2008	2,199	0.028	0.022	0.066	-133.466	-65.685	149.17	0.862	1.666	8.286	8.422	253,417
Indonesia	1995:2008	474	0.017	0.011	0.134	-0.237	-0.098	0.31	0.923	1.792	9.879	9.626	57,100
Malaysia	1995:2008	1,134	0.013	0.007	0.089	-32.638	-20.958	46.763	0.267	0.327	8.386	7.488	128,133
Pakistan	1995:2008	359	0.008	0	0.2	-22.926	-18.494	18.258	1.25	0.534	10.522	10.749	16,788
South Korea	1995:2008	1,125	0.086	0.048	0.201	-0.01	-0.004	0.021	0.404	-0.186	9.244	9.249	286,184
Philippines	1995:2008	303	0.019	0.014	0.085	-10.025	-8.56	6.436	0.069	-0.025	7.586	7.603	37,807
Taiwan	1995:2008	1,536	0.094	0.03	0.374	-0.247	-0.184	0.261	-0.097	0.201	7.507	7.554	267,261
Thailand	1995:2008	901	0.011	0.012	0.077	-13.15	-5.481	18.918	0.105	0.351	10.036	9.467	67,201

Table 2.1 continued

Country	Dates	# Stocks	Flows			Liquidity (x10^7)			Returns			Volatility	Mcap ($m.)
			mean	median	st.dev.	mean	median	st.dev.	mean	median	st.dev.	mean	mean
Panel E: Developed America													
Canada	1995:2008	3,351	0.017	0.025	0.118	-123.664	-103.163	101.957	0.831	1.387	4	3.845	751,868
U.S.	1995:2008	4,427	0.049	0.05	0.051	-0.916	-0.577	1.295	2.745	3.586	4.059	4.035	11,075,816
Panel F: Emerging America													
Argentina	1995:2008	115	0.009	0.007	0.314	-11.112	-9.31	6.548	1.101	1.454	9.042	9.482	31,752
Brazil	1999:2008	649	0.069	0.08	0.13	-98.768	-84.544	58.049	2.266	2.753	7.185	7.304	378,378
Chile	1995:2008	260	0.009	-0.004	0.087	-0.066	-0.057	0.049	1.058	0.799	4.676	5.014	76,576
Colombia	1995:2008	85	-0.007	0	0.125	-0.007	-0.008	0.008	3.087	1.534	7.217	7.864	31,560
Mexico	1995:2008	391	-0.021	-0.022	0.202	-5.731	-3.844	5.025	0.702	1.032	5.748	5.796	156,886
Peru	1995:2008	234	0.039	0.047	0.394	-62.138	-29.345	186.917	1.478	1.96	6.212	6.29	18,211
Venezuela	1995:2002	38	0.046	-0.055	1.287	-233.421	-70.156	614.836	2.591	0.795	10.218	9.82	4,874

Table 2.2: VAR results for all countries and for developed and emerging countries separately

This table presents the results of vector autoregressive (VAR) models of order 1 with monthly net capital inflows, market liquidity, and market returns as endogenous variables. Panel A presents the results of VARs estimated for all 46 countries in our sample jointly, and Panel B and C present the results of VARs estimated for 22 developed countries and 24 emerging countries separately, using the classification of the International Finance Corporation (IFC) of the World Bank Group. Each panel reports the results of four different VAR specifications, based on the time-series of value-weighted or equally-weighted average returns and liquidity across individual stocks by country and based on local currency returns (Return) or U.S. dollar returns ($Return) from January 1995 to December 2008. We standardize all variables to have zero mean and unit standard deviation at the country-level, thus accounting for country fixed effects. Before the standardization, we stochastically detrend liquidity at the country-level by subtracting a six-month moving average. Following Froot et al. (2001), we constrain coefficients to be the same for all countries within the groups of developed and emerging countries in Panels B and C. In line with Griffin et al. (2004), we restrict the variance-covariance and coefficient matrices to be block diagonal. We use iterative maximum likelihood to estimate the VARs. Significance at the 1%, 5%, and 10% level is indicated by a, b, and c, respectively.

	Value-weighted series						Equally-weighted series					
	Flows	Liquidity	Returns	\$Returns	Intercept	R^2	Flows	Liquidity	Returns	\$Returns	Intercept	R^2
Panel A: All countries												
Flows equation	0.2133[a]	0.0173	0.0507[a]		-0.0196[c]	0.05	0.2208[a]	0.019	0.0205[c]		-0.0164	0.05
	0.2148[a]	0.0197		0.0390[a]	-0.0196[c]	0.05	0.2180[a]	0.0167		0.0388[a]	-0.0162	0.05
Liquidity equation	-0.0033	0.4406[a]	0.2134[a]		-0.0035	0.27	0.0092	0.4889[a]	0.2483[a]		-0.0094	0.36
	-0.0001	0.4445[a]		0.1915[a]	-0.0031	0.26	0.006	0.5159[a]		0.1975[a]	-0.0078	0.34
Return equation	0.0189	0.0074	0.1349[a]		-0.0048	0.02	0.0223[c]	-0.0277[b]	0.2860[a]		0.0011	0.08
	0.0380[a]	0.0179		0.1498[a]	-0.0082	0.03	0.0380[a]	0.0133		0.1504[a]	-0.0079	0.03
Panel B: Developed countries												
Flows equation	0.2155[a]	0.0308[c]	0.0738[a]		-0.0165	0.06	0.2177[a]	0.0385[b]	0.0522[a]		-0.0171	0.06
	0.2171[a]	0.0379[b]		0.0500[a]	-0.017	0.06	0.2161[a]	0.0465[a]		0.0474[a]	-0.0169	0.06
Liquidity equation	0.0014	0.5208[a]	0.2577[a]		-0.0047	0.39	-0.0007	0.5385[a]	0.2795[a]		-0.0097	0.47
	0.002	0.5308[a]		0.2318[a]	-0.0056	0.38	-0.0072	0.5875[a]		0.2276[a]	-0.0092	0.44
Return equation	0.0237	0.0116	0.1630[a]		-0.0101	0.03	0.0332[c]	-0.0067	0.3162[a]		-0.0023	0.1
	0.0482[a]	0.0337[c]		0.1324[a]	-0.0099	0.03	0.0475[a]	0.0399[b]		0.1304[a]	-0.0099	0.03
Panel C: Emerging countries												
Flows equation	0.2110[a]	0.0029	0.0282[c]		-0.0224	0.05	0.2222[a]	-0.003	-0.0123		-0.0158	0.05
	0.2112[a]	0.0024		0.0286[c]	-0.0222	0.05	0.2171[a]	-0.0103		0.0295[c]	-0.0158	0.05
Liquidity equation	-0.0129	0.3651[a]	0.1658[a]		-0.0029	0.18	0.0142	0.4415[a]	0.2106[a]		-0.0092	0.27
	-0.0092	0.3649[a]		0.1514[a]	-0.0019	0.18	0.0117	0.4514[a]		0.1664[a]	-0.007	0.26
Return equation	0.0153	0.0006	0.1086[a]		0.0003	0.01	0.011	-0.0523[a]	0.2547[a]		0.0042	0.06
	0.0268	0.0039		0.1646[a]	-0.0069	0.03	0.0266	-0.0098		0.1666[a]	-0.0064	0.03

Table 2.3: VAR results for six different regions separately

This table presents the results of VAR(1) models (with monthly net capital inflows, market liquidity, and market returns as endogenous variables) estimated by six different regions: developed Europe (Panel A), emerging Europe (Panel B), developed Asia/Pacific (Panel C), emerging Asia (Panel D), developed America (Panel E), and emerging America (Panel F). The time-series of liquidity and (local currency) returns are the value-weighted average returns and liquidity across individual stocks by country. The first line of each panel contains the baseline VAR results with the three endogenous variables only. Subsequent lines contain the results of VARs that include the following exogenous factors: regional flows (FLOW_REG), local market volatility (VOL), the local market dividend yield (DY), the world interest rate (WIR), U.S. market returns and liquidity (R_US and LIQ_US), and local market turnover (TURN) We standardize all variables to have zero mean and unit standard deviation at the country-level, thus accounting for country fixed effects. Before the standardization, we stochastically detrend liquidity, VOL, DY, and TURN at the country-level, as well as WIR, by subtracting a six-month moving average. We constrain the coefficients to be the same for all countries within each region and we restrict the variance-covariance and coefficient matrices to be block diagonal. We use iterative maximum likelihood to estimate the VARs. We suppress intercepts to conserve space. Significance at the 1%, 5%, and 10% level is indicated by a, b, and c, respectively.

Flows	Liquidity	Returns	*FLOW_REG*	*VOL*	*DY*	*WIR*	*R_US*	*LIQ_US*	*TURN*	R^2
Panel A: Developed Europe										
Flows equation										
0.2084[a]	0.0420[c]	0.0445[b]								0.05
0.1849[a]	0.0334	0.0414[b]	0.2873[a]							0.06
0.2082[a]	0.0458[b]	0.0523[b]		0.0167						0.05
0.2170[a]	0.036	0.0226			-0.0309					0.06
0.2084[a]	0.0424[c]	0.0450[b]				-0.0055				0.05
0.1804[a]	0.0232	-0.0021					0.0403	0.1642[a]		0.08
0.2075[a]	0.0422[c]	0.0447[b]							0.0168	0.05
Liquidity equation										
0.0088	0.4791[a]	0.2582[a]								0.34
0.0033	0.4771[a]	0.2575[a]	0.0682							0.35
0.0096	0.4642[a]	0.2278[a]		-0.0647[a]						0.35
0.0025	0.4430[a]	0.2051[a]			-0.1225[a]					0.35
0.0088	0.4793[a]	0.2584[a]				-0.0017				0.34
0.01	0.4730[a]	0.1931[a]					0.0932[a]	0.0227		0.35
0.0062	0.4796[a]	0.2588[a]							0.0472[a]	0.35
Returns equation										
0.0142	0.0221	0.1824[a]								0.04
0.0062	0.0192	0.1813[a]	0.0990[c]							0.04
0.014	0.0263	0.1908[a]		0.0179						0.04
0.0166	-0.0114	0.1152[a]			-0.1203[a]					0.04
0.0159	0.0112	0.1700[a]				0.1240[a]				0.05
0.0266	0.0176	0.0829[a]					0.1520[a]	-0.0195		0.05
0.0076	0.0236	0.1842[a]							0.1217[a]	0.05

Table 2.3 continued

Flows	Liquidity	Returns	*FLOW_REG*	*VOL*	*DY*	*WIR*	*R_US*	*LIQ_US*	*TURN*	R^2
Panel B: Emerging Europe										
Flows equation										
0.2700[a]	0.0005	0.0209								0.08
0.2674[a]	-0.0028	0.0115	0.1193[c]							0.08
0.2692[a]	0.0003	0.0182		0.0226						0.08
0.2700[a]	0.0015	0.025			0.0099					0.08
0.2695[a]	0.0003	0.0224				-0.0225				0.08
0.2384[a]	-0.0319	-0.023					0.0526	0.1637[a]		0.1
0.2670[a]	0.0029	0.0063							0.0617[b]	0.08
Liquidity equation										
-0.0236	0.3231[a]	0.1545[a]								0.14
-0.0276	0.3178[a]	0.1401[a]	0.1843[a]							0.15
-0.0234	0.3232[a]	0.1551[a]		-0.0049						0.14
-0.0233	0.3188[a]	0.1355[a]			-0.0463					0.15
-0.024	0.3229[a]	0.1554[a]				-0.0137				0.15
-0.0514c	0.2970[a]	0.0970[a]					0.0926[a]	0.1333[a]		0.17
-0.0194	0.3201[a]	0.1743[a]							-0.0827[a]	0.15
Returns equation										
0.0479	0.0351	0.1115[a]								0.02
0.0467	0.0336	0.1075[a]	0.0519							0.02
0.0458	0.0344	0.1049[a]		0.0564[c]						0.02
0.0482	0.028	0.0805[b]			-0.0747[b]					0.02
0.0501	0.0362	0.1054[a]				0.0928[a]				0.03
0.0305	0.022	0.0489					0.1214[a]	0.0655[c]		0.03
0.0443	0.0378	0.0943[a]							0.0728[b]	0.02
Panel C: Developed Asia/Pacific										
Flows equation										
0.2495[a]	0.0119	0.1461[a]								0.1
0.2506[a]	0.0138	0.1489[a]	-0.0301							0.1
0.2469[a]	0.0131	0.1631[a]		0.0362						0.1
0.2484[a]	0.0037	0.1374[a]			-0.0228					0.1
0.2493[a]	0.0104	0.1462[a]				0.0158				0.1
0.2458[a]	0.006	0.1483[a]					-0.0096	0.05		0.1
0.2451[a]	0.0124	0.1451[a]							0.0345	0.1

Table 2.3 continued

Flows	Liquidity	Returns	*FLOW_REG*	*VOL*	*DY*	*WIR*	*R_US*	*LIQ_US*	*TURN*	R^2
Panel C: Developed Asia/Pacific, continued										
Liquidity equation										
-0.0328	0.5308[a]	0.2996[a]								0.45
-0.0372	0.5231[a]	0.2886[a]	0.1204[b]							0.45
-0.0322	0.5305[a]	0.2957[a]		-0.0084						0.45
-0.037	0.5013[a]	0.2683[a]			-0.0819[b]					0.45
-0.0325	0.5335[a]	0.2994[a]				-0.0276				0.45
-0.035	0.5277[a]	0.2975[a]					0.0009	0.02		0.45
-0.0401	0.5316[a]	0.2978[a]							0.0571[b]	0.45
Returns equation										
0.0672[c]	0.0032	0.0972[b]								0.02
0.0617[c]	-0.0066	0.0832[b]	0.1531[b]							0.02
0.0607[c]	0.0061	0.1405[a]		0.0919[b]						0.02
0.0658[c]	-0.0074	0.0860[b]			-0.0293					0.02
0.0667[c]	-0.0018	0.0975[b]				0.0503				0.02
0.0687[c]	0.0089	0.07					0.0554	-0.056		0.02
0.0541	0.0047	0.0941[b]							0.1025[a]	0.03
Panel D: Emerging Asia										
Flows equation										
0.2279[a]	-0.0094	0.0469[c]								0.06
0.2192[a]	-0.0119	0.0365	0.1221[b]							0.06
0.2279[a]	-0.0128	0.0481[c]		0.0114						0.06
0.2235[a]	-0.0251	0.0264			-0.0545[c]					0.06
0.2264[a]	-0.0105	0.0478[c]				0.0448[c]				0.06
0.2170[a]	-0.0113	0.0136					0.0814[a]	0.0503[c]		0.07
0.2280[a]	-0.0092	0.0565[b]							-0.0243	0.06
Liquidity equation										
0.0008	0.4640[a]	0.2243[a]								0.31
-0.0055	0.4622[a]	0.2167[a]	0.0885[c]							0.31
-0.0002	0.4561[a]	0.2064[a]		-0.0401[c]						0.31
-0.0087	0.4292[a]	0.1790[a]			-0.1212[a]					0.32
0.0011	0.4642[a]	0.2241[a]				-0.01				0.31
-0.0021	0.4648[a]	0.2034[a]					0.0594[b]	-0.01		0.32
0.0007	0.4638[a]	0.2162[a]							0.0203	0.31

Table 2.3 continued

Flows	Liquidity	Returns	*FLOW_REG*	*VOL*	*DY*	*WIR*	*R_US*	*LIQ_US*	*TURN*	R^2
				Panel D: Emerging Asia, continued						
Returns equation										
0.0267	-0.0366	0.1044^{a}								0.01
0.0159	-0.0397	0.0915^{a}	0.1526^{b}							0.02
0.027	-0.0354	0.1099^{a}		0.01						0.01
0.0252	-0.0421	0.0973^{a}			-0.0191					0.01
0.0267	-0.0367	0.1045^{a}				0.0024				0.01
0.0233	-0.0354	0.0779^{a}					0.0759^{a}	-0.0105		0.02
0.0266	-0.0368	0.0905^{a}							0.035	0.01
				Panel E: Developed America						
Flows equation										
0.1575^{a}	-0.0194	0.1283^{b}								0.05
0.1550^{a}	-0.0252	0.1222^{b}	0.0364							0.05
0.1590^{a}	-0.0153	0.1633^{c}		0.05						0.05
0.1588^{a}	-0.0111	0.1441^{b}			0.0284					0.05
0.0023	0.1735^{b}	0.2304^{a}				0.06				0.11
-0.0139	0.1296	0.2333^{b}					-0.0099	0.12		0.12
0.1562^{a}	-0.0185	0.1412^{b}							0.0598	0.05
Liquidity equation										
0.0416	0.7549^{a}	0.1725^{a}								0.68
0.042	0.7559^{a}	0.1735^{a}	-0.006							0.68
0.0398	0.7501^{a}	0.1305^{a}		-0.06						0.68
0.039	0.7382^{a}	0.1406^{a}			-0.0574					0.68
0.0578	0.6980^{a}	0.2253^{a}				-0.03				0.63
0.0508	0.6699^{a}	0.2983^{a}					-0.1007	0.06		0.64
0.0396	0.7562^{a}	0.1910^{a}							0.0863^{a}	0.69
Returns equation										
0.0013	-0.0303	0.1620^{a}								0.03
0.0012	-0.0305	0.1617^{a}	0.0015							0.03
0.0038	-0.0232	0.2228^{a}		0.0827						0.03
-0.0068	-0.0824	0.0627			-0.1785^{b}					0.04
0.0661	-0.062	0.1749^{b}				0.0713				0.04
0.0618	-0.0474	0.0294					0.1914	-0.0063		0.05
0.0003	-0.0296	0.1712^{a}							0.043	0.03

Table 2.3 continued

Flows	Liquidity	Returns	*FLOW_REG*	*VOL*	*DY*	*WIR*	*R_US*	*LIQ_US*	*TURN*	R^2
Panel F: Emerging America										
Flows equation										
0.1210[a]	0.0181	0.0141								0.02
0.1163[a]	0.0182	0.0099	0.0547							0.02
0.1196[a]	0.0165	0.0153		-0.04						0.02
0.1193[a]	0.0151	-0.001			-0.0492					0.02
0.1208[a]	0.0166	0.0144				0.02				0.02
0.1201[a]	0.017	0.0021					0.0267	0.01		0.02
0.1229[a]	0.0104	0.0082							-0.0174	0.02
Liquidity equation										
-0.0223	0.2610[a]	0.0776[b]								0.08
-0.0248	0.2611[a]	0.0753[b]	0.0298							0.08
-0.0228	0.2604[a]	0.0780[a]		-0.02						0.08
-0.0237	0.2584[a]	0.0646[b]			-0.0422					0.08
-0.0225	0.2588[a]	0.0780[a]				0.03				0.08
-0.0232	0.2599[a]	0.0666[b]					0.0238	0.01		0.08
-0.0313	0.2443[a]	0.0581[c]							0.0624[c]	0.07
Returns equation										
-0.0366	0.0175	0.1171[a]								0.01
-0.0319	0.0174	0.1213[a]	-0.0548							0.02
-0.0374	0.0165	0.1179[a]		-0.0249						0.02
-0.0383	0.0143	0.1010[a]			-0.0525					0.02
-0.0365	0.0182	0.1170[a]				-0.0098				0.01
-0.0354	0.0177	0.0838[b]					0.0864[b]	-0.0114		0.02
-0.0339	0.014	0.1124[a]							-0.0257	0.01

Table 2.4: VAR results for small cap and large cap stocks separately

This table presents the results of VAR(1) models (with monthly net capital inflows, market liquidity, and market returns as endogenous variables) estimated for small cap and large cap stocks separately. We also report the six-month cumulative generalized impulse response (GIR) of flows (liquidity) to a one standard deviation (1SD) shock in liquidity (flows), expressed as a fraction of 1SD of flows (liquidity). We estimate the VARs by six different regions from January 1995 to December 2008. We define small cap (large cap) stocks as those with a market value in the bottom (top) 35% of the cross-sectional distribution of all stocks in a given country, at the beginning of each month. We construct separate liquidity and (local currency) returns time-series for small cap and large cap stocks as the value-weighted average returns and liquidity across individual stocks in each category by country. We standardize all variables to have zero mean and unit standard deviation at the country-level, thus accounting for country fixed effects. Before the standardization, we stochastically detrend the liquidity time-series at the country-level by subtracting a six-month moving average. We constrain the coefficients to be the same for all countries within each region and we restrict the variance-covariance and coefficient matrices to be block diagonal. We use iterative maximum likelihood to estimate the VARs. We suppress intercepts to conserve space. Significance at the 1%, 5%, and 10% level is indicated by a, b, and c, respectively.

	Large cap stocks						Small cap stocks					
	Flows	Liquidity	Returns	R^2	6m GIR to flows shock	6m GIR to liq. shock	Flows	Liquidity	Returns	R^2	6m GIR to flows shock	6m GIR to liq. shock
	Flows equation						*Flows equation*					
Developed Europe	0.2089^a	0.0453^b	0.0423^b	0.05		0.20^c	0.2184^a	0.032	0.0614^a	0.06		0.33^b
Emerging Europe	0.2695^a	-0.0084	0.0253	0.08		0.03	0.2837^a	-0.0034	-0.0029	0.08		0.07
Developed Asia/Pacific	0.2392^a	0.0629	0.1353^a	0.1		0.48	0.2612^a	0.0403	0.0635	0.08		0.41
Emerging Asia	0.2275^a	0.0036	0.0488^c	0.06		0.01	0.2381^a	0.0027	-0.0272	0.06		0.04
Developed America	0.1547^a	0.0775	0.1095^b	0.05		0.15	0.1675^a	-0.0371	0.0854	0.04		0.1
Emerging America	0.1205^a	-0.0373	0.0199	0.02		-0.04	0.2244^a	0.0256	-0.0157	0.05		0.01
	Liquidity equation						*Liquidity equation*					
Developed Europe	0.0162	0.3681^a	0.2507^a	0.24	0.16		-0.0011	0.4732^a	0.2774^a	0.4	0.22^c	
Emerging Europe	-0.0118	0.3722^a	0.2153^a	0.22	0.09		0.0131	0.3018^a	0.1844^a	0.15	0.12	
Developed Asia/Pacific	0.003	0.3948^a	0.3190^a	0.34	0.35		0.0361	0.5011^a	0.3161^a	0.48	0.42^c	
Emerging Asia	0.0186	0.2665^a	0.2976^a	0.2	0.1		0.0580^a	0.4254^a	0.2488^a	0.32	0.25^c	
Developed America	0.0984^c	0.2267^a	0.2642^a	0.16	0.24		0.0148	0.6549^a	0.2223^a	0.6	0.40^c	
Emerging America	-0.0056	0.2328^a	0.1463^a	0.08	0.03		-0.0147	0.1450^a	0.0646	0.03	-0.04	
	Returns equation						*Returns equation*					
Developed Europe	0.0152	0.0079	0.1776^a	0.03			0.0207	0.0731^a	0.3114^a	0.12		
Emerging Europe	0.0497	0.0384	0.1003^a	0.02			0.0166	0.0345	0.2233^a	0.06		
Developed Asia/Pacific	0.0718^c	-0.0068	0.0917^b	0.02			0.049	-0.0023	0.2172^a	0.05		
Emerging Asia	0.0264	-0.0523^c	0.1036^a	0.01			0.035	-0.0880^a	0.1957^a	0.04		
Developed America	-0.0036	0.0011	0.1351^b	0.02			0.0423	0.0444	0.3070^a	0.11		
Emerging America	-0.0368	-0.0268	0.1191^a	0.01			0.001	-0.0698^c	0.1591^a	0.03		

Table 2.5: Interaction between flows and liquidity for liquidity crisis periods and "normal" periods separately

This table presents the results of panel models to explain monthly net capital inflows and market liquidity in liquidity crisis periods and "normal" periods separately. We estimate the panel models by six different regions from January 1995 to December 2008. In both models, we use one-month lagged flows, liquidity, market returns, U.S. market returns (R_US), and U.S. market liquidity (LIQ_US) as independent variables. We interact each of these variables with dummy variables for liquidity crisis periods and normal periods. We define liquidity crises as the bottom 30% of the time-series distribution of market liquidity within each country. The time-series of liquidity and (local currency) returns are the value-weighted average returns and liquidity across individual stocks by country. We standardize all variables to have zero mean and unit standard deviation at the country-level, thus accounting for country fixed effects. Before the standardization, we stochastically detrend the liquidity time-series at the country-level by subtracting a six-month moving average. We constrain the coefficients to be the same for all countries within each region and we restrict the variance-covariance and coefficient matrices to be diagonal. We suppress intercepts to conserve space. Significance at the 1%, 5%, and 10% level is indicated by a, b, and c, respectively.

	Flows× Normal	Flows× Crisis	Liquidity× Normal	Liquidity× Crisis	Returns× Normal	Returns× Crisis	*R_US*× Normal	*R_US*× Crisis	*LIQ_US*× Normal	*LIQ_US*× Crisis	R^2
					Flows equation						
Developed Europe	0.1482[a]	0.1959[a]	0.0308	-0.0001	0.0457	-0.0257	0.0177	0.0443	0.1514[a]	0.1688[a]	0.08
Emerging Europe	0.2710[a]	0.2239[a]	-0.0479	0.0247	-0.0485	-0.0162	0.0278	0.0707[c]	0.1333[b]	0.1796[a]	0.1
Developed Asia/Pacific	0.1918[a]	0.2719[a]	0.041	-0.0067	0.1821[b]	0.1255[b]	-0.0779	0.0638	0.0311	0.0464	0.1
Emerging Asia	0.0741	0.2850[a]	-0.0051	-0.023	0.0111	0.0239	0.1134[a]	0.0547	0.0463	0.0534[c]	0.08
Developed America	-0.1878	-0.0731	0.2797[b]	-0.2401	0.5075[b]	0.062	-0.3366	0.226	-0.0139	0.4025[a]	0.2
Emerging America	0.3052[a]	0.0594[c]	0.0273	-0.0164	-0.017	0.013	0.0782	-0.0051	-0.002	0.0262	0.03
					Liquidity equation						
Developed Europe	0.0084	0.0107	0.4346[a]	0.5071[a]	0.3058[a]	0.1098[a]	0.1330[a]	0.0422	0.0418	0.0116	0.37
Emerging Europe	-0.0521	-0.0438	0.2054[a]	0.4347[a]	0.0683	0.1037[a]	0.2204[a]	0.0121	0.3207[a]	0.0509	0.2
Developed Asia/Pacific	-0.0941[c]	0.0034	0.4069	0.6651	0.5628	0.1413	-0.1244[b]	0.0811[c]	0.1565	0.0174[a]	0.48
Emerging Asia	-0.0387	0.0163	0.1134[a]	0.5126	0.3021	0.1317	0.1364	0.0056	-0.0005	0.4324[a]	0.33
Developed America	-0.0155	0.0285	0.6068[a]	0.6488[a]	0.7671[a]	0.1387	-0.3982[a]	0.0008	0.1054	0.1045	0.67
Emerging America	-0.0823	0	0.1556	0.476	0.0789	0.0457	0.0093	0.0374	0.019	-0.0031[a]	0.1

Table 2.6: Regressions to explain differences across countries in the response of liquidity to a shock in capital flows

This table presents the results of nine multivariate cross-sectional regressions of the six-month cumulative generalized impulse response (GIR) of market liquidity to a 1SD chock in capital inflows for each of the 46 countries in our sample on several country characteristics measuring a country's economic and financial development, regulatory environment, information environment, openness, and market risk. EMERGING is a dummy variable for emerging markets as classified by the IFC. GDP_CAPITA and MKTCAP_GDP (World Development Indicators) are the logarithm of the average ratio of stock market capitalization over GDP and the logarithm of GDP per capita. BANK_CREDIT_GDP (World Bank) is the logarithm of the ratio of domestic credit provided by commercial banks over GDP. TURNOVER (World Bank) is the total value of shares traded each year divided by the average market capitalization during the year. AD_RIGHTS (Djankov et al., 2008) is the anti-director rights index, which is an aggregate index of shareholders rights. RULE_OF_LAW (La Porta et al., 1998) measures the law and order tradition in the country. CORRUPTION (La Porta et al., 1998) measures the corruption in government. Short sales (Bris et al., 2007) is a dummy variable that equals 1 if short-selling is common practice. ACCOUNT_STAND (La Porta et al., 1998) measures information dissemination in accounting practices. ANALYST (Chang et al., 2000) measures the average number of analysts following large firms. MEDIA_DEVELOP (Bushman et al., 2004) measures media development in each country. CAP_CONTROLS and TRADE_FREEDOM (2009 Economic Freedom of the World annual report) measure international capital market controls and freedom to trade internationally. FOREIGN_BANKS (Levine, 2001) is the fraction of foreign-owned banking assets of total banking assets in a country. VOL is the average market-wide EGARCH(1,1) volatility for each country. Intercepts are suppressed to conserve space. Significance at the 1%, 5%, and 10% level is indicated by a, b, and c, respectively – based on heteroskedasticity consistent (White) standard errors.

		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
	EMERGING	0.0291								
	GDP_CAPITA		0.02							
Economic/ financial development	***MKTCAP_GDP***	-0.0859	0.0442	-0.0055	-0.1988^{b}	-0.1988^{c}	-0.1943^{b}	-0.1533	-0.1361	-0.2008^{b}
	BANK_CREDIT_GDP			0.2019	0.2468	0.2276	0.2309	0.1978	0.2095	0.2072
	TURNOVER					-0.0011				
	AD_RIGHTS	-0.0167								
Regulatory environment	***RULE_OF_LAW***		0.0199		-0.0213		-0.0326			
	CORRUPTION			0.0149						
	SHORT_SALES						0.0627			
	ACCOUNT_STAND	0.0239^{a}			0.0222^{a}	0.0219^{a}	0.0222^{a}	0.0200^{a}	0.0205^{a}	0.0224^{a}
Information environment	***ANALYST***		0.0099							
	MEDIA_DEVELOP			0.0017						
	CAP_CONTROLS							-0.0244		
Openness	***TRADE_FREEDOM***								-0.0485	
	FOREIGN_BANKS									-0.0315
Market risk	***VOL***								4.913	
# Obs.		37	43	39	36	36	35	36	36	36
R^2		0.36	0.2	0.24	0.43	0.43	0.43	0.42	0.43	0.42

Figure 2.1: Cumulative net portfolio flows by region, 1995:01 – 2008:12

This figure shows the cumulative aggregate net equity portfolio inflows for six regions from January 1995 to December 2008. We scale country-specific portfolio inflows by the market capitalization of the local stock market at the beginning of each month. Aggregate net flows by region are computed as the equally-weighted average of net flows across the countries in each region. We note that emerging Asia is plotted using the secondary y-axis on the right.

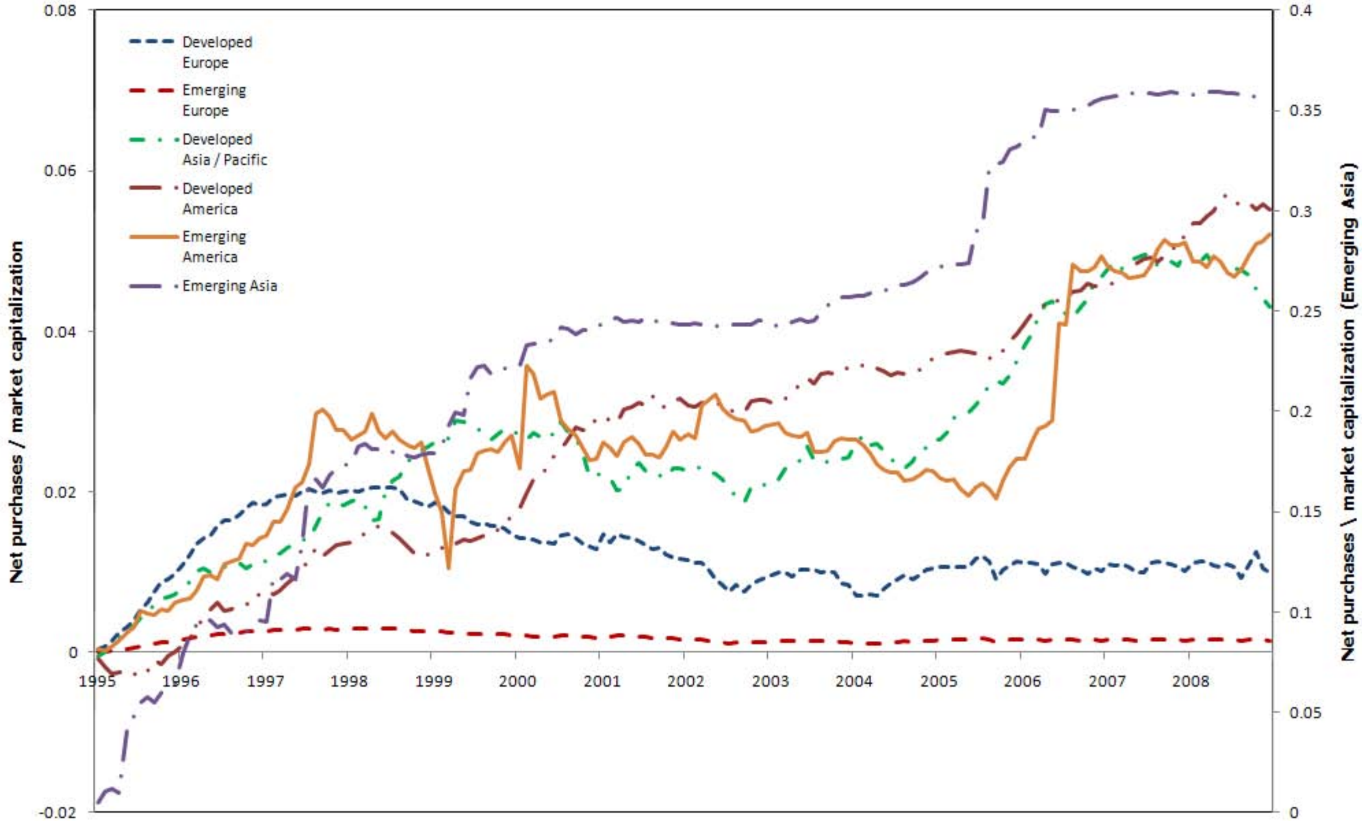


Figure 2.2: Aggregate market returns by region, 1995:01 – 2008:12

This figure shows the time-series of aggregate market returns for six regions from January 1995 to December 2008. We compute country-specific market returns as the value-weighted average of monthly returns (in local currency) across individual stocks within a country. Aggregate market returns by region are computed as the equally-weighted average of country-specific market returns across the countries in each region.

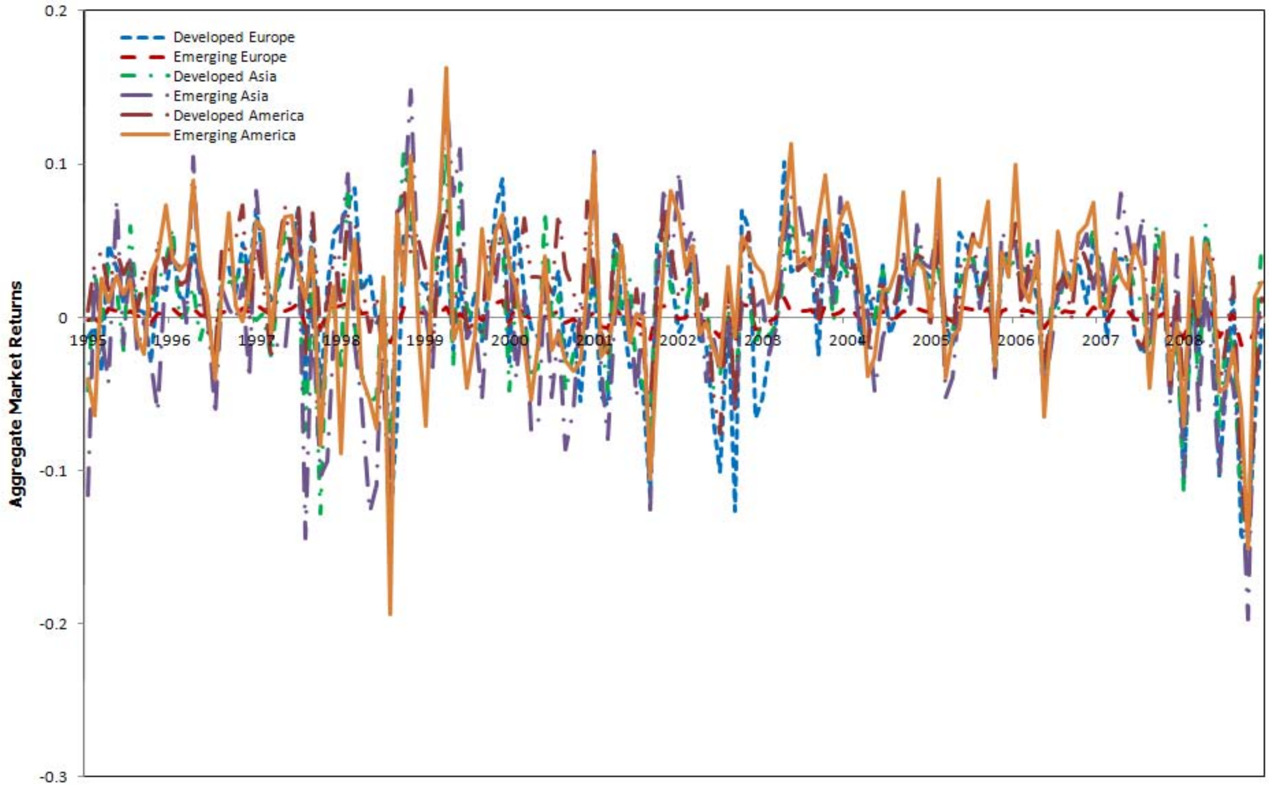


Figure 2.3: Aggregate market liquidity by region, 1995:01 – 2008:12

This figure shows the time-series of aggregate market liquidity for six regions from January 1995 to December 2008. We compute country-specific market liquidity as the value-weighted average of monthly stock liquidity across individual stocks within a country. Since the level of liquidity is not comparable across countries due to differences in trading volume definitions and currency units, we standardize the series to have zero mean and unit standard deviation before we aggregate within each region. Aggregate market liquidity by region is computed as the equally-weighted average of country-specific market liquidity across the countries in each region.

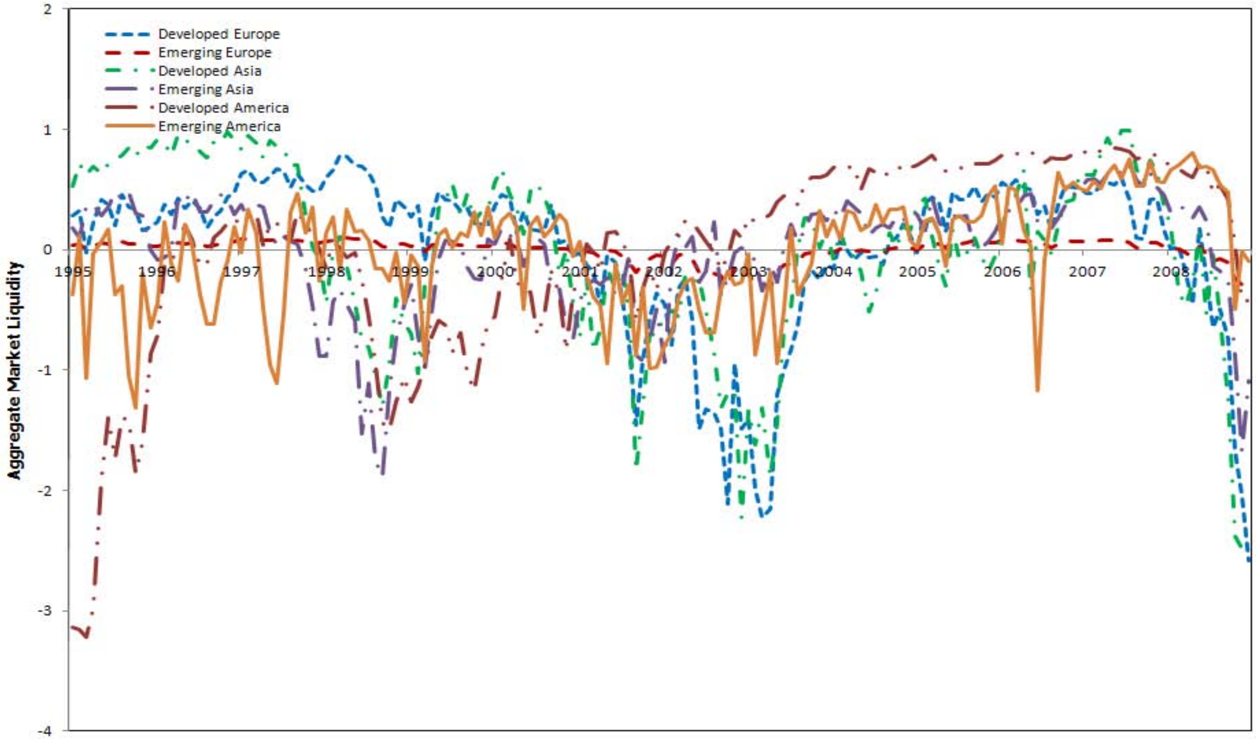


Figure 2.4: Cumulative GIRs of the baseline VAR model for developed/emerging Europe

This figure shows the standardized cumulative generalized impulse response functions (GIRs) based on the results of the baseline VAR models (with monthly net capital inflows, market liquidity, and market returns as endogenous variables) for developed and emerging Europe reported in Table 3. To conserve space, we only present GIRs of flows to a one standard deviation (1SD) shock in returns and liquidity (expressed as a fraction of 1SD of flows), and GIRs of returns and liquidity to a 1SD shock in flows (expressed as a fraction of 1SD of returns and liquidity). The 95% confidence intervals are computed using Monte Carlo simulation.

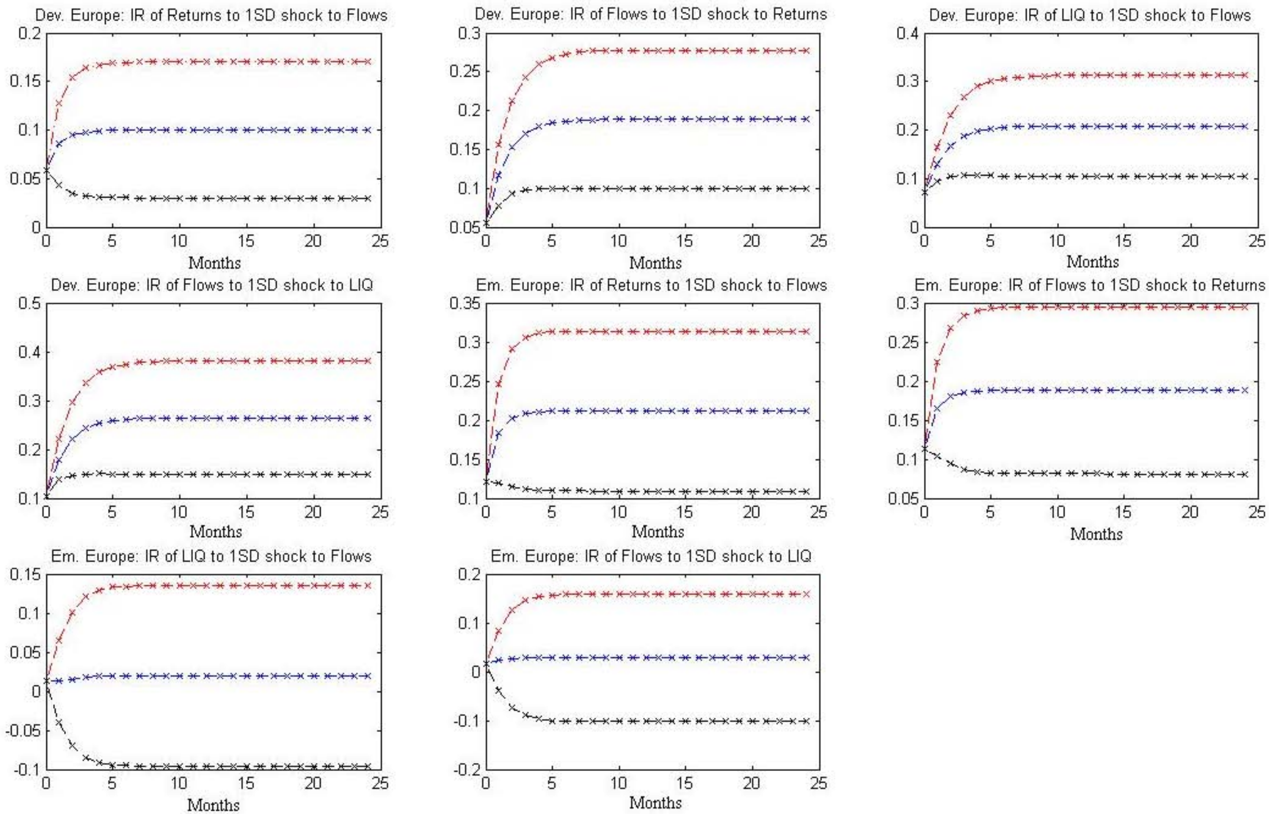


Figure 2.5: Cumulative GIRs of the baseline VAR model for developed/emerging Asia/Pacific

This figure shows the standardized cumulative generalized impulse response functions (GIRs) based on the results of the baseline VAR models (with monthly net capital inflows, market liquidity, and market returns as endogenous variables) for developed Asia/Pacific and emerging Asia reported in Table 3. To conserve space, we only present GIRs of flows to a one standard deviation (1SD) shock in returns and liquidity (expressed as a fraction of 1SD of flows), and GIRs of returns and liquidity to a 1SD shock in flows (expressed as a fraction of 1SD of returns and liquidity). The 95% confidence intervals are computed using Monte Carlo simulation.

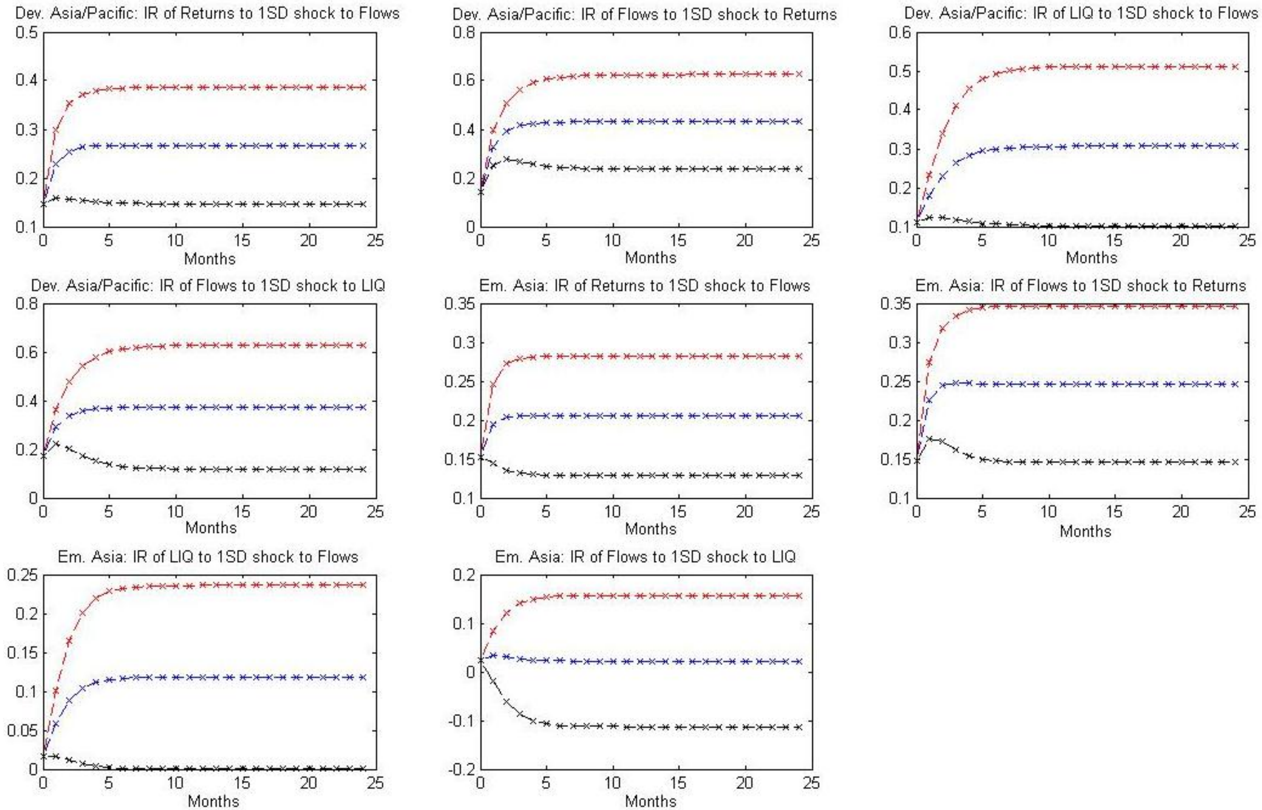


Figure 2.6: Cumulative GIRs of the baseline VAR model for developed/emerging America

This figure shows the standardized cumulative generalized impulse response functions (GIRs) based on the results of the baseline VAR models (with monthly net capital inflows, market liquidity, and market returns as endogenous variables) for developed and emerging America reported in Table 3. To conserve space, we only present GIRs of flows to a one standard deviation (1SD) shock in returns and liquidity (expressed as a fraction of 1SD of flows), and GIRs of returns and liquidity to a 1SD shock in flows (expressed as a fraction of 1SD of returns and liquidity). The 95% confidence intervals are computed using Monte Carlo simulation.

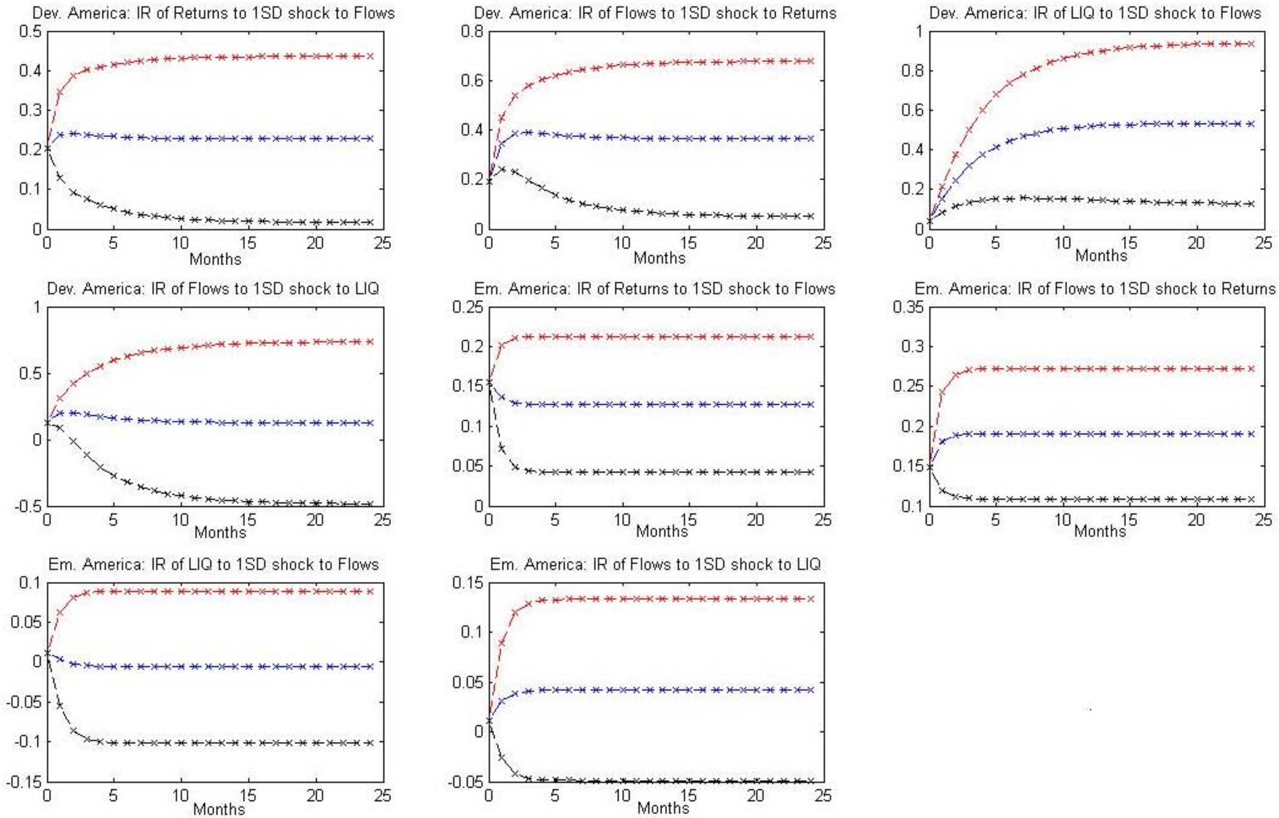


Figure 2.7: Cumulative GIRs of flows to a 1SD shock in liquidity for 46 individual countries

This figure shows the standardized cumulative generalized impulse responses (GIRs) of net capital inflows to a one standard deviation (1SD) shock in market liquidity after 3, 6, and 12 months (expressed as a fraction of 1SD of flows) for each of the 46 countries in our sample from January 1995 to December 2008. The GIRs are based on the results of the baseline VAR model (with monthly net capital inflows, market liquidity, and market returns as endogenous variables) estimated by country. The countries on the x-axis of the figure are grouped by region based on their economic development and geographic location: developed Europe, emerging Europe, developed Asia/Pacific, emerging Asia, developed America, and emerging America. Bars that are colored black indicate GIRs that are statistically significant at the 5% level, based on 95% confidence bounds computed using Monte Carlo simulation.

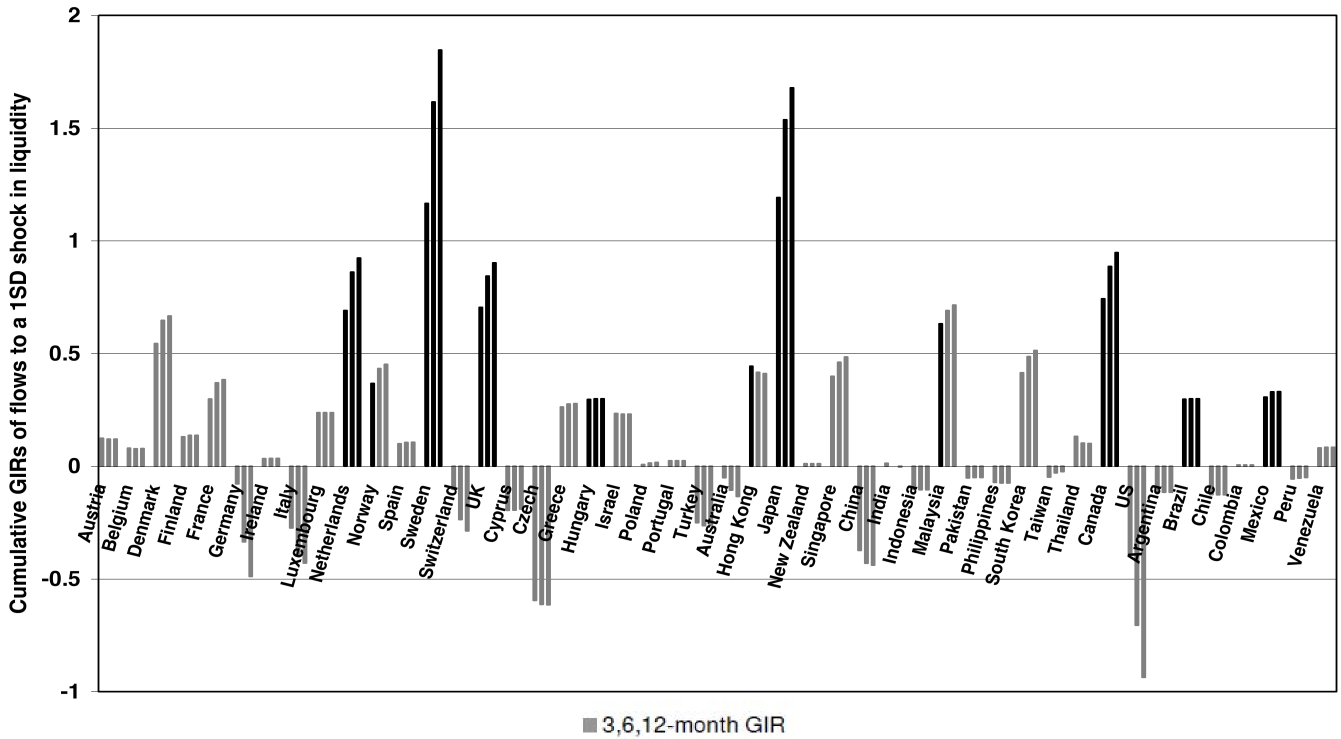
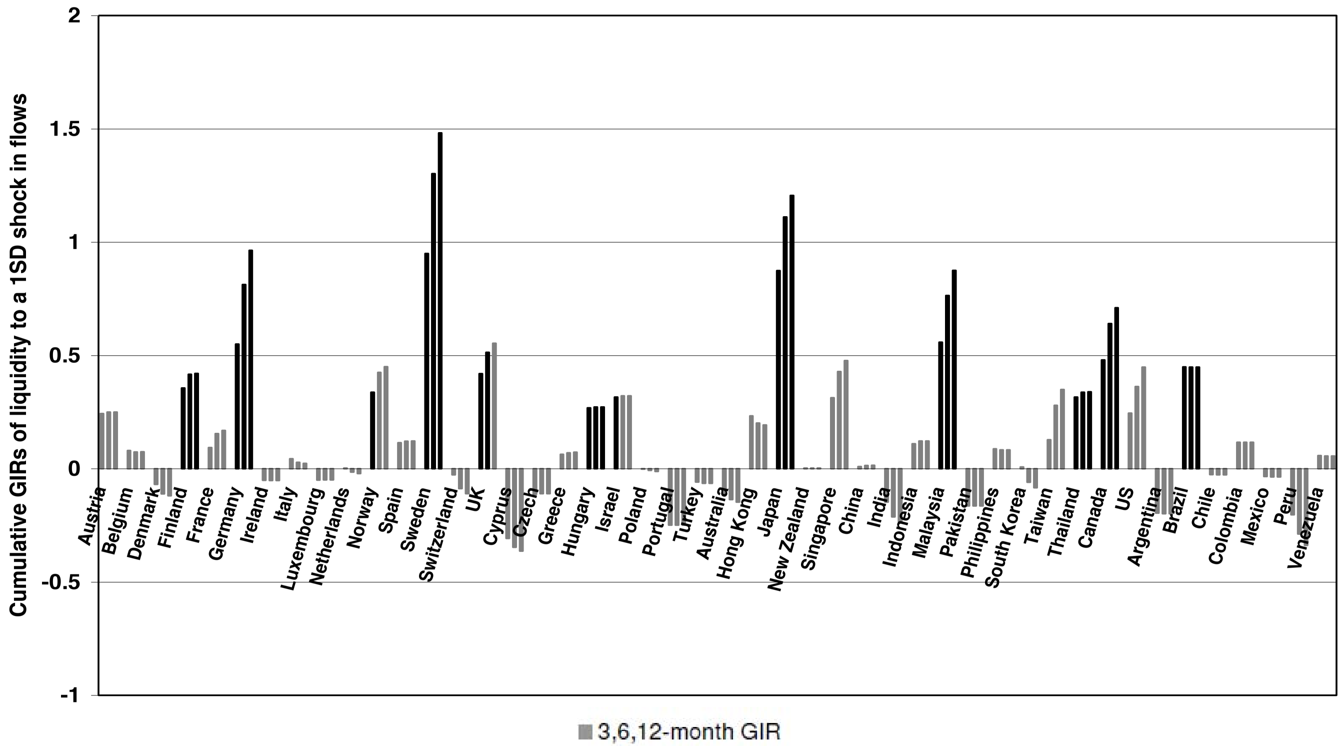


Figure 2.8: Cumulative GIRs of liquidity to a 1SD shock in flows for 46 individual countries

This figure shows the standardized cumulative generalized impulse responses (GIRs) of market liquidity to a one standard deviation (1SD) shock in market net capital inflows after 3, 6, and 12 months (expressed as a fraction of 1SD of liquidity) for each of the 46 countries in our sample from January 1995 to December 2008. The GIRs are on the results of the baseline VAR model (with monthly net capital inflows, market liquidity, and market returns as endogenous variables) estimated by country. The countries on the x-axis of the figure are grouped by region based on their economic development and geographic location: developed Europe, emerging Europe, developed Asia/Pacific, emerging Asia, developed America, and emerging America. Bars that are colored black indicate GIRs that are statistically significant at the 5% level, based on 95% confidence bounds computed using Monte Carlo simulation.



Chapter 3
Do Firms Issue More Equity when Markets are More Liquid?[5]

3.1 Introduction

If the demand for a firm's shares is perfectly elastic, an increase in the supply of that firm's shares resulting from an equity issue has no effect on the price of shares keeping everything else the same. The existing empirical literature presents considerable challenges to the view that the demand for shares is perfectly elastic. First, many studies build on the finding in Shleifer (1986) that firms added to indices, which increases their demand, experience abnormal returns. Second, studies that have access to data that make it possible to directly measure the demand for shares find that it is downward-sloping (e.g., Bagwell, 1992). Third, there is a vast literature showing that in many countries stock prices fall when an equity issue is announced, a result that is consistent with the existence of downward-sloping demand curves as well as other explanations (see Eckbo, Masulis, and Norli (2007) for a review of the literature). Fourth, more generally the theoretical and empirical market liquidity literature suggests that buy or sell orders (which tend to involve far fewer shares than equity issues) move share prices (e.g., Kyle, 1985; Easley and O'Hara, 1987; Glosten and Harris, 1988; Breen, Hodrick, and Korajczyk, 2002). Fifth, a more recent literature shows that market liquidity affects the expected costs of underwriters in placing an issue, their fees, and the price at which shares are sold (e.g., Gao and Ritter, 2010; Butler, Grullon, and Weston, 2005; Ellul and Pagano, 2006).

[5] Van Dijk thanks the Netherlands Organization for Scientific Research (NWO) for financial support through a "Vidi" grant. We are grateful for comments from Andrew Carverhill, Thierry Foucault, Jeffrey Pontiff, Ioanid Rosu, and seminar participants at Boston College, Boston University, Erasmus University, HEC Paris, and the 2012 Frontiers of Finance Conference at Warwick Business School.

Imperfect liquidity is a common thread to these findings from the empirical literature. As a firm's shares trade in a less liquid market, investors have to be given more of a discount to absorb these shares. We would therefore expect that equity issuance is more costly for existing shareholders when a firm's stock is less liquid. As issuance becomes more costly, firms are expected to issue less equity, everything else equal. In this paper, we investigate the hypothesis that security issuance is inversely related to illiquidity. We find very strong evidence across the world that firms become less likely to issue equity when the liquidity of equity markets worsens.

The liquidity of a firm's common stock can worsen because aggregate liquidity is becoming poorer or because of idiosyncratic shocks. Idiosyncratic liquidity shocks could be caused by shocks to firm attributes related to firm value, so that it would be difficult to identify the impact of liquidity as opposed to the impact of shocks to factors that affect liquidity but other firm characteristics as well. For instance, adverse information about a firm could lower the stock price and increase information asymmetry which would then lower liquidity as well. Since one would expect an increase in information asymmetry to make it more expensive for a firm to issue equity, identification of the liquidity effect when liquidity changes because of information asymmetry would be challenging. In this paper, we resolve this identification issue by focusing on equity issuance at the country level and by examining the relation between aggregate equity issuance and aggregate liquidity. Aggregate liquidity could affect a firm's decision to issue equity because there are strong common factors in liquidity (e.g., Chordia, Roll, and Subrahmanyam, 2000) and because aggregate liquidity could proxy for the general capacity of the market to absorb new shares.

We create a sample of equity issues that covers 36 countries from 1995 to 2008. Like earlier papers that investigate equity issuance globally, such as Henderson, Jegadeesh, and Weisbach (2006) and Kim and Weisbach (2008), we obtain the equity issues from SDC and include both initial public offerings and seasoned offerings. Our dataset has 1,872 country-quarters. We use two measures of equity issuance. The first measure consists of counts normalized by listings. The second one uses proceeds normalized by market capitalization. Most of our work focuses on the counts measure as the proceeds measure can be affected by a single large issue in many countries. We use the Amihud (2002) liquidity measure estimated across countries by Karolyi, Lee, and van Dijk (2012). The level of the Amihud measure is not comparable across countries due to differences in trading volume definitions and currency units. We thus standardize the Amihud measure, so that it can be compared in a meaningful way across countries. However, we would expect differences in levels of liquidity across countries to affect equity issuance. Further, as noted by recent studies (e.g., Doidge, Karolyi, and Stulz, 2012; Kim and Weisbach, 2008; McLean, Zhang, and Zhao, 2011), countries differ along many dimensions that affect equity issuance. We therefore estimate our regressions with country fixed effects and year fixed effects. All our regressions use quarterly data. When we regress our count equity issuance measure on lead liquidity innovations, contemporaneous liquidity innovations and four lags of liquidity innovations controlling for market returns, we find that while the effect of lead liquidity innovations is not significant, the lead as well as three of the four lagged liquidity innovation variables have a positive and significant coefficient.

The unconditional quarterly count variable is 2.52%. We find that a one standard deviation shock to liquidity increases equity issuance contemporaneously by 28 basis points, representing an increase of 11%. The economic impact of a liquidity innovation in any of the three prior quarters affects equity issuance at least by half of the contemporaneous impact. The cumulative effect of a one standard deviation improvement in liquidity on equity issues over the next five quarters is 101 basis points (or roughly 40% of the unconditional mean of the quarterly count variable). Another useful way to assess the importance of the liquidity effect is that liquidity innovations explain as much of the variation in equity issuance as stock returns. Stock returns are often used as a proxy for market timing.

After having established that equity issuance is positively related to liquidity innovations, we examine whether this relation could be explained by variables known to be correlated with aggregate liquidity that might affect equity issuance on their own. In particular, studies in the U.S. predicting aggregate seasoned equity issuance (e.g., Choe, Masulis, and Nanda, 1993) and the aggregate rate at which firms go public (e.g., Lowry, 2003) show that equity issuance is affected by the state of capital markets and aggregate economic activity, which are variables known to be related to liquidity as well. It is already known from the literature that aggregate equity issuance is lower when market volatility is higher (e.g., Schill, 2004). We therefore control for volatility. While we find a negative coefficient on lagged volatility, lagged volatility does not affect the coefficient on liquidity in a meaningful way. We do find that recent conditional volatility in liquidity (a measure of liquidity risk) is strongly negatively related to equity issuance, and reduces the explanatory power of lagged liquidity innovations, which suggests that firms not only care about the level of liquidity, but also about the risk that it deteriorates.

Market-to-book is used in studies of market timing (e.g., Loughran and Ritter, 1995, 1997; Baker and Wurgler, 2002; DeAngelo, DeAngelo, and Stulz, 2010). There is also evidence that more liquid firms in the U.S. have a higher market-to-book ratio (Fang, Noe, and Tice, 2009), so that liquidity could be proxying for market-to-book in our regressions. After controlling for liquidity and market returns, we find no significant effect of market-to-book on equity issuance, while our conclusion concerning the effect of liquidity is unchanged.

Recent literature shows that liquidity is a predictor of economic activity (e.g., Næs, Skjeltorp, and Ødegaard, 2010). Since at least Miller (1963), it is known that poor economic activity is associated with lower equity issuance and, not surprisingly, this finding holds in our sample. We find that when we control for proxies for future levels of economic activity, the coefficients on the liquidity measures remain significant.

Baker and Stein (2004) argue that liquidity is higher when more irrational investors are in the market and that the presence of these investors (in combination with short sales constraints) is associated with overvaluation. Their prediction is that firms issue more as liquidity improves. When we control for various measures of sentiment, we find that these measures are not related to equity issuance in our sample and the effects of the liquidity variables are unchanged when we include these measures. Also, we examine whether the effect of liquidity is symmetric, namely whether positive and negative shocks have a similar effect. We find that negative shocks have a much stronger effect and that there is little evidence that positive shocks have an effect at all. This finding is not supportive of Baker and Stein (2004) and other models whose key prediction is that an increase in liquidity leads to greater equity issuance.

We then turn to tests that focus more directly on the nature of the mechanism that explains this relation between liquidity and equity issues. We would expect that many factors that affect equity issuance would be the same for public and private equity issues. However, private equity issues do not increase the supply of traded shares as typically the investors in a private equity issue face restrictions on selling the shares. We would therefore expect firms to have a private equity issue rather than a public equity issue when liquidity is poor. We investigate this hypothesis and find support for it. Next, we would expect adverse liquidity shocks to be accompanied by postponements and cancellations of equity issues. We find that postponements are more likely for this group of countries following adverse liquidity shocks, although cancellations are not. When we examine whether the effect of liquidity is similar for IPOs and seasoned equity offerings, we find that it is stronger for IPOs. Through most of the paper, we measure equity issuance by dividing counts of equity issues by the number of listed firms. We would expect results to be weaker when we use proceeds instead of counts because the proceeds measure is extremely skewed and can be heavily influenced by one single extremely large issue in many countries. When we investigate whether there is a relation between aggregate equity issuance proceeds and liquidity at the country level, we find that such an effect exists, but only for IPOs.

Our paper contributes to several literatures. We obviously contribute to the equity issuance literature. We find that liquidity is an important determinant of equity issuance across the world. While the recent literature on equity issuance has focused on market timing motivations for equity issuance, we show that liquidity's importance is of the same magnitude as the market timing motivation. A growing recent literature emphasizes the interaction between market liquidity and funding liquidity, following the work of Brunnermeier and Pedersen (2009). The empirical literature on this interaction has focused on financial institutions. In this paper, we show that market liquidity affects funding liquidity generally. Several papers investigate how stock liquidity affects some aspects of the equity issuance process. In particular, Butler, Grullon, and Weston (2005) show that underwriters charge more as liquidity is lower and Gao and Ritter (2010) demonstrate that underwriters affect the slope of the demand function for shares through their marketing activities. Our paper adds to that literature by showing that aggregate liquidity has a powerful effect on security issuance. Finally, there is an extremely large literature on the role of liquidity on the pricing of financial assets. In this paper, we show that the effects of liquidity extend beyond financial markets; liquidity also has a pervasive impact on corporate financial policies. While Fang, Noe, and Tice (2009) and Lipson and Mortal (2009) show that stock liquidity is related to a firm's capital structure, such a finding does not necessarily mean that firms are more likely to issue equity in more liquid markets. Our contribution therefore helps understand one mechanism whereby more liquid firms have less leverage, namely that higher liquidity makes it less costly to issue equity.

The paper proceeds as follows. In Section 3.2, we introduce our sample. In Section 3.3, we show how equity issuance is related to liquidity. In Section 3.4, we check whether liquidity is related to equity issuance because it proxies for other variables that are known to affect equity issuance. In Section 3.5, we investigate in more detail how equity issuance depends on liquidity. We conclude in Section 3.6.

3.2 Data

We collect monthly data on the number of as well as on the amount of proceeds (in US$) raised from both IPOs and SEOs (public and private) in 36 countries from January 1995 to December 2008 from the Securities Data Company (SDC) database. Our sample consists only of common stock offerings (ordinary common shares). However, in discussions with SDC representatives it was brought to our attention that there is a limited number of outdated security classifications that refer to common shares and were applied in the early part of our sample for certain countries. For these cases, we extend our sample of equity offerings to include the earlier definitions as well.[6] We include only primary offerings, since pure secondary issues by current shareholders do not increase the supply of a firm's shares, and therefore fall outside the scope of the present study. We exclude issues by utility companies, which are heavily regulated (2-digit SIC codes of 49), as well as issues by financial firms (SIC codes between 6000 and 6999). We also exclude foreign issues and issues of depository receipts (DRs). In addition, we discard issues that although announced, have been eventually withdrawn (cancelled or postponed) from our main sample. For the U.S., we only include offerings from companies traded on the NYSE because our liquidity measure is not comparable across exchanges.[7] SEOs consist of public follow-on offerings, as well as private placements and rights offerings. The sample includes both underwritten issues and rights issues. In almost every market, the overwhelming majority of equity offerings are underwritten (the exceptions are Australia and Japan).

We aggregate equity issues at a quarterly frequency on the basis of their issue date. We deflate the quarterly number (US$ proceeds) of issues by the total number (market capitalization in US$) of all publicly listed companies in the country as of the end of the previous year. The resulting issuance measures reflect the relative increase in the supply of equity given the size of each market. We use the World Development Indicators database to obtain information on the number of listed companies in a market, and Datastream for the overall market capitalization.
As a measure of time-variation in liquidity, we use the market-wide Amihud (2002) proxy constructed by Karolyi, Lee, and van Dijk (2012) that is available for the 36 countries in our sample over our sample period.[8] The Amihud proxy is designed to capture the marginal impact of a unit of trading volume on the stock price. It is computed as the daily ratio of the absolute stock return over the local currency trading volume of the stock. This measure stays close to the intuitive description of liquid markets as those that accommodate trading with the least effect on price. Amihud (2002) shows that this measure is strongly positively related to microstructure estimates of illiquidity for the U.S. stock market. Hasbrouck (2006) and Goyenko, Holden, and Trzcinka (2009) show that the Amihud measure performs well relative to other proxies in capturing high-frequency measures of transaction costs based on U.S. data. Lesmond (2005) reports a high correlation

[6] Examples of such security definitions include the category of "Par Value Common Shares" for Japan, "Equity Shares" for India, and "Class A Common/Ordinary Shares" for China.
[7] We identify NYSE equity offerings based on the SDC field "Primary Exchange Where Issuer's Stock Trades".
[8] The data on liquidity is available at http://mathijsavandijk.com.

between the Amihud measure and bid-ask spreads in 23 emerging markets. Many recent empirical studies use the Amihud proxy to measure stock market liquidity, both for the U.S. and for other countries. Examples include Acharya and Pedersen (2005), Spiegel and Wang (2005), Avramov, Chordia, and Goyal (2006), Kamara, Lou, and Sadka (2008), Watanabe and Watanabe (2008), and Beber and Pagano (2011). Karolyi, Lee, and van Dijk (2012) take a log transformation of the Amihud measure and multiply it by -10,000 to obtain a measure that is increasing in liquidity. To mitigate the effect of outliers, we winsorize their monthly liquidity time-series at the 1^{st} and 99^{th} percentiles by country. We then transform the monthly market liquidity time-series to a quarterly frequency by computing the average within each quarter. We apply the same procedure to the monthly turnover time-series from Karolyi, Lee, and van Dijk (2012).

Because market liquidity is characterized by persistent long-term trends (e.g., Chordia, Roll, and Subramanyam, 2008; Naes, Skjeltorp, and Ødegaard, 2011), we test for stationarity using the panel unit root test of Levin, Lin, and Chu (2002) and find evidence of non-stationarity. Therefore, all our regressions include a measure of liquidity innovations (rather than liquidity levels), taken as the residuals from country-by-country AR(1) regressions of the level of market liquidity.

We obtain the daily total market return index for each country in our sample from Datastream. We then compute the equally-weighted average of the daily market returns within each quarter to obtain the corresponding quarterly time-series. We construct a quarterly time-series of market volatility for each country as the standard deviation of the daily market returns within the quarter and a quarterly time-series of liquidity risk as the conditional volatility of the raw quarterly liquidity series based on a GARCH(1,1) model.

We also construct quarterly time-series of idiosyncratic volatility and of "stock price synchronicity" (Morck, Yeung, and Yu, 2000) based on the average R^2 from a simple market model run for individual stocks based on daily data within the quarter. For this purpose, we use Datastream to collect the daily total return index (*RI*) and monthly market capitalization (*MV*; expressed in millions of local currency) for all individual stocks traded in the 36 countries in our sample. To be consistent with Karolyi, Lee, and van Dijk (2012), we limit our sample to only stocks from major exchanges.

Data on quarterly aggregate market-to-book ratios, price-earnings ratios, and dividend yields are also obtained from Datastream. As proxies for macroeconomic conditions we use the quarterly seasonally adjusted real GDP growth rates obtained from Haver Analytics, and the sales growth rates from obtained from Datastream (following, e.g., Lowry, 2003; Naes, Skjeltorp, and Ødegaard, 2011). For the same purpose, we use the amplitude adjusted composite leading economic indicator from the OECD, which is a compilation of several key economic indicators that provide signals on future turning points of economic activity.

To account for investor sentiment we use three different proxies: the U.S. investor sentiment index of Baker and Wurgler (2006), which is increasing with investors' optimism; the local closed-end country fund discount (Lee, Shleifer, and Thaler, 1991), which is only available for 24 countries in our sample; and a global sentiment indicator computed as the equally-weighted average of the discounts of local closed-end fund discounts as in Karolyi, Lee, and van Dijk (2012). For the latter two variables, lower numbers indicate more optimistic investors.[9]

Table 3.1 presents summary statistics for the number of equity issues, equity issuance proceeds, and market returns, liquidity, and volatility for each of the 36 countries in our sample. The table distinguishes developed and emerging countries based on the classification by the International Finance Corporation (IFC). The total number of equity issues (IPOs plus SEOs) in the sample is 47,399 (of which 36,400 took place in developed countries and 10,999 in emerging countries). The number of equity issues in Australia (12,013) is striking and may be due to the mining boom. We have carefully inspected the SDC data for Australia and found no reasons to assume that the number of equity issues is incorrect. Nonetheless, we rerun all our analyses without Australia to make sure the results are not driven by this particular country. Other countries with a large number of IPOs and SEOs over 1995-2008 include Canada, Hong Kong, India, Japan, South Korea, the U.K., and the U.S.

The second and third columns of Table 3.1 show the time-series mean and standard deviation of the quarterly number of equity issues scaled by the number of listed stocks by country. This is the main dependent variable in our analyses. On average, the countries in our sample experience a number of equity issues per quarter that corresponds to 2.52% of the number of listed stocks on the local equity market. There is considerable variation in the average equity issuance count variable across countries. The mean ratio of equity issues to listed stocks varies from 0.26% for South Africa to 15.31% for Australia. The ratio is larger in developed than in emerging countries (3.24% vs. 1.62%), even when we exclude Australia (2.61% vs. 1.62%). The time-series standard deviations in the third column of Table 3.1 suggest considerable time-variation in equity issuance. Consistent with prior studies, we find that equity issues tend to be clustered in time. The slope coefficient in a pooled AR(1) model of the quarterly equity issues count variable across countries is 0.81.

[9] Data for these variables is available at http://mathijsavandijk.com.

The fourth and fifth columns of Table 3.1 show the time-series mean and standard deviation of the quarterly proceeds of these equity issues (expressed in US$) scaled by the local stock market capitalization (also in US$). We use this equity issuance proceeds variable as an alternative to the counts variable in some of our tests. On average, firms in the countries in our sample raise public equity capital per quarter corresponding to 0.22% of the local equity market capitalization. This number is much smaller than the average count variable of 2.52% and thus indicates that the size of the average equity issue is much smaller than the average market cap of the firms listed on the local stock market. Average equity proceeds are somewhat greater in emerging countries than in developed countries, at 0.27% vs. 0.18%. China displays an outlier for this variable, with average equity proceeds per quarter corresponding to 0.77% of the local market capitalization, or 3.5 times the average across all 36 countries. Again, we have no reasons to question the SDC data for China and suspect this number is driven by several large privatizations early on in the sample when the Chinese stock market was still relatively undeveloped.

The means and standard deviations of market returns, market liquidity, and market volatility lie in the same range of values as reported by Karolyi, Lee, and van Dijk (2012) when we take into account that we measure market returns in % per quarter and market volatility in % per day – as opposed to per month as in Karolyi, Lee, and van Dijk (2012). 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. Therefore, we standardize the quarterly time-series of market liquidity innovations for each country to have zero mean and unit standard deviation in our tests.

3.3 Does liquidity help to explain time-variation in equity issues?

Table 3.2 shows the estimation results of pooled tobit models to explain quarterly variation in the equity issuance count variable (i.e., the number of IPOs + SEOs scaled by the number of listed stocks) in the 36 countries in our sample over 1995-2008 (in unreported tests, we obtain similar results when we exclude the years of the recent global financial crises 2007-2008). We use tobit specifications since the dependent variable is truncated at zero; many of the countries in our sample have zero equity issues in at least some quarters. Almost all models include country fixed effects to account for time-invariant country characteristics that can explain cross-country variation in equity issuance intensity. To be conservative, we also include year fixed effects in almost all models to account for any common global trends – although they subsume some of the time-variation in equity issues that could potentially be due to liquidity. As prior studies (e.g., Lowry, 2003) argue that there may be institutional reasons that cause equity issuance to be less intense in the first calendar quarter, we also include a quarter one dummy in many of the tobit models. In the last model of Table 3.2, we also include a lagged dependent variable. Standard errors are clustered at the country-level. The last two rows of Table 3.2 report the results of F-tests on the joint significance of all liquidity variables, and of only the lagged liquidity variables.

Model (1) of Table 2 includes one-quarter lead local stock market liquidity innovations, contemporaneous liquidity innovations, and four quarterly lags of liquidity innovations as explanatory variables. The coefficients on the contemporaneous and the first three lags of liquidity innovations are all positive and statistically significant, which is consistent with the hypothesis that firms issue more equity in and following quarters of improving market liquidity. The coefficient on lead liquidity innovations is close to zero and statistically insignificant. There is thus little evidence of liquidity timing in the sense that firms are able to time their equity issues before market liquidity worsens.

The economic effects of contemporaneous and lagged liquidity innovations are substantial. A one standard deviation increase in market liquidity is associated with a contemporaneous increase in equity issues by 28 basis points (equal to the magnitude of the coefficient, since the liquidity variables have been standardized to have unit standard deviation), which corresponds to 11% of the unconditional average ratio of equity issues of 2.52%. The economic effects of the lagged liquidity variables are smaller, but still sizable at more than half of the contemporaneous effect. The cumulative effect of a one standard deviation improvement in liquidity on equity issues over the next five quarters is 101 basis points (or around 40% of the average fraction of issues in any given quarter across all countries in our sample).

One could argue that the contemporaneous effect of liquidity on issues may be driven by reverse causality, since equity issues could affect local stock market liquidity. However, there are at least three reasons why this is unlikely to be a concern in our analyses. First, equity issues correspond to a tiny fraction of existing listings on each market (counts are on average 2.52% of the number of listed stocks and proceeds are on average 0.22% of local market capitalization) and we measure market liquidity based on the value-weighted average liquidity across the existing stocks on a market. We thus expect the impact of equity issues on our liquidity variables to be very small. Second, if anything, we would expect the effect of equity issues on market liquidity to be negative, while we find a positive coefficient on contemporaneous liquidity innovations in Table 3.2. IPOs tend to involve relatively small stocks that are less liquid than the average existing stock. SEOs create the equivalent of a large sell order imbalance on the market for existing stocks, which is likely to temporarily depress liquidity. Third, in each of the models in Table 3.2 at least two of the coefficients on the lagged liquidity variables are significant (in addition to the significant contemporaneous effect of liquidity), which suggests that liquidity matters even when disregarding the contemporaneous effect because of potential reverse causality concerns.

In model (2) of Table 3.2, we use the same specification as in model (1) but then for lead, contemporaneous, and lagged local market returns instead of market liquidity innovations (for the same sample of country-quarters). These results serve two purposes. First, they confirm the finding of prior work that equity issues are positively and significantly related to contemporaneous and lagged market returns, and negatively and significantly related to lead market returns.[10] Second, they provide a benchmark for the importance of the effect of market liquidity in model (1). Both the contemporaneous and the lagged effects of liquidity innovations are comparable in magnitude to the effects of market returns. The cumulative effect of a positive one standard deviation shock to market returns on equity issues over the next five quarters is 102 basis points (not taking into account the coefficient on lead market returns), which is almost identical to the cumulative effect of 101 basis points for liquidity innovations discussed above.

In model (3), we include liquidity innovations and returns at the same time. The effects of both diminish somewhat relative to the first two models (for example, the coefficient on one-quarter lagged liquidity innovations becomes insignificant), but both liquidity and returns are still statistically and economically significant determinants of time-variation in equity issues and still have comparable cumulative effects. The coefficient on the quarter one dummy is negative and significant, but its inclusion does not materially affect the coefficients on the liquidity and return variables. In model (4), we drop the lead liquidity innovations as well as the three- and four-quarter lags of market returns as they are not significant in model (3). Models (5) and (6) demonstrate that the effects of liquidity and returns are roughly equally strong when we discard either the year fixed effects or both the year and country fixed effects. Model (7) includes a lagged dependent variable, which has a coefficient of 0.544 and is statistically significant. The effects of liquidity and returns survive. In most of the other analyses we present below, we do not include a lagged dependent variable since our purpose is to understand

[10] Whether the latter finding can be attributed to market timing abilities by managers is subject to debate (e.g., Butler, Grullon, and Weston, 2005).

which economic forces drive time-variation in equity issues rather than to develop the best possible econometric model to explain the dynamics of equity issues.
In unreported robustness tests, we estimate the specifications in Table 3.2 using panel tobits with random effects (instead of country fixed effects) and using regular panel models (instead of tobits) and obtain similar results.

In sum, Table 3.2 presents evidence that equity issuance is positively related to innovations in liquidity. The effect of liquidity on equity issues survives controlling for market returns and is roughly equally important as the effect of market returns uncovered by earlier studies.

3.4 Is the effect of liquidity due to other factors?

The results in the previous section show that equity issuance is positively related to liquidity, even after controlling for market returns. This finding is consistent with the hypothesis that managers take the costs associated with downward-sloping demand curves into account in their decision to issue equity. However, it could also be the case that our liquidity variables proxy for other factors that affect equity issuance. In this section, we investigate whether the effects of liquidity can be explained by other financial and economic variables, including capital market conditions, (expected) economic activity, asymmetric information, and investor sentiment.

Table 3.3 reports the results of tobit regressions that include various other measures of capital market conditions in addition to market liquidity innovations and market returns. All models include country and year fixed effects as well as the quarter one dummy. Significance is again based on standard errors clustered at the country-level.

In model (1), we add contemporaneous and lagged market volatility to our baseline model that includes market liquidity and returns. We know that liquidity is negatively related to volatility (e.g., Chordia, Sarkar, and Subrahmanyam, 2005) and Schill (2004) shows there are fewer equity issues in volatile times. It is thus possible that the effects of liquidity in Table 3.2 capture the role of market volatility. Consistent with Schill (2004), we find a negative and significant coefficient on (one-quarter lagged) volatility. However, there is virtually no change in the magnitude and statistical significance of the coefficients on the liquidity variables.
Baker and Stein (2004) argue that market liquidity is a sentiment indicator and that periods of positive sentiment coincide with intense equity issuance. Using turnover

as a liquidity proxy, they show that liquidity is positively correlated with aggregate time-variation in U.S. equity issuance. Model (2) of Table 3.3 shows that the liquidity effects in our global sample are not driven by turnover. The coefficients on neither contemporaneous nor on one- or two-quarter lagged market turnover are significant and the coefficients on the liquidity variables are unaffected. Model (3) shows that the contemporaneous effect of liquidity survives controlling for a proxy for liquidity risk (conditional liquidity volatility based on a GARCH(1,1) model). However, the significantly negative effect of one-quarter lagged liquidity risk and the weakened effects of lagged liquidity innovations suggest that equity issuance is in part related to liquidity because firms respond to uncertainty about liquidity in the recent past.

Although we control for potential market timing effects using lead, contemporaneous, and lagged market returns, many studies use the market-to-book ratio as a proxy for market timing. Since more liquid firms in the U.S. have a higher market-to-book ratio (Fang, Noe, and Tice, 2009), we want to make sure that liquidity is not picking up the effect of market-to-book. Model (4) shows that issuance is not related to the market-to-book ratio after controlling for liquidity and returns, and the effects of liquidity are not diminished. Model (5) shows a significant effect of the contemporaneous price-earnings ratio on equity issues, but again the effects of liquidity are intact. The coefficients on the dividend-price ratio in model (6) are not significant. The effects of liquidity can thus not be attributed to these valuation proxies.

The estimation results of model (7) indicate that even when controlling for all of these variables as well as a lagged dependent variable, there is still a statistically and economically significant effect of liquidity innovations on aggregate equity issues. In addition to the effects of liquidity and market returns, model (7) still shows a significant effect of liquidity risk and of the price-earnings ratio. In sum, the effect of liquidity is not driven away by controlling for a host of other capital market conditions.

Recent studies show that liquidity forecasts economic activity (e.g., Næs, Skjeltorp, and Ødegaard, 2010) and we know from the equity issuance literature that firms issue more equity in anticipation of better economic conditions. Following Lowry (2003), we proxy for expectations about economic conditions using contemporaneous and lead GDP growth as well as sales growth in models (1) through (3) of Table 3.4. Lowry introduces these variables as proxies for the demand for capital. In model (3), we also include the composite leading economic indicator by the OECD. (We note that data on the sales growth and the leading economic indicator variables are available for fewer country-quarter observations than reported in Tables 3.2 and 3.3.) In line with the results of earlier studies that document that firms issue more equity in (anticipation of) good economic times, the coefficients on contemporaneous GDP growth and sales growth are positive and significant – though only when these variables are considered in isolation. Moreover, the effects of the liquidity variables are still significant.

It is well-documented that the liquidity of a stock is inversely related to the degree of asymmetric information about the stock's value. More asymmetric information is also likely to lead to greater costs of raising equity capital, so changes in information asymmetries could influence liquidity and equity issuance simultaneously and in the same direction. As argued in the introduction, this identification issue is unlikely to be of great concern in our analysis of the effect of aggregate liquidity on aggregate equity issuance.[11] Nonetheless, it may be the case that market-wide fluctuations in information asymmetries affect aggregate liquidity and aggregate issuance at the same time and in a similar way. In model (4) of Table 3.4, we include two proxies for market-wide variation in information asymmetries. The first is idiosyncratic volatility, computed as the value-weighted average of the residual volatility from market model regressions run for each individual stock within a country. The second is "stock price synchronicity," which is computed as the equally-weighted average R^2 from market model regressions run for each individual stock within a country. Morck, Yeung, and Yu (2000) argue that greater stock price synchronicity is associated with less-informative stock prices. Model (4) shows that the inclusion of these variables does not materially affect the coefficients on the contemporaneous and lagged liquidity innovations.

Models (5) through (7) of Table 3.4 include various proxies for investor sentiment. In the model of Baker and Stein (2004), irrational investors can drive up stock prices above their fundamental value in the presence of short-sales constraints, and irrational investors also make the market more liquid. If market liquidity and sentiment are related, the effects of liquidity on equity issues could thus be driven not by managerial concerns about downward-sloping demand curves, but by their incentives to issue equity when their stock is overvalued. Investor sentiment should be reflected in market returns and valuation ratios, so our evidence that the effects of liquidity survive the inclusion of returns and valuation proxies (such as market-to-book) is hard to reconcile with a sentiment-based explanation for our main results. However, to further examine the sentiment hypothesis, we also include direct proxies for sentiment in our tobit models. We use local and global closed-end country fund discounts (Lee, Shleifer, and Thaler, 1991) and the U.S. investor sentiment index of Baker and Wurgler (2006) as proxies for variation in investor sentiment. We obtain the country fund discount variables from Karolyi, Lee, and

[11] Baker and Stein (2004, p. 272) state that it seems "a stretch to argue that there are large swings in the degree of asymmetric information about the market as a whole."

van Dijk (2012). They construct time-series of local closed-end country fund discounts for 22 of the countries in our sample based on a sample of 42 closed-end funds. The global sentiment indicator is the equally-weighted average of the discounts of these 42 country funds. None of the sentiment variables is significant in models (5) through (7) and the effects of liquidity remain significant even after controlling for these sentiment proxies. The magnitudes of the coefficients on liquidity innovations are somewhat attenuated in model (7), but this model can only be estimated based on 840 country-quarter observations (compared to 1,800 in Table 3.2) and the *F*-tests in the bottom two rows of Table 3.4 confirm that the joint effects of all liquidity variables and of only the lagged liquidity variables are still significant at the 5% level.

Overall, the results in Tables 3.3 and 3.4 suggest that the positive relation between market liquidity and aggregate equity issues is not due to economic or financial variables that are unrelated to the aggregate demand elasticity of the stock market, but could simultaneously affect liquidity and equity issuance for other reasons.

3.5. How do equity issues depend on liquidity?

In this section, we investigate the mechanism through which liquidity affects equity issuance. We explore asymmetries in this relation, study the choice between private and public equity issues, and analyze postponement and cancellations of equity issues. We conclude with an analysis of the effect of liquidity on IPOs vs. SEOs and of the effect of liquidity on equity issue proceeds rather than equity issue counts.

Table 3.5 allows for an asymmetric effect of declines and improvements in liquidity by introducing dummy variables indicating quarters with the top (Market liquidity UP) and the bottom (Market liquidity DOWN) 33% observations by country based on liquidity innovations. The table contains five different models that differ in the number of lags of these dummy variables and in the extent to which we control for market returns. The results are consistent throughout the table: the relation between liquidity and equity issues is driven by the quarters with the greatest deterioration in liquidity. The coefficient on the contemporaneous DOWN market liquidity dummy is always statistically significant at the 5% level or better. Its magnitude suggests that the ratio of equity issues is about 30 to 40 basis points lower in quarters with the most negative liquidity innovations, or about 15% of the unconditional average ratio of equity issues of 2.52%. In addition, in most models, the coefficients on at least two of the lagged DOWN liquidity dummies are significant. In model (4), the cumulative effect of a large deterioration in liquidity on equity issues over the next five quarters (based only on the significant coefficients on the DOWN liquidity dummies) is negative 89 basis points, or around 35% of the average fraction of issues in any given quarter across all countries in our sample. This effect is close in magnitude to the cumulative effect of a one standard deviation shock to liquidity documented in Section 3.3 based on Table 3.2. In contrast, we find only weak evidence that equity issuance goes up in or following quarters with large improvements in market liquidity. The coefficient on the contemporaneous UP market liquidity dummy is positive and significant at the 10% level, but only in models (1) and (2) and none of the lagged UP market liquidity variables has a significant coefficient.[12]

These results seem to be at variance with the intuition of the model of Baker and Stein (2004), which predicts that liquidity is related to equity issues because – in the presence of short-sales constraints – stocks can become overvalued and more liquid at the same time, and managers tend to issue more equity during these times. In contrast, our results are driven by periods of deteriorating liquidity. More generally, stories about managers exploiting mispricing on the equity market tend to focus on episodes of overvaluation and high liquidity when the overvaluation is associated with active participation in the markets of noise traders. The asymmetric effects of liquidity innovations on equity issuance documented in Table 3.5 thus seem hard to reconcile with alternative explanations based on investor sentiment.

It is interesting to note that although Baker and Stein (2004) argue that liquidity and sentiment are positively related, they do not necessarily attribute the positive empirical relation between market turnover (their proxy for liquidity) and aggregate U.S. equity issuance they find to managers having some comparative advantage in assessing mispricing and therefore timing equity issues to exploit overvaluation. In fact, footnote 7 of Baker and Stein (2004) discusses that their preferred interpretation is that "managers care about market liquidity per se – i.e., they simply wish to avoid large price impacts when issuing equity." The bigger point Baker and Stein want to make is that managers may appear to time the market successfully even when they base their decision to issue equity on the demand elasticity of the equity market, which happens to be correlated with investor sentiment.

The results in Table 5 lead us to conclude that it is unlikely that the effect of liquidity on equity issuance is due to sentiment. First, sentiment should be picked up by the market return variables and valuation proxies. Second, including direct

[12] In unreported robustness tests, we obtain almost identical results for the UP and DOWN liquidity dummies when we allow for asymmetric effects of market returns in a similar way.

measures of sentiment in our regression does not take away the effects of liquidity. Third, the effects of liquidity are driven by large deteriorations in liquidity, which is not consistent with common stories about how sentiment affects public capital raising.

We would expect that many of the other factors that could affect equity issues (and that may not have been perfectly controlled for in Tables 3.2 through 3.5) should have similar effects on public and private equity issues. However, downward-sloping demand curves are less of a concern for private equity issues since investors in a private issue tend to face restrictions on selling the shares, which implies that a private equity issue has less of an effect on the supply of shares in the public market. We therefore expect that poor liquidity conditions lead managers to opt for a private rather than a public equity issue. We test this conjecture in Table 3.6 by estimating tobit models to explain time-variation in the quarterly number of privately placed SEOs scaled by the number of public SEOs plus the number of privately placed SEOs. All models in Table 3.6 contain contemporaneous and lagged market liquidity innovations and market returns as well as lead of market returns. Models (2) through (6) also include proxies for capital market conditions, future economic activity, or asymmetric information. The bottom line is that liquidity has a negative and significant effect on the fraction of private equity issues. In other words, firms tend to issue more private equity relative to public equity when market liquidity deteriorates. In model (1), the cumulative effect of a one standard deviation deterioration in liquidity on the fraction of private equity issues over the next two quarters is around 3.1% (where the unconditional average fraction of private SEOs in our sample is 25.0%). The negative relation between the fraction of private equity issues and liquidity innovations survives the inclusion of market volatility, market-to-book, idiosyncratic volatility, and stock price synchronicity.

If firms are concerned about the price impact of equity issues, adverse liquidity shocks should make them more likely to postpone or cancel equity issues previously filed. We investigate this hypothesis in Table 3.7. We obtain quarterly data on the number of postponements and cancellations from SDC. We scale the number of postponements (cancellations) in a country-quarter by the number of actual equity issues plus the number of postponements (cancellations). Models (1) through (4) explain time-variation in postponements, while models (5) through (8) explain time-variation in cancellations. Like in Table 3.6, we control for market returns and for proxies for capital market conditions, future economic activity, or asymmetric information in different models. One drawback of the SDC data on postponements and cancellations is that they are reported by the filing date of the equity issue and not by the actual postponement or cancellation date. We expect that most postponements and cancellations are announced within six months of the filing date, so we include only contemporaneous and two quarterly leads of the explanatory variables in Table 3.7. The aggregation of postponements and cancellations by filing dates prevents us from making strong statements about the exact timing of postponements and cancellations relative to changes in market liquidity, returns, capital market conditions, and economic activity.

Model (1) of Table 3.7 shows that postponements are negatively related to both market liquidity innovations and to market returns, consistent with the hypothesis that firms tend to postpone equity issues during times of deteriorating liquidity and decreasing valuations. The economic effect of liquidity is large and of the same order of magnitude as that of returns. Both the effects of liquidity and returns survive the inclusion of additional variables in models (2) through (4). In contrast, we find no significant effect of the liquidity variables on the fraction of cancelled equity issues. A potential explanation is that cancellations of equity issues are more costly (if only as a signal about the issuing firm's prospects) and are therefore less likely to be based on capital market conditions alone. We do still find a significantly negative effect of market returns, though it is weaker in models (5)-(8) than in models (1)-(4). Unreported results show that the impact of liquidity on postponements of equity issues is similar for IPOs and SEOs.

In Table 3.8, we examine whether the effects of market liquidity innovations are different for IPOs and SEOs. Models (1) through (4) have the ratio of IPOs to listed stock as dependent variable, while models (5) through (8) are based on SEOs over listed stocks. There are a number of interesting results in Table 3.8. First, liquidity is a significant determinant of time-variation in both IPOs and SEOs. Second, the liquidity effects are stronger for IPOs. The cumulative effect of a one standard deviation shock to liquidity on equity issues over the next five quarters (based only on the significant liquidity coefficients in models (1) and (5)) is 65 basis points for IPOs and 25 basis points for SEOs. The effect of contemporaneous liquidity innovations is stronger for IPOs than for SEOs throughout. In models (4) and (8) – which control for all explanatory variables in this table – four of the five liquidity coefficients are significant for IPOs, versus only two for SEOs. That said, the number of observations is significantly reduced in models (4) and (8) and, if anything, the *F*-tests reported in the last two rows of Table 3.8 seem to suggest a stronger joint effect of lagged liquidity for SEOs. Third, the effects of market returns are considerably stronger both statistically and economically for SEOs than for IPOs. Most notably, the negative effect of one-quarter lead returns reported in previous tables is only observed in the SEO specifications. In other words, the evidence consistent with market timing is much stronger for SEOs than for IPOs.

In Table 3.9, we investigate whether our finding that firms issue less equity when market liquidity deteriorates is robust to using equity issue proceeds instead of equity issue counts. We run similar tobits as before, but use quarterly equity issue proceeds scaled by the local stock market capitalization (both expressed in US$) as dependent variable. We again distinguish between IPOs and SEOs; models (1) through (4) try to explain time-variation in IPO proceeds, and models (5) through (8) focus on SEO proceeds. Ex ante, we expect these results to be weaker since the proceeds measure is highly skewed and is more sensitive to individual extreme observations. We therefore drop China from the sample for this analysis, as Table 3.1 shows that there were a number of issues with very large proceeds that are likely to influence the results. (We obtain slightly weaker results when we include China.)

Models (1) through (4) of Table 3.9 show a strong effect of liquidity innovations on IPO proceeds. At least two of the coefficients on contemporaneous and lagged liquidity innovations are significant in each model. The cumulative effect of a one standard deviation shock to liquidity on IPO proceeds over the next five quarters (based only on the significant liquidity coefficients in model (1)) is 0.09% of local market capitalization, which corresponds to around 40% of the unconditional average fraction of equity issues of 0.22% in our sample – an economic effect that is comparable in magnitude to the effect on equity issue counts documented in Section 3.3 based on Table 3.2. In contrast, models (5) through (8) show almost no significant effect of liquidity innovations on SEO proceeds.

3.6 Conclusions

In this paper, we have shown that equity issuance across the world is strongly related to equity market liquidity. In particular, liquidity is an equally important determinant of equity issuance as market returns. We provide evidence that this important role of liquidity in equity issuance cannot be attributed to liquidity serving as a proxy for future economic growth or market sentiment. The relation between equity issuance and liquidity appears stronger for decreases in liquidity than increases. As one would expect, the fraction of private equity issues to public equity issues increases as liquidity worsens since private equity issues do not increase the supply of traded shares in the short run because of restrictions on selling the shares from such issues. We interpret our finding to be supportive of the view that that in imperfectly liquid markets, the demand for shares is downward-sloping and that corporations take into account the slope of the demand curve for shares in their financing decisions. Our analysis has focused on market-level liquidity and issuance. Further research should examine whether liquidity at the firm level affects financing policies as well.

Table 3.1: Summary statistics

This table reports the total number of equity issues (IPOs and SEOs from SDC), and the time-series average and standard deviation (based on quarterly data) of the number of equity issues scaled by the number of listed stocks, of the total proceeds (in US$) of these equity issues scaled by the local stock market capitalization (in US$), of local stock market returns (in local currency), and of market liquidity, as well as the time-series average of the local market volatility. The sample covers the period from the first quarter of 1995 through the fourth quarter of 2008 (with the exception of Brazil and Germany, for which the data start in 1999:I, and Poland, for which the data start in 1996:II). Market returns are the total returns on the value-weighted local market index from Datastream. The liquidity time-series are taken from Karolyi, Lee, and van Dijk (2012) and are based on the value-weighted average of the daily estimates of Amihud's (2002) price impact proxy for individual stocks – computed as the absolute stock return divided by local currency trading volume. The Amihud measure is multiplied by -10,000 so that we obtain a measure that is increasing in liquidity. Volatility is the value-weighted average of individual stock volatility for every quarter.

Countries	# Equity issues	# Equity issues / # Listed companies		Proceeds / local market cap		Market returns		Market liquidity		Market volatility
		mean (%)	st.dev.	mean (%)	st.dev.	mean (%)	st.dev.	mean	st.dev.	mean
Developed Countries										
Australia	12,013	15.309	4.5993	0.4126	0.5686	0.0391	0.0988	-0.706	0.3872	0.8445
Austria	95	1.7238	1.8889	0.2189	0.2689	0.0219	0.1636	-0.9726	0.6679	0.8661
Belgium	151	1.6293	2.0957	0.0906	0.1401	0.026	0.158	-0.5089	0.3242	0.9367
Canada	5,178	5.1065	3.1686	0.2284	0.1823	0.0422	0.132	-0.7698	0.4018	0.9106
Denmark	197	1.6133	1.4026	0.1173	0.1563	0.0384	0.1568	-0.0748	0.0643	0.9925
Finland	181	2.757	3.0731	0.1586	0.2696	0.0621	0.2785	-0.4777	0.4481	1.8307
France	1,138	2.7289	1.7541	0.1753	0.243	0.0391	0.1688	-0.9335	0.6931	1.1561
Germany	934	2.3011	2.1491	0.2317	0.2787	0.0304	0.1799	-1.2991	0.9297	1.1213
Hong Kong	2,823	5.9706	3.4771	0.1055	0.0862	0.0393	0.1952	-0.0827	0.0636	1.4499
Italy	377	2.5403	2.3623	0.2953	0.5504	0.0291	0.172	-0.2152	0.1764	1.1665
Japan	4,534	2.9519	1.0626	0.1576	0.1583	-0.0005	0.1588	-0.0025	0.0014	1.2258
Netherlands	229	1.9035	1.736	0.1098	0.1696	0.0286	0.1743	-0.1425	0.1384	1.1334
New Zealand	130	1.5674	1.8053	0.1806	0.345	0.0287	0.1068	-1.1213	0.3764	0.7295
Norway	377	3.8794	2.5345	0.4214	0.4376	0.041	0.1894	-0.0777	0.0412	1.2298
Singapore	876	3.8994	2.3402	0.1367	0.1627	0.019	0.2232	-0.9222	0.5042	1.1754
Spain	178	0.4728	0.5821	0.1573	0.27	0.0506	0.1588	-0.189	0.175	1.0485
Sweden	428	2.8811	2.0682	0.1328	0.2519	0.0456	0.1978	-0.0573	0.0373	1.375
Switzerland	178	1.2996	1.3561	0.077	0.1244	0.0339	0.147	-0.0804	0.0546	0.9977
U.K.	4,792	3.8666	1.8814	0.1524	0.1046	0.0301	0.1137	-0.199	0.2486	0.9715
U.S.	1,591	0.4332	0.1879	0.0595	0.0302	0.0376	0.1139	-0.0208	0.0172	0.9854

Table 3.1 continued

Countries	# Equity issues	# Equity issues / # Listed companies		Proceeds / local market cap		Market returns		Market liquidity		Market volatility
		mean (%)	st.dev.	mean (%)	st.dev.	mean (%)	st.dev.	mean	st.dev.	mean
Emerging countries										
Argentina	48	0.6133	0.7894	0.1175	0.2703	0.0517	0.2239	-0.9933	0.502	1.5657
Brazil	128	0.5071	0.5244	0.1017	0.1547	0.074	0.2278	-0.4877	0.4578	1.5221
Chile	166	1.0721	1.1693	0.1279	0.2073	0.0335	0.1378	-0.003	0.0023	0.8167
China	1,286	2.9684	3.5382	0.7674	1.2834	0.0612	0.2855	-0.0384	0.0426	1.8783
Greece	218	1.3593	1.6975	0.2272	0.4071	0.0458	0.2298	-2.9752	2.2572	1.3931
India	2,418	0.8823	1.6295	0.1171	0.206	0.0501	0.2269	-0.6527	0.552	1.521
Indonesia	202	1.2762	1.0818	0.4047	0.6211	0.0488	0.2778	-0.0031	0.0043	1.6862
Malaysia	1,232	2.7717	1.5933	0.1612	0.1575	0.0224	0.2196	-1.3489	0.8099	1.1674
Mexico	49	0.5058	0.8336	0.0764	0.1836	0.0704	0.1672	-0.0365	0.0176	1.2442
Philippines	132	1.0569	1.3966	0.0939	0.1845	0.0098	0.2142	-0.1353	0.0676	1.2706
Poland	203	1.9204	2.1497	0.357	0.5329	0.0506	0.229	-2.2061	1.9785	1.5268
Portugal	94	1.7484	1.8641	0.6037	1.1258	0.0282	0.1788	-1.0851	0.8026	0.8617
South Africa	66	0.2575	0.3289	0.0393	0.0839	0.0588	0.1594	-0.5774	0.3832	1.1217
South Korea	3,226	3.728	3.4454	0.5561	0.8031	0.0428	0.2854	-0.0009	0.0015	1.8862
Taiwan	1,117	3.5377	1.7733	0.2493	0.2693	0.0174	0.2049	-0.0071	0.0072	1.5083
Thailand	414	1.7046	1.6815	0.2583	0.4254	0.0051	0.2695	-0.1475	0.1485	1.7531

Table 3.2: Tobit models to explain quarterly variation in equity issues in 36 countries

This table reports coefficient estimates of pooled tobit models to explain variation in the quarterly number of new equity issues (IPOs and SEOs from SDC) – scaled by the number of listed stocks – in each of the 36 countries in our sample over the period 1995-2008. Independent variables include lead, contemporaneous, and lagged local market liquidity innovations and local market returns, a dummy for the first calendar quarter, and a lagged dependent variable. The liquidity time-series are taken from Karolyi, Lee, and van Dijk (2012) and are based on daily estimates of Amihud's (2002) price impact proxy for individual stocks – computed as the absolute stock return divided by local currency trading volume. The Amihud measure is multiplied by -10,000 so that we obtain a measure that is increasing in liquidity. Since the level of Amihud market liquidity is non-stationary in most countries, we use market liquidity innovations (taken as the residuals from country-by-country AR(1) regressions of the level of market liquidity) as independent variable. Market returns are the total returns on the value-weighted local market index from Datastream. All independent variables are standardized to have zero mean and unit standard deviation, so the coefficients can be interpreted as the effect of a one standard deviation (1SD) shock in the independent variable. The last two rows present the results of F-tests on the joint significance of all lagged market liquidity variables and of all market liquidity variables, respectively. Significance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively (based on standard errors that are clustered by country).

Dependent variable:	*# equity issues (IPOs + SEOS) / # listed companies in quarter t*						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Market liquidity (t+1)	0.00003		0.00079				
Market liquidity (t)	0.00279***		0.00220***	0.00217***	0.00201***	0.00174**	0.00175***
Market liquidity (t-1)	0.00182***		0.00033	0.00033	0.00003	0.00021	-0.00064
Market liquidity (t-2)	0.00292***		0.00194**	0.00214**	0.00190*	0.00284**	0.00146**
Market liquidity (t-3)	0.00160*		0.00147	0.00190**	0.00178**	0.00229**	0.00092
Market liquidity (t-4)	0.00095		0.00152*	0.00166**	0.00162**	0.00234**	0.00126**
Market returns (t+1)		-0.00220***	-0.00181***	-0.00149***	-0.00232***	-0.00239***	-0.00187***
Market returns (t)		0.00140*	0.001	0.00126	0.0005	0.00056	0.00221***
Market returns (t-1)		0.00278***	0.00346***	0.00346***	0.00324***	0.00322***	0.00329***
Market returns (t-2)		0.00310***	0.00191**	0.00187***	0.00195**	0.00158*	0.00049
Market returns (t-3)		0.00173**	0.0007				
Market returns (t-4)		0.00122*	0.00054				
Quarter 1 dummy			-0.00733***	-0.00721***	-0.00715***	-0.00769***	-0.00971***
Equity issues (t-1)							0.544***
Year fixed effects	yes	yes	yes	yes	no	no	yes
Country fixed effects	yes	yes	yes	yes	yes	no	yes
# Observations	1,800	1,800	1,800	1,800	1,800	1,800	1,800
# Countries	36	36	36	36	36	36	36
Pseudo R^2	0.327	0.329	0.339	0.338	0.33	0.0108	0.437
F -test lagged liquidity	3.751***	NA	1.577	1.928	1.985*	2.409*	2.216*
F -test all liquidity	8.468***	NA	4.242***	5.522***	4.337***	2.972**	3.531***

Table 3.3: Tobit models to explain quarterly variation in equity issues in 36 countries: Controlling for capital market conditions

This table reports coefficient estimates of pooled tobit models to explain variation in the quarterly number of new equity issues (IPOs and SEOs from SDC) – scaled by the number of listed stocks – in each of the 36 countries in our sample over the period 1995-2008. Independent variables include lead, contemporaneous, and/or lagged local market liquidity innovations, returns, volatility, turnover, liquidity risk (conditional liquidity volatility based on a GARCH(1,1) model), market-to-book ratio, price-earnings ratio, dividend-price ratio, a dummy for the first calendar quarter, and a lagged dependent variable. The liquidity time-series are taken from Karolyi, Lee, and van Dijk (2012) and are based on daily estimates of Amihud's (2002) price impact proxy for individual stocks – computed as the absolute stock return divided by local currency trading volume. The Amihud measure is multiplied by -10,000. Since the level of Amihud market liquidity is non-stationary in most countries, we use market liquidity innovations (taken as the residuals from country-by-country AR(1) regressions of the level of market liquidity) as independent variable. All independent variables are standardized. The last two rows present the results of F-tests on the joint significance of all lagged and all market liquidity variables, respectively. Significance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively (based on standard errors that are clustered by country).

Dependent variable:	*# equity issues (IPOs + SEOS) / # listed companies in quarter t*						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Market liquidity (t)	0.00228***	0.00217***	0.00264**	0.00161***	0.00162***	0.00209***	0.00192**
Market liquidity (t-1)	0.00024	0.00038	0.00104	0.00008	0.0002	0.00019	-0.00006
Market liquidity (t-2)	0.00190**	0.00217**	0.00165	0.00211**	0.00195**	0.00198**	0.00084
Market liquidity (t-3)	0.00175*	0.00192**	0.00156	0.00217***	0.00195***	0.00174**	0.00087
Market liquidity (t-4)	0.00167**	0.00174**	0.00134	0.00167**	0.00163**	0.00158**	0.00129
Market returns (t+1)	-0.00165***	-0.00155***	-0.00140**	-0.00123*	-0.00063	-0.00137**	-0.00153**
Market returns (t)	0.00121	0.00101	0.00119	0.00104	0.00061	0.00144	0.00157*
Market returns (t-1)	0.00323***	0.00341***	0.00345***	0.00314**	0.00248**	0.00325**	0.00246*
Market returns (t-2)	0.00155**	0.00194***	0.00180**	0.00163**	0.00160**	0.00160**	0.00056
Market volatility (t)	0.00045						-0.00123
Market volatility (t-1)	-0.00160*						-0.00014
Market volatility (t-2)	-0.00119						0.00038
Market turnover (t)		0.00135					0.00116
Market turnover (t-1)		-0.00054					-0.00046
Market turnover (t-2)		-0.00106					-0.00144
Market liquidity risk (t+1)			0.00105				0.00097
Market liquidity risk (t)			0.00068				0.00041
Market liquidity risk (t-1)			-0.00354***				-0.00380**
Market liquidity risk (t-2)			0.00115				0.00196
Market-to-book ratio (t)				0.00198			0.00105
Market-to-book ratio (t-1)				0.00067			-0.00112
Market-to-book ratio (t-2)				0.00027			0.00017

Table 3.3 continued

Price-earnings ratio (t)					0.00438***		0.00250*
Price-earnings ratio (t-1)					0.0014		0.00083
Price-earnings ratio (t-2)					-0.00139		-0.00181
Dividend-price ratio (t)						0.0001	0.00298**
Dividend-price ratio (t-1)						-0.00129	-0.00229
Dividend-price ratio (t-2)						-0.00033	-0.00071
Quarter 1 dummy	-0.00746***	-0.00770***	-0.00709***	-0.00701***	-0.00700***	-0.00738***	-0.00954***
Equity issues (t-1)							0.512***
Year fixed effects	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes
# Observations	1,800	1,800	1,800	1,762	1,797	1,800	1,762
# Countries	36	36	36	35	36	36	35
Pseudo R^2	0.339	0.338	0.339	0.349	0.356	0.338	0.444
F -test lagged liquidity	1.667	1.763	0.758	3.900***	2.895**	2.295*	0.87
F -test all liquidity	4.603***	5.249***	3.710***	4.771***	3.362***	4.141***	1.651

Table 3.4: Tobit models to explain quarterly variation in equity issues in 36 countries: Controlling for business cycle, asymmetric information, and investor sentiment

This table reports coefficient estimates of pooled tobit models to explain variation in the quarterly number of new equity issues (IPOs and SEOs from SDC) – scaled by the number of listed stocks – in each of the 36 countries in our sample over the period 1995-2008. Independent variables include lead, contemporaneous, and/or lagged local market liquidity innovations and returns, business cycle proxies (GDP and sales growth, OECD leading indicator), asymmetric information proxies (idiosyncratic volatility, "stock price synchronicity" or average R2 from market model as in Morck, Yeung, and Yu, 2000), investor sentiment (local closed-end country fund discount, global closed-end fund discount, and the U.S. sentiment index of Baker and Wurgler, 2006), a dummy for the first calendar quarter, and a lagged dependent variable. All independent variables are standardized. The last two rows present the results of F-tests on the joint significance of all lagged market liquidity variables and of all market liquidity variables, respectively. Significance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively (based on standard errors that are clustered by country).

Dependent variable:	*# equity issues (IPOs + SEOS) / # listed companies in quarter t*						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Market liquidity (t)	0.00187**	0.00160**	0.00142*	0.00274***	0.00224***	0.00251***	0.00140*
Market liquidity (t-1)	-0.00005	-0.00107	-0.00119	0.00077	0.00033	0.00048	0.00004
Market liquidity (t-2)	0.00175*	0.00197*	0.00179*	0.00254***	0.00212**	0.00231**	0.00122**
Market liquidity (t-3)	0.0015	0.00268***	0.00236***	0.00225**	0.00190**	0.00205**	0.00114**
Market liquidity (t-4)	0.00173**	0.00227**	0.00218**	0.00196**	0.00168**	0.00174**	0.00038
Market returns (t+1)	-0.00127**	-0.00196**	-0.00190**	-0.00133**	-0.00176***	-0.00196***	-0.00210***
Market returns (t)	0.00136	0.00142	0.00127	0.00119	0.00146*	0.00109	0.00099
Market returns (t-1)	0.00352***	0.00472***	0.00440***	0.00296***	0.00363***	0.00352***	0.00293***
Market returns (t-2)	0.00163**	0.00255***	0.00213**	0.00177**	0.00190***	0.00201**	-0.00011
GDP growth (t+2)	0.00220*		0.00067				
GDP growth (t+1)	0.0004		-0.00017				
GDP growth (t)	0.0002		0.00107				
Sales growth (t+2)		0.00204**	0.00185				
Sales growth (t+1)		0.0004	0.00018				
Sales growth (t)		0.00192	0.00147				
Leading economic indicator (t)			0.00089				
Idiosyncratic volatility (t)				0.00234*			
Idiosyncratic volatility (t-1)				0.00105			
Stock price synchronicity (t)				-0.00069			
Stock price synchronicity (t-1)				-0.0018			

Table 3.4 continued							
Global sentiment (t)					0.00258		-0.00144
Global sentiment (t-1)					-0.00061		0.00033
U.S. sentiment index (t)						-0.00022	0.00005
U.S. sentiment index (t-1)						-0.00158	-0.00085
Closed-end fund discount (t)							0.00011
Closed-end fund discount (t-1)							0.00024
Quarter 1 dummy	-0.00788***	-0.00847***	-0.00868***	-0.00762***	-0.00660***	-0.00676***	-0.0104***
Equity issues (t-1)							0.551***
Year fixed effects	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes
# Observations	1,746	1,221	1,202	1,800	1,800	1,609	840
# Countries	36	26	26	36	36	35	22
Pseudo R^2	0.35	0.413	0.415	0.342	0.338	0.352	0.537
F-test lagged liquidity	1.726	4.377***	3.993***	2.602**	1.944	1.986*	3.244**
F-test all liquidity	2.666**	4.242***	3.530***	6.455***	5.461***	4.235***	2.729**

Table 3.5: Tobit models to explain quarterly variation in equity issues in 36 countries: Asymmetric effect of liquidity

This table reports coefficient estimates of pooled tobit models to explain variation in the quarterly number of new equity issues (IPOs and SEOs from SDC) – scaled by the number of listed stocks – in each of the 36 countries in our sample over the period 1995-2008. The key independent variables are (contemporaneous and lagged) dummy variables indicating quarters with the top (Market liquidity UP) and bottom (Market liquidity DOWN) 33% observations based on liquidity innovations. Other independent variables include lead, contemporaneous and lagged local market local market returns, and a dummy for the first calendar quarter. All independent variables are standardized. The last two rows present the results of F-tests on the joint significance of all UP and DOWN market liquidity variables, respectively. Significance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively (based on standard errors that are clustered by country).

Dependent variable:	*# equity issues (IPOs + SEOS) / # listed companies in quarter t*				
	(1)	(2)	(3)	(4)	(5)
Market liquidity UP (t)	0.00311*	0.00319*	0.00227	0.00232	0.0025
Market liquidity DOWN (t)	-0.00425***	-0.00428***	-0.00304**	-0.00293**	-0.00283**
Market liquidity UP (t-1)	0.00097	0.00115	-0.00031	-0.00022	-0.0001
Market liquidity DOWN (t-1)	-0.00291**	-0.00333***	-0.00146	-0.0017	-0.00168
Market liquidity UP (t-2)	-0.00024	0.00075	-0.00058	0.00052	0.00029
Market liquidity DOWN (t-2)	-0.00186	-0.00167	-0.00139	-0.00108	-0.0009
Market liquidity UP (t-3)		0.00093		0.00122	0.00069
Market liquidity DOWN (t-3)		-0.00246*		-0.00276*	-0.00213
Market liquidity UP (t-4)		-0.00037		-0.00039	-0.00064
Market liquidity DOWN (t-4)		-0.00295**		-0.00323**	-0.00309**
Market returns (t+1)			-0.00169***	-0.00169***	-0.00171***
Market returns (t)			0.0012	0.00123	0.00109
Market returns (t-1)			0.00292***	0.00316***	0.00307***
Market returns (t-2)			0.00204***	0.00222***	0.00236***
Market returns (t-3)					0.00127
Market returns (t-4)					0.00089
Quarter 1 dummy	-0.00657***	-0.00672***	-0.00690***	-0.00712***	-0.00713***
Year fixed effects	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes
# Observations	1,872	1,800	1,872	1,800	1,800
# Countries	36	36	36	36	36
Pseudo R^2	0.318	0.33	0.325	0.337	0.338

Table 3.6: Tobit models to explain quarterly variation in the fraction of privately placed SEOs in 36 countries

This table reports coefficient estimates of pooled tobit models (censored at 0 and 1) to explain variation in the quarterly number of privately placed SEOs (from SDC) – scaled by the number of public SEOs plus the number of privately placed SEOs – in each of the 36 countries in our sample over the period 1995-2008. Independent variables include lead, contemporaneous, and/or lagged local market liquidity innovations and returns, proxies for capital market conditions (market volatility, market-to-book ratio), business cycle proxies (GDP growth), and asymmetric information proxies (idiosyncratic volatility, "stock price synchronicity" or average R2 from market model as in Morck, Yeung, and Yu, 2000). Significance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively (based on standard errors that are clustered by country).

Dependent variable:	*# private SEOs / (# public + private SEOs) in quarter t*					
	(1)	(2)	(3)	(4)	(5)	(6)
Market liquidity (t)	-0.0256***	-0.0164***	-0.0211***	-0.0303***	-0.0223***	-0.0242***
Market liquidity (t-1)	-0.0052*	0.0038	0.0014	-0.006	0.0001	-0.0054*
Market returns (t+1)	-0.0288***	-0.0342***	-0.0308***	-0.0369***	-0.0341***	-0.0317***
Market returns (t)	0.0334***	0.0354***	0.0295***	0.0325***	0.0297***	0.0412***
Market returns (t-1)	-0.0192***	-0.0210***	-0.0612***	-0.0270***	-0.0222***	-0.0191***
Market returns (t-2)	-0.0189***	-0.0324***	-0.0130***	-0.0302***	-0.0236***	-0.0226***
Market volatility (t)		0.0320***				
Market volatility (t-1)		-0.0143				
Market volatility (t-2)		-0.0528***				
Market-to-book ratio (t)			-0.0042			
Market-to-book ratio (t-1)			0.0627***			
Market-to-book ratio (t-2)			-0.0934***			
GDP growth (t+2)				0.0203*		
GDP growth (t+1)				-0.0239*		
GDP growth (t)				0.0207		
Idiosyncratic volatility (t)					0.0220***	
Idiosyncratic volatility (t-1)					-0.0104	
Idiosyncratic volatility (t-2)					-0.0465***	
Stock price synchr. (t)						0.0269***
Stock price synchr. (t-1)						-0.0011
Stock price synchr. (t-2)						-0.0062
Year fixed effects	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes
# Observations	1,236	1,236	1,213	1,208	1,235	1,236
# Countries	36	36	35	36	36	36
Pseudo R^2	0.391	0.393	0.385	0.388	0.392	0.391

Table 3.7: Tobit models to explain quarterly variation in postponements and cancellations of equity issues in 36 countries

This table reports coefficient estimates of pooled tobit models to explain variation in the quarterly number of postponed equity issues (models (1)-(4)) scaled by the number of actual equity issues plus the number of postponements and in the quarterly number of canceled equity issues (models (5)-(8)) scaled by the number of actual equity issues plus the number of cancellations – in each of the 36 countries in our sample over the period 1995-2008. Postponements and cancellations of IPOs and SEOs are obtained from SDC. Independent variables include lead and contemporaneous local market liquidity and returns, proxies for capital market conditions (market-to-book ratio), the state of the business cycle (GDP growth), and asymmetric information (idiosyncratic volatility, "stock price synchronicity" or average R2 from market model as in Morck, Yeung, and Yu, 2000). Since SDC does not report postponements and cancellations by the postponement or cancellation date but by the filing date, we only include contemporaneous and lead independent variables. Significance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively (based on standard errors that are clustered by country).

Dependent variable:	*# postponements / (# actual issues + # postponements) in quarter t*				*# cancellations / (# actual issues + # cancellations) in quarter t*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market liquidity (t+2)	-0.0484***	-0.0536***	-0.0572***	-0.0470***	-0.0057	-0.0054	-0.0026	-0.0082
Market liquidity (t+1)	-0.0345***	-0.0466***	-0.0451***	-0.0616***	-0.0011	-0.0046	-0.001	-0.0027
Market liquidity (t)	-0.0397***	-0.0482***	-0.0550***	-0.0527***	0.0078	0.0141	0.0081	0.0169
Market returns (t+2)	-0.0276***	-0.0535***	-0.0212***	-0.0523***	-0.0291*	-0.0524**	-0.0378**	-0.0360*
Market returns (t+1)	-0.0073	0.0178***	-0.0081	-0.0158***	0.0165	-0.0028	0.0114	0.0131
Market returns (t)	-0.0301***	-0.0487***	-0.0295***	-0.0402***	-0.0493***	-0.0514***	-0.0461***	-0.0587***
Market-to-book ratio (t+2)		0.1280***				0.046		
Market-to-book ratio (t+1)		-0.0952***				0.0078		
Market-to-book ratio (t)		0.1150***				-0.0523		
GDP growth (t+2)			0.0884***				0.0161	
GDP growth (t+1)			-0.0588***				-0.0331	
GDP growth (t)			0.0658***				0.00603	
Idiosyncratic volatility (t+2)				0.0143				-0.0028
Idiosyncratic volatility (t+1)				-0.0656***				-0.0217
Idiosyncratic volatility (t)				0.0402***				0.0634**
Stock price synchronicity (t+2)				-0.0635***				0.0056
Stock price synchronicity (t+1)				-0.0072				0.0001
Stock price synchronicity (t)				0.0028				-0.0077
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
# Observations	1,667	1,636	1,607	1,601	1,696	1,664	1,635	1,630
# Countries	36	35	36	36	36	35	36	36
Pseudo R^2	0.323	0.34	0.32	0.349	0.178	0.182	0.179	0.192

Table 3.8: Tobit models to explain quarterly variation in equity issues in 36 countries: IPOs vs. SEOs

This table reports coefficient estimates of pooled tobit models to explain variation in the quarterly number of new equity issues (separate regressions for IPOs and SEOs from SDC) – scaled by the number of listed stocks – in each of the 36 countries in our sample over the period 1995-2008. Models (1) through (4) have IPOs scaled by listed companies as dependent variable. Models (5) through (8) have SEOs scaled by listed companies as dependent variable. Independent variables include lead, contemporaneous, and/or lagged local market liquidity innovations and returns, proxies for capital market conditions (market volatility, market-to-book ratio), business cycle proxies (GDP growth, OECD leading indicator), asymmetric information proxies (idiosyncratic volatility, "stock price synchronicity" or average R2 from market model as in Morck, Yeung, and Yu, 2000), investor sentiment (global closed-end fund discount), and a dummy for the first calendar quarter. The last two rows present the results of F-tests on the joint significance of all lagged market liquidity variables and of all market liquidity variables, respectively. Significance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively (based on standard errors that are clustered by country).

Dependent variable:	*# IPOs / # listed companies in quarter t*				*# SEOs / # listed companies in quarter t*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market liquidity (t)	0.00193***	0.00265***	0.00250***	0.00239***	0.00081*	0.00073	0.00141***	0.00083*
Market liquidity (t-1)	0.00063	0.00054	0.00065	0.00082	0.00027	-0.0006	0.00039	-0.00091
Market liquidity (t-2)	0.00157**	0.00089	0.00151**	0.00136*	0.00160**	0.00127*	0.00177***	0.00107
Market liquidity (t-3)	0.00164*	0.00099	0.00174*	0.00212**	0.00099*	0.00094	0.00131**	0.00105
Market liquidity (t-4)	0.00138***	0.00160**	0.00193***	0.00232***	0.00027	0.00087*	0.00084	0.00115**
Market returns (t+1)	-0.00062	0.00006	-0.00026	0.0001	-0.00144***	-0.00165***	-0.00116***	-0.00159**
Market returns (t)	0.00009	-0.00053	0.00048	-0.00104	0.00109	0.00147*	0.00083	0.00158
Market returns (t-1)	0.00134*	0.0013	0.00194**	0.00213*	0.00211***	0.00280***	0.00195**	0.00247*
Market returns (t-2)	0.00156***	-0.00021	0.00107**	0.00024	0.00154***	0.00134**	0.00122**	0.00065
Market volatility (t)				-0.00124				0.00122
Market volatility (t-1)				-0.00163*				-0.00031
Market volatility (t-2)				0.00026				-0.00188
Market-to-book ratio (t)				0.00212				0.00007
Market-to-book ratio (t-1)				-0.00248**				0.00085
Market-to-book ratio (t-2)				0.00219**				0.00177
GDP growth (t+2)		0.0009		0.00032		0.0013		0.00104
GDP growth (t+1)		0.00057		0.00096		-0.00113		-0.00104
GDP growth (t)		0.0004		0.00015		0.0008		0.00031
Leading econ. indic. (t)		0.00515**		0.00308**		0.00044		0.00042
Idiosyncratic volatility (t)			0.00074				0.00149	
Idiosyncratic volatility (t-1)			0.00112	0.00196			0.00021	0.0015
Stock price synchr. (t)			0.00052	0.00082			-0.00138**	-0.00264***
Stock price synchr. (t-1)			0.00005	-0.00033			-0.00206**	-0.00283**
Global sentiment (t)				0.00103				0.00082
Global sentiment (t-1)				0.00217*				-0.00118
Quarter 1 dummy		-0.00784***	-0.00612***	-0.00724***		-0.00373**	-0.00372***	-0.00414**
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
# Observations	1,800	1,389	1,800	1,351	1,800	1,389	1,800	1,351
# Countries	36	29	36	28	36	29	36	28
Pseudo R^2	0.19	0.209	0.199	0.212	0.422	0.492	0.431	0.51
F-test lagged liquidity	1.961*	1.692	2.804**	2.474**	2.650**	2.283*	2.859**	3.416***
F-test all liquidity	4.433***	3.292***	5.145***	3.318***	2.858**	1.861*	3.535***	2.818**

Table 3.9: Tobit models to explain quarterly variation in equity issues in 35 countries: IPO proceeds vs. SEO proceeds

This table reports coefficient estimates of pooled tobit models to explain variation in the quarterly US$ proceeds of new equity issues (separate regressions for IPOs and SEOs from SDC) – scaled by the US$ local market capitalization – in 35 countries in our sample (we drop China because of its very large proceeds) over the period 1995-2008. Models (1) through (4) have IPO proceeds scaled by local market cap as dependent variable. Models (5) through (8) have SEO proceeds scaled by local market cap as dependent variable. Independent variables include lead, contemporaneous, and/or lagged local market liquidity innovations and returns, proxies for capital market conditions (market volatility, market-to-book ratio), business cycle proxies (GDP growth, OECD leading indicator), asymmetric information proxies (idiosyncratic volatility, "stock price synchronicity" or average R2 from market model as in Morck, Yeung, and Yu, 2000), investor sentiment (global closed-end fund discount), and a dummy for the first calendar quarter. The last two rows present the results of F-tests on the joint significance of all lagged market liquidity variables and of all market liquidity variables, respectively. Significance at the 1%, 5% and 10% level is indicated by ***, **, and *, respectively (based on standard errors that are clustered by country).

Dependent variable:	*IPO proceeds / local market cap in quarter t*				*SEO proceeds / local market cap in quarter t*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market liquidity (t)	0.00027***	0.00034***	0.00036***	0.00046***	0.00001	-0.00002	0.00005	0.00002
Market liquidity (t-1)	0.00002	-0.00007	0	-0.00001	0.00005	-0.00011	0.00002	-0.00014
Market liquidity (t-2)	0.00022***	0.00011	0.00020**	0.00012	0.00013	0.00005	0.00013	0.00011
Market liquidity (t-3)	0.00040***	0.00033**	0.00040***	0.00032**	0.00019	0.0001	0.00020*	0.00014
Market liquidity (t-4)	0.00004	0.00002	0.00014	0.00008	-0.00014	-0.00012	-0.00006	-0.00009
Market returns (t+1)	0.00011	0.00017	0.00015*	0.00013	-0.00014	-0.00023	-0.00012	-0.00023
Market returns (t)	0.00009	-0.00005	0.00019*	-0.00028*	0.00020*	0.00026*	0.00025*	0.00017
Market returns (t-1)	0.00017	0.00016	0.00023**	0.00022	0.00045***	0.00055***	0.00046***	0.00038*
Market returns (t-2)	0.00023**	-0.00011	0.00015	-0.00003	0.00021	0.00012	0.00016	0.00021
Market volatility (t)				0.00013				0.00022
Market volatility (t-1)				-0.00005				0.00022
Market volatility (t-2)				-0.00003				0.00029
Market-to-book ratio (t)				0.00043				0.00047
Market-to-book ratio (t-1)				-0.00064**				-0.00026
Market-to-book ratio (t-2)				-0.00003				-0.00016
GDP growth (t+2)		-0.00022		-0.00032		0.00044		0.00047
GDP growth (t+1)		0.00073**		0.00092**		-0.00051**		-0.00047*
GDP growth (t)		-0.00004		-0.00004		0.00072***		0.00072***
Leading econ. Indic. (t)		0.00051***		0.00054***		0.00015		0.00018
Idiosyncratic volatility (t)			0.00005	0.00015			-0.00013	0.00001
Idiosyncratic volatility (t-1)			0.00015	0.00019			0.00017	0.00013
Stock price synchr. (t)			0.00020*	0.00026*			0.00009	-0.00002
Stock price synchr. (t-1)			-0.00012	-0.00017			-0.00024**	-0.00048**

Table 3.9 continued

Global sentiment (t)				-0.00032				0.00012
Global sentiment (t-1)				0.00091**				-0.00011
Quarter 1 dummy		-0.00120***	-0.00096***	-0.00137***		-0.00088**	-0.00064**	-0.00077*
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
# Observations	1,749	1,338	1,749	1,303	1,749	1,338	1,749	1,303
# Countries	35	28	35	27	35	28	35	27
Pseudo R^2	0.051	0.062	0.055	0.068	0.024	0.032	0.026	0.035
F-test lagged liquidity	4.513***	2.676**	5.650***	1.988*	1.63	0.723	1.265	0.941
F-test all liquidity	5.940***	3.562***	5.988***	3.134***	1.355	0.593	1.082	0.762

Chapter 4
Market Liquidity, Operating Efficiency and Bank Performance[13]

4.1 Introduction

There is little ambiguity that the disciplinary role of capital markets is of the utmost importance for promoting good corporate governance and ensuring optimal allocation of resources in the economy. By trading corporate claims in public markets investors are able to monitor managerial conduct and reward investment decisions that increase firm value, or penalize those with an adverse effect on shareholders' wealth. Hence, in addition to mobilizing capital expeditiously, markets also produce information regarding a firm's securities, allowing investors to evaluate firm performance continuously. In the case of the banking sector, the role of capital markets is by no means less important. As a matter of fact, given the increasing complexity of the universal banking model, its dispersed funding mix, and the expanding type of its activities (Calomiris, 1997), sharing monitoring costs with private investors can only benefit official supervisors by allowing them to allocate their scarce resources in a more purposeful way.

According to the premises of agency theory, inefficient contractual arrangements or absence of monitoring can allow managers to expropriate investors by diverting corporate resources to private benefits, engage in excessive risk-taking or under-utilize a firm's investment capacity due to extraction of monopoly rents (e.g. Shleifer, and Vishny, 1997). In the case of banks the situation is further complicated due to the existence of high entrance barriers, public subsidies, and government guarantees (Merton, 1977; Keeley, 1990). To address such concerns, the Bank for International Settlements (BIS) has advanced a "three-pillar" regulatory framework which puts market discipline on centre stage (Basel II). The

[13] We are grateful to the participants of the IPA seminar at the ECB for their helpful comments.

third pillar consists of a set of disclosure requirements that would allow market participants to exert control over banks, and thus moderate risk taking in the financial sector (e.g. BIS, 2001). When compared to the first two pillars[14], market monitoring demonstrates some particularly useful features which are mainly based on markets' inherent ability to aggregate information in a decentralized and continuous way. In contrast to official oversight mechanisms that are typically rigid, bureaucratic, and infrequent, investors are endowed with the incentive to monitor bank behaviour continuously, using information obtained from a variety of sources (Herring, 2003). As a consequence, investors can deter banks from engaging in inefficient investments by raising the cost or by restricting the volume of funds available for their financing (Crockett, 2002). Moreover, capital markets are credited with the ability to moderate agency frictions within the firm (Homström, and Tirole, 1993; Chung, Firth, and Kim, 2002; Edmans, 2009; Edmans, and Manso, 2011), enhancing performance (Smith, 1996; Brav, Jiang, Partnoy, and Thomas, 2008; Cornett, Marcus, Saunders, and Tehranian, 2007), and maximizing economic welfare (Wurgler, 2000; Tadesse, 2004; Durnev, Li, Mock, and Yeung, 2004). Nevertheless, even though there is an extensive literature discussing the positive implications of market monitoring on firm performance, only a limited number of studies to date investigate the interplay between capital markets and the banking sector in that respect.

In this paper we contribute to the literature by investigating the influence exerted by equity markets on bank operating efficiency, risk-taking, and performance from a perspective that, to the best of our knowledge, has not been addressed to date, namely that of stock liquidity. To be able to discipline bank managers, investors need to be able to transact in a secondary market with the minimum possible frictions. Since high liquidity typically translates to low transaction costs, which in turn alludes to low information asymmetry (Wurgler, and Zhuravskaya, 2002; Sadka, and Scherbina, 2006; Chordia, Roll, and Subrahmanyam, 2008), we expect that investors will be more effective in their monitoring when the secondary market of a bank's securities is more active. Thus, our conjecture is that banks with a liquid stock are subject to more rigorous monitoring by shareholders, and as a result are forced to operate more efficiently. Conversely, limited market participation by investors will impede information dissemination and lead to price inertia, thus creating a divergence between bank fundamentals and market valuations. This, in turn, can nurture perverse incentives by bank managers, leading to excessive risk-taking and shareholder expropriation.

[14] The first two pillars consist of capital adequacy conditions, and an elaborate review process from official supervisors respectively.

To assess the role of liquidity, we compile a detailed dataset with balance sheet information for more than 1,100 banks, spanning 31 countries around the world. The extensive coverage of our data permits us to investigate the importance of market monitoring across countries that differ in a number of dimensions, namely the extent of economic development, governance standards, the degree of concentration within the banking sector, and the intensity of regulatory interventions. Given that stock liquidity is an elusive concept that is notoriously difficult to quantify, we refrain from relying on a single measure and choose to perform our analysis employing three of the most commonly used indicators, namely the (modified) Amihud ratio (2002), the (proportional) quoted spread, and stock turnover[15]. We also construct several indicators of risk-taking and alternative measures of bank performance.

Our key findings can be summarized as follows. First, we document a positive relation between bank stock liquidity and *Tobin's Q*. In other words, the present value of expected cash flows represents a higher multiple of asset replacement costs for banks with more liquid stock. We interpret this finding as an early confirmation of our hypothesis that banks subject to more intense investor monitoring are able to generate more value from their investments. The same applies for banks that have low dependence on non-core funding, hold more cash on their balance sheet, are better capitalised, and have bigger size. Next, we decompose *Tobin's Q* into three components, namely a factor accounting for investor sentiment, another for leverage, and a proxy for operating profitability (Fang, Noe, and Tice, 2009). We find that differences in liquidity do not generate variation in investor sentiment, but, consistent with the market discipline interpretation, are significantly associated with profitability (positive) and leverage (negative).

Naturally, higher profitability can reflect superior lending technology, greater skill in the allocation of capital, or more efficient operational structure. Nevertheless, it could also reflect increasing risk exposure across a number of dimensions. Our analysis lends no support to the latter explanation. Our findings are confirmed when we use the equivalent of the Sharpe ratio to measure bank profitability per unit of risk employed. In further support of our hypothesis, we document that banks with higher stock liquidity operate closer to the efficient frontier, demonstrate lower credit risk, and have lower probability of default. Consistent with earlier studies, we also show that banks with more diversified sources of revenue have a lower share of non-performing loans. In other words, increasing reliance to non-core activities can offset the foregone income due to

[15] For a detailed account of different liquidity measures available, as well as a discussion of their relative merits/shortcomings we refer to Hasbrouck (2006) and Goyenko, Holden, and Trzcinka (2009).

more conservative lending, thus explaining the lower credit risk of those banks. Greater dependence on non-core financing, however, typically translates to higher risk and lower profitability. We also show that capital buffers are negatively associated with insolvency risk, which we attribute to the fact that better capitalised banks have a more valuable charter, and as a result have less incentive to engage in excessive risk.

Finally, we try to shed more light on the particular mechanism through which the liquidity channel operates. An information-based interpretation would suggest that improved liquidity encourages the participation of informed investors in the price discovery process, thus rendering market monitoring more efficient. We investigate this explanation by creating portfolios of bank stocks differing over the extent of information-driven trading, but find no evidence of a positive relation with liquidity. Our empirical analysis is, however, more supportive of an agency-based interpretation. For example, when we distinguish banks' on the basis of their susceptibility to principal-agent type of conflicts we find that the liquidity effects is significantly more pronounced in the group that ranks higher in that respect. We also present evidence that the monitoring exerted by debt holders and depositors is significantly more effective in the case of banks with more liquid stock. This is reflected in the increasing responsiveness of both deposit growth and debt costs to bank risk-taking in banks that belong to the top of the liquidity spectrum.

An important concern in our study relates to the possibility of endogeneity or reverse causality between our measures of bank performance and stock liquidity. For example, one might argue that investors will typically increase their holdings of banks that outperform and underweight those with disappointing risk-return characteristics. Assuming that banks operating closer to the efficient frontier are able to deliver superior risk-adjusted performance, it is reasonable to expect an increasing demand for their stock by retail investors, which will foster liquidity in the secondary market. Moreover, banks engaging in riskier and more opaque activities might deter retail investors from holding their stock since information costs can be prohibitively high for them to overcome. As a result, retail ownership of such information intensive bank stocks will be limited and their liquidity contained. To address such concerns we lag our regressors by one year, but also confirm the main body of our findings using a two-stage least squares approach which we discuss more extensively in the sections that follow. Another argument is that liquidity might correlate to bank performance due to their joint dependence with an omitted variable. We thus populate our regressions with an extensive battery of controls accounting for balance sheet liquidity, credit risk, income diversification, dependence on non-core financing, market performance, capitalization, and size effects. Moreover, we also extend our empirical setup to

include a number of macroeconomic factors controlling for business cycle conditions, economic development, and the general level of risk aversion.
The paper proceeds as follows. In Section 4.2, we briefly discuss the related literature. In Section 4.3, we describe our data sources, and conduct univariate tests proving some first evidence on the relation between stock liquidity and bank performance. In Section 4.4, we conduct our multivariate analysis and perform a number of empirical tests. We conclude in Section 4.5.

4.2 Related Literature

Modern financial intermediaries interact with markets on a daily basis. The funding model adopted by banks, combined with the complex nature of their activities dictate the issuance of claims with different features, seniority, and legal attributes. However, due to differences in their exposure to agency frictions and to the extent of (implicit or explicit) government guarantees, different bank securities are subject to different levels of scrutiny by investors, and are thus prone to various degrees of market discipline. Nevertheless, literature to date has almost exclusively focused on the role of credit, keeping a rather negligent stance on the influence exerted by shareholders. Morgan and Stiroh (1999, 2001) for example, show that even though bond investors price the credit risk of U.S. banks similarly to that of non-financial companies with the same credit rating, they tend to treat banks with systemic importance more favourably. They also demonstrate that credit spreads promptly adjust to changes in the asset mix and the type of income generating activities of banks, and thus conclude that the threat of rising financing costs will impede banks from excessive risk-taking. In the case of demandable deposits, most of the evidence over their disciplinary role is documented for the market of uninsured deposits (Sangkyun, and Peristiani, 1998; Peria, and Schmukler, 2001).
However, even though the risk from rising refinancing costs and the adverse effect from increasing interest expenses can constitute a credible self-disciplining mechanism, they are still certain drawbacks that might render them inefficient. For example, it seems natural to argue that unless bank managers can credibly commit to a given level of risk, they can always reduce the cost of debt *ex post* by engaging in more risky activities, after the terms of the debt contract have been established (Blum, 2002). Moreover, other studies indicate that the disciplinary role of deposits can be undermined by the generous deposit insurance schemes that prevail in many countries (Demirgüç-Kunt, and Huizinga, 2004). The aforementioned examples thus indicate that even though most of the effort to date has been towards illustrating the disciplinary role of debt, there are reasons to expect that other type

of claims, e.g. equity, can be an equal if not a superior source of market discipline (Levonian, 2001). Since equity is unarguably the most information sensitive corporate claim, and shareholders the least protected class of investors (same in the case of banks as recent experience demonstrates[16]), it would be natural to assume that common shareholders are better incentivized to monitor the financial condition of a bank, especially when compared to creditors with superior seniority who typically enjoy substantial government guarantees (Merton, 1977; Nier, and Baumann, 2006). Hence, in this paper we decide to place our attention in the equity markets and thus further abstract from previous papers which, in their majority, investigate the nexus between capital markets and banks from the perspective of creditors.

Regarding the role of stock liquidity, we believe there are a number of reasons explaining why it can have a causal effect on bank performance. First and foremost, the existence of a liquid market is a necessary precondition for informational efficiency, which is valuable for investors who use market signals to derive their assessment of managerial decision-making. For example, several studies document that the cost of information arbitrage decreases with stock market liquidity (Wurgler, and Zhuravskaya, 2002; Chordia et al., 2008), whereas others show that convergence to fundamentals is faster when liquidity improves (Sadka, and Scherbina, 2006). The rationale is that informed investors can more easily take advantage of their superior information in a liquid market since they transact with a larger pool of "liquidity" traders at a lower cost, which in turn increases the marginal benefits of collecting private information. Hence, the market price of liquid stocks provides a credible signal of insiders' expectations on the long-term prospects of current investment, allowing investors to look beyond present earnings in their valuation analysis, which typically reflects past decisions. Additionally, the importance of the embedded growth component in equity valuations can foster managers to overcome their myopic preferences and thus pursue strategies that favour sustainable growth, rather than seeking short-term profitability (Dow, and Gorton, 1997; Edmans, 2009). Hence, by reducing information costs, market liquidity enhances monitoring by investors, mitigates managerial opportunism, and promotes long-term growth. Furthermore, managers have a strong incentive to incorporate equity market valuations in their decisions because this has direct implications on the cost of capital which can determine the type and amount of funds available for the financing of future investment opportunities (Mikkelson, and Megan, 1988). Hence, by demonstrating superior price informativeness a liquid

[16] For examples we refer to a series of recent articles e.g. "Long-Suffering Bankia Shareholders Set for More Losses", by Toyer, and Dowsett, Reuters, 2012; "US and UK Unveil Failing Banks Plan", by Masters, and Giles, Financial Times, 2012; "Spain Pressed to Inflict Losses on Small Investors", by Johnson, Spiegel, and, Chaffin, Financial Times, 2012.

stock has positive implications on the quality of the feedback managers' are able to extract from the market, which itself consists of an indirect form of discipline.

The positive impact of liquidity on performance can also have an agency-based interpretation. In their seminal paper, Homström, and Tirole (1993) argue that a liquid market can alleviate the principal-agent problem by facilitating the structuring of more efficient compensation schemes. In another study, Maug (1998) shows that market liquidity reduces the likelihood of free-riding by small investors because it allows large shareholders to purchase additional shares at low cost. This increases their incentive to monitor since they can now profit by engaging in corporate activism[17]. However, even in cases when shareholders are diversified and might lack the motive to engage in corporate activism, liquidity can still foster discipline by reducing their expected cost of exit through a liquidation of their shares (Admati, and Pfleiderer, 2009; Bharath, Jayaraman, and Nagar, 2012). Hence, the threat of coordinated dumping by insiders and its potential adverse effect on managers' wealth can impede managerial opportunism and exert a disciplining effect. It is also reasonable to assume that liquidity disciplines management by making the threat of a takeover more credible. Even though there are significant regulatory constraints on hostile bank acquisitions, underperforming banks might still become a target of a hostile takeover (e.g. Baradwaj, Fraser, and Furtado, 1990). When markets are liquid, the cost of purchasing shares in the secondary market is reduced, which suggests that bidders encounter less obstacles in their effort to accumulate a critical mass of stock in pursuit of their purpose. As a result, the market of corporate control operates more efficiently when a bank's stock is more liquid.

In addition to the aforementioned agency-based causative explanations, efficiency gains from liquidity can be derived due to its ramifications over ownership structure or its impact on the cost of equity financing. A considerable number of papers document that companies with low information frictions are more appealing to small investors, and as a result tend to have more dispersed ownership structure (Rubin, 2007). Conversely, low secondary market liquidity can further deter small shareholders from investing due to expropriation concerns (e.g. collusion of large shareholders with the management) or high adverse selection costs; this in turn will translate into inertia in the secondary market, a concentrated ownership structure and a further increase in the cost of equity financing. Empirical evidence on the relation between ownership structure and bank efficiency, however, is at best scarce and inconclusive. Sanders, Strock and Travlos (1990) show that deregulation exacerbates risk taking particularly in the case of banks controlled by

[17] Examples of shareholder activism are typically encountered in voting, proxy contests, shareholders' resolutions, nomination of directors etc.

shareholders rather than managers. In addition, Laeven, and Ross (2009) show that concentration in cash flow rights is positively correlated with risk, and that increasing regulation can generate perverse incentives in the case of banks with large owners. In another paper, Iannotta, Nocera, and Sironi (2007) focus on European banks and find that ownership concentration is positively related to asset quality and negatively related to insolvency risk, whereas an earlier analysis of the German banking sector finds no material difference in efficiency across banks with different ownership characteristics (Altunbas, Evans, and Molyneux, 2001).

Since a concentrated ownership structure is typically associated with a larger illiquidity discount rate, it will naturally translate to a larger cost of equity financing (e.g. Dierkens, 1991; Butler, Grullon, and Weston, 2005). Hence, by raising the financing cost of future investment opportunities through equity, illiquidity can have negative implications on expected profitability. Moreover, several studies document that firms with illiquid shares use debt markets more often to raise capital, and therefore demonstrate higher leverage (Frieder and Martell, 2006; Lipson and Mortal, 2009). This increases the agency cost of debt which in turn can exacerbate problems of underinvestment. In another example, Beltratti and Stulz (2012) use an international sample of banks and show that lower leverage is associated with better performance in the recent financial turmoil. Following the aforementioned evidence, it is intuitive to conjecture that stock liquidity can have important implications on banks' operating efficiency and risk appetite through its impact on the type of available financing options and through its implications over capital structure (Gropp, and Heider, 2008).

Nevertheless, there are also reasons to suspect that liquidity can have the opposite effect on corporate governance. For example, one might argue that increasing stock liquidity due to a dispersed ownership structure implies that the marginal benefits from private information collections are now redistributed to a larger number of shareholders. This exacerbates the concern of potential "free-riding" by small investors, and essentially undermines the incentives of large investors to monitor managers diligently (Shleifer, and Vishny, 1986). In addition, the low transaction costs of liquid companies reduce the cost of exit by large shareholders (Bhide, 1993) which can further undermine corporate control since shareholders with private information might just choose to "vote with their feet". Even though many of the aforementioned arguments have been refuted by theoretical (Homström, and Tirole, 1993; Maug, 1998) as well as empirical work (Fang et al., 2009) mostly in the context of non-financial companies, there is certainly a lack of research over the role of trading activity and stock liquidity on the performance of banks. Our effort in this paper is to cover this shortfall.

4.3 Data and Summary Statistics

We use Bankscope to collect annual balance sheet information for publicly listed banks over the period 1997 to 2012. Our sample of banks spans 31 countries, from which 19 are classified as developed and the remaining 12 as emerging markets[18]. One of the advantages of such an extensive dataset is to that it allows us to investigate the tenor of our findings across a heterogeneous number of countries, and thus shed more light on the interplay between market monitoring and different regulatory restrictions, legal environments, corporate governance standards and economic structures. By restricting our attention to listed banks we ensure a minimum level of information quality and comparability across different countries (Demirgüç-Kunt, and Huizinga, 2010). In the case of international banks, Bankscope converts all balance sheet information into U.S. dollars. One concern in that respect might be that U.S. dollar denomination might obscure the impact of a turmoil in the currency markets on the profitability and financing costs of domestic banks. In the case of emerging markets, arms-length financing to local banks is mostly extended in hard currency, and thus any unhedged currency mismatch between bank assets and liabilities can have a significant impact on the banking sector, particularly in periods of dramatic devaluations. However, since all our variables are expressed in relative terms (typically in units of balance sheet assets), we do not expect this conversion to affect our analysis.

Our initial sample contains information for a total of 1,527 banks from which 857 come from the U.S. To avoid double-counting, we restrict our sample to include only information obtained from consolidated accounts. We also exclude banks classified as investment banks since their funding structure, legal restrictions, and business model differs markedly from other types of banks (Delis, and Kouretas, 2011). As a result, our final dataset consists of 1,105 banks which are categorised either as commercial banks, savings banks, real estate and mortgage banks, or bank holding companies. Limited data availability for a number of balance sheet components however, will further reduce our sample size as we later demonstrate with our empirical analysis. To mitigate the effect of outliers in our inference, we also follow the example of previous studies and winsorize the data at the 2% level[19], in both sides of the sample distribution.

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[18] Following the classification of the *International Finance Corporation* (IFC), developed markets in our sample are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Luxembourg, Netherlands, Norway, Singapore, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The emerging markets in our sample are Chile, China, Greece, India, Ireland, Malaysia, Peru, Portugal, Russia, South Africa, South Korea, and Thailand.

[19] Our findings do not differ materially for different levels of winsorization.

4.3.1 Measures of Stock Liquidity

To construct our liquidity variables we compile data from Datastream and Bloomberg. More specifically, we use Datastream to collect the weekly adjusted price (*P*; closing price in local currency adjusted for splits and dividends), the weekly total return index (*RI*), the weekly trading volume (*VO*; expressed in 1,000 shares), and the corresponding number of shares outstanding (*NOSH*; expressed in thousands of shares) for each bank in our sample. Literature to date has developed an extensive number of alternative liquidity measures. Nevertheless, there is no conclusive evidence on which is the most appropriate, mainly because different measures capture different aspects of liquidity. The Amihud proxy is widely considered among the most popular liquidity measures, and several studies document that it is significantly correlated with high-frequency measures of transaction costs (Goyenko, Holden, and Trzcinka, 2009). It is constructed to reflect the marginal price response caused by a unit of trading volume (in local currency), and hence its value is increasing with illiquidity. We follow the example of other studies (e.g. Karolyi, Lee, and van Dijk, 2012) and multiply by -1 the logarithm of the Amihud ratio in order to obtain a measure that is increasing with liquidity. By using the logarithmic transformation we also mitigate concerns related to excessive skewness or non-symmetry in our data (we apply the same transformation to the other liquidity measures as well). In more detail, we construct the Amihud liquidity measure based on the formula below:

$$LIQ_{i,t} = -log\left(1 + \frac{|Ret_{i,t}|}{P_{i,t} \cdot VO_{i,t}}\right) \quad (4.1)$$

where $LIQ_{i,t}$ is the Amihud liquidity measure, $Ret_{i,t}$ is the stock return, $P_{i,t}$ is the adjusted closing price, and $VO_{i,t}$ is the trading volume of bank stock i on week t. Hence, the greater the price reaction due to a unit of trading volume, the higher the compensation requested due to concerns of adverse selection, and thus the lower the liquidity.

Another commonly used measure of liquidity is stock turnover. It primarily reflects trading activity in the secondary market and is typically computed as the (*log*) ratio of trading volume divided by the number of shares outstanding. Below is the respective formula:

$$TV_{i,t} = log\left(1 + \frac{VO_{i,t}}{NOSH_{i,t}}\right) \quad (4.2)$$

where $TV_{i,t}$ is the turnover measure, $VO_{i,t}$ is the trading volume, $NOSH_{i,t}$ is the number of shares outstanding for bank stock i on week t. Essentially, high stock turnover is associated with reduced inventory risk by market makers, and should therefore reflect better liquidity. Nevertheless, increased trading volume can also indicate a larger participation of short-term investors demonstrating herding behaviour, thus consuming rather than enhancing liquidity. In that respect, turnover can be a misleading indicator of liquidity since during periods when investors liquidate their positions disproportionally and thus liquidity abates, trading volume might still appear elevated provided that market makers are still accommodating the trading flow. Notwithstanding the ambiguity over its interpretation however, stock turnover remains among the most popular liquidity measures, and thus our choice is to include it in our study.

The last of our liquidity proxies is the (proportional) quoted spread, which typically qualifies as one of the most refined and direct measures of liquidity. It is computed as the ratio of the prevailing ask quote minus the prevailing bid quote, standardized relative to the midpoint of the prevailing bid-ask quote. More specifically, our computation is based on the formula below:

$$SPD_{i,d} = log\left(1 + \frac{ask_{i,d} - bid_{i,d}}{(ask_{i,d} + bid_{i,d})/2}\right) \tag{4.3}$$

where $SPD_{i,t}$ is the proportional quoted spread, $ask_{i,t}$ is the prevailing ask price, and $bid_{i,t}$ is the prevailing bid price for bank stock i on day d. To eliminate outliers due to reporting errors we exclude stock-day observations with bid quotes larger or equal to ask quotes, dollar spreads exceeding 5 (local currency units), and values of the proportional spread above 4. Naturally, higher levels of the quoted spread reflect higher transaction costs, which is reminiscent of higher information asymmetry and reduced liquidity for the particular stock.

To construct the annual value of the aforementioned liquidity measures we compute the arithmetic mean of the weekly Amihud (turnover) ratio and the arithmetic mean of the daily quoted spread for each year. For a detailed definition of all our variables we refer to Table A1 in the Appendix.

4.3.2 Bank efficiency, risk, and performance variables

As our first measure of bank performance we use *Tobin's Q* which is typically computed as the ratio of the market value of equity plus the book value of its liabilities divided by the book value of assets. As a market-based measure of performance, *Tobin's Q* is considered a closer proxy for the economic rate of return of a bank's assets since it incorporates the discount rate of future profits with the appropriate risk premium. Moreover, it is forward-looking and demonstrates higher resilience over earnings management, or anticipated changes in tax laws and accounting rules which render accounting measures less reliable. In principle, banks with assets that trade at a higher multiple of their book value are perceived as more efficient, and thus more likely to capitalize on their growth option by translating their opportunity set to the maximum possible profits. Within the banking industry this can be attributed either to greater managerial competence, superior lending/screening technology (e.g. risk management, credit monitoring), or more cost-effective operational structure. On the other hand, it can also reflect a favourable market valuation of its charter due to superior market power, which might have been established over historical rather than efficiency grounds. To account for this concern, we apply a decomposition of *Tobin's Q* (Fang, Noe, and Tice, 2009) and evaluate the relative contribution of stock liquidity to each individual component[20]. We also employ two of the most commonly used accounting measures of profitability, namely Return on Assets (*ROA*) and Return on Equity (*ROE*). The former typically reflects the ability of management to generate profits conditional on the overall size of the balance sheet, but it can also be biased upwards in case a bank commits a substantial amount of capital in off-balance sheet investment. *ROE* on the other hand represents the total profit generated per unit of shareholder equity, and as a result it might be a more relevant metric of the benefits induced by shareholder monitoring. One shortcoming however is that the latter measure does not adjust for the level of bank leverage, which might be elevated for the purpose of boosting shareholder profits in order to favourably influence market valuations at the expense of higher default risk. Moreover, *ROA* and *ROE* are both backward-looking performance measures since they both record the outcome of investments made at an earlier stage. This concern however is mitigated by the fact that in our empirical setup all the dependent variables follow the regressors by one year. We complement our performance analysis using a risk-adjusted measure of performance reminiscent of the Sharpe ratio, which we compute as the ratio of the average *ROA* over its standard deviation. Our version of the Sharpe ratio demonstrates only cross-sectional variation, and we only compute it when the minimum number of years with available information is no less than four (Demirgüç-Kunt, and Huizinga, 2010). A higher Sharpe ratio reflects improved ability to realize profits for a given unit of risk and as such it alludes to superior skill by management and greater operating efficiency.

[20] More details can be found in the sections that follow.

Our main measure of a bank's solvency risk is the *z-score* which we compute as the natural logarithm of one plus the sum of the mean *ROA* plus the mean ratio of equity capital over assets, divided by the standard deviation of the *ROA*. The log transformation is used to mitigate concerns typically attributed to the skewness of the initial distribution (Laeven, and Levine, 2009). The aforementioned ratio essentially translates to the number of standard deviations bank *ROA* needs to decline to completely wipe out the equity base of the bank. As such, the values of a bank's *z-score* are monotonically increasing (decreasing) with the distance (probability) to default. Similar to the Sharpe ratio, we require a minimum of four years of available information to be able to compute the *z-score* of each bank. We also use the standard deviation of a bank's *ROA* as an additional indicator of profit uncertainty, and hence risk. We complement our risk analysis with two additional measures that vary both across time and the cross-section, namely the share of impaired loans in the overall portfolio of bank loans, and the dollar share of assets classified as non-performing standardized by the overall value of assets. The former accounts for the credit risk in a bank's loan portfolio, whereas the latter reflects credit risk as a proportion of the balance sheet. Given that the share of non-interest income in total revenue has been rapidly increasing, the latter measure can provide a more informative account of the relative importance of credit risk in the balance sheet.

We also investigate the relation between liquidity and operating efficiency across banks. To the extent that banks at the top-end of the liquidity spectrum demonstrate superior profitability that is not merely an artifact of riskier activities (profit efficiency), it would be interesting to examine how stock liquidity relates to operating efficiency. In other words, assuming that stock liquidity proxies for more efficient monitoring by shareholders and given its positive ramifications on principal-agent frictions and managerial discipline, we would expect that banks with higher stock liquidity operate closer to their efficient production function. Hence, if market discipline translates to more efficient use of bank capital it might also be associated to superior operating standards as reflected in better risk management techniques, superior screening and monitoring technology of loans, and more accurate valuation techniques. To measure operating efficiency we rely on one of the most commonly used cost efficiency metrics, namely the ratio of operating costs over total generated income (e.g. Iannotta et al., 2007). As an additional efficiency measure we use the ratio of gross revenues over the total number of employees. One drawback of the latter approach however is the limited number of available observations over the annual number of employees for each bank which limits our sample size substantially.

4.3.3 Control variables

A potential concern with our analysis relates to the argument that stock liquidity and bank performance (or risk) can be both determined by a common set of variables. One way to address such concerns that allude to spurious inference due to an omitted variable bias is by populating our inference with an extensive number of control variables. Thus, our approach is to control for a wide set of factors, both at the industry and country level, that previous studies have elicited as determinants of bank profitability. We compute the ratio of cash and deposits with the central bank (CB) over the total value of assets and interpret it as the proportion of liquid assets relative to the size of the balance sheet. More liquidity in the balance sheet can translate to higher resilience over the adverse potential of rising financing costs, since banks will be able to use their cash to offset the impact of deposit withdrawals or deteriorating conditions in the interbank market. On the other hand, a higher proportion of liquidity in the balance sheet can exacerbate agency issues related to free cash flow problems or indicate a greater risk-shifting capacity on behalf of bank managers who can expeditiously mobilize their cash to engage in riskier activities. Hence, its relation to risk and bank performance is considered ambiguous. We also control for bank dependence on non-core financing which typically translates to funding instability since it exposes banks to significant rollover risk. To construct our measure, we follow Beltratti, and Stulz (2012) and compute the share of non-core liabilities consisting of deposits from other banks (also loans and repos), short term borrowing (e.g. money market instruments and CDs), and financing obtained from capital markets not categorized otherwise over the dollar value of overall short term funds which also include total customer deposits. As recent experience demonstrated, non-core liabilities are very sensitive to economic conditions and changing market valuations, rendering a bank more susceptible to the possibility of a run in the wholesale market (Ivashina, and Scharfstein, 2008; Cornett, McNutt, Strahan, and Tehranian, 2011). Nevertheless, given the limited supply of deposits, banks with greater access to wholesale funds are able to adjust their capital structure faster and can thus reap a larger share of the opportunity set when liquidity in the wholesale market is abundant (Adrian, and Shin, 2008). Hence, the impact of non-core financing on bank profitability and risk can also be ambiguous. We also control for the extent of revenue diversification at each bank by computing the share of non-interest related income in total operating income. As several studies indicate, non-interest income (e.g. revenues from trading securities, brokerage fees, fiduciary income, and charges not otherwise categorized) has become an increasingly important source of revenue for banks over the recent years (Demirgüç-Kunt, and Huizinga, 2010). Banks exclusively focused on credit provision are more exposed to the risk of a downturn in the real estate market compared to those with a more diversified revenue structure. However, as several studies indicate, profits derived from certain non-interest related activities (e.g. trading securities) demonstrate substantial cyclicality (Stiroh, 2004), and thus banks being overly dependent on such activities might demonstrate even higher susceptibility to economic downturns than otherwise. We also explore the relative contribution of the two most important components of the non-interest income variable to bank profitability, namely income from securities trading and fees, by including their respective share over total operating income in our regressions. As a measure of bank exposure to credit risk we use the ratio of the dollar value of outstanding loans and committed credit lines divided by total assets. Customer loans cover a wide range of lending, from credit extended to municipalities or the government, to loans provided to corporate clients, retail mortgages etc. Except for the aforementioned type of loans however, many banks are exposed to large amounts of unused loan commitments, and can thus face substantial liquidity risk during an economic downturn when takedown demand increases (Cornett et al., 2011). In extreme conditions, bank clients draw down their emergency credit lines *en masse*, undermining the ability of banks to extend credit when it is most needed and capitalize from other profitable opportunities. Hence, including untapped credit lines in our computations is quintessential since our measure would otherwise understate bank exposure to credit risk. We construct a proxy of bank capitalization based on the share of tangible equity in total assets (we subtract the value of intangible assets from equity whenever available), which essentially corresponds to the bank's capital buffer to adverse profitability shocks. Banks with a higher share of own equity are expected to demonstrate higher risk aversion because of the greater costs associated with a default, whereas banks with low capitalization might seek to maximize their implicit put option by engaging in riskier behaviour.

We naturally control for the role of scale economies as well as for other size related issues (e.g. systemic importance and implicit government guarantees) by including the logarithm of the real value of total bank assets (we deflate them using the CPI of the respective year). Larger asset size can also relate to greater analyst coverage, and/or higher visibility by equity investors, in which case more information would be produced and stock liquidity would increase. We also control for market performance by computing the time-series average of weekly stock returns for each bank. In this way we account for positive feedback trading by momentum investors who might demonstrate a bias towards best performing bank stocks, thus elevating trading activity in the secondary market. The underlying argument is that if we assume that cash flows shocks are -at least- partially anticipated by equity investors, they would boost market performance and thus generate the aforementioned clientele effects that translate to higher liquidity. Hence, to identify the role of stock liquidity independently of that from the complex mix of signals typically contained in market values it is necessary to control for stock market performance. Additionally, we differentiate across banks on the basis of the annual growth rate of their loans and deposits, whereas we also control for differences the cost structure by including the ratio of overhead expenses over total assets (in some specification we specifically control for the share of personnel costs in total assets). A rigid cost structure can weigh negatively on performance by narrowing down bank profit margins, and as such it is important to include in our inference (e.g. Demirgüç-Kunt, and Huizinga, 2010).

Bank performance is highly dependent on macroeconomic conditions (Athanasoglou, Brissimis, and Delis, 2008). Several studies indicate that the same holds for systemic liquidity (e.g. Brockman, Chung, and Pèrignon, 2009; Naes et al., 2011). When the economy is growing (contracting) the average number of borrowers who are unable to meet their payment obligations abates (soars), and thus the quality of banks' loan portfolio improves (deteriorates). As a result, a correlation between liquidity and bank performance might be merely the reflection of a general improvement in the economic environment. We address the aforementioned concerns by including an extensive number of variables that account for the general state of the economy and investor sentiment. We proxy for general economic conditions using the annual average of quarterly (year-to-year) real GDP growth rate, and the annual average of the quarterly inflation rate (CPI). To the best of our knowledge, there is no clear prediction for the relation between inflation and bank profitability. Banks able to anticipate inflation successfully can divert part of their balance sheet to inflation proof-assets or adjust their cost structure to protect their profit margin. In the opposite case, banks unable to foresee inflation might be unable to promptly adjust their lending rates to offset rising operating expenses, and thus witness a decline in their profitability. We also use the S&P500 option implied volatility index (*VIX*) as a measure of aggregate risk aversion and investor sentiment, and the GDP per capita as a proxy of economic development. The *VIX* captures uncertainty over economic conditions and changes in global risk aversion that can influence the demand for credit and consequently bank profitability, but can also relate to trading activity in equity markets and thus to liquidity (Adrian, and Shin, 2008). We also include the domestic short (time-series average of the quarterly 3-month T-Bill rate) and long term interest rates (time series average of the quarterly 10-year sovereign bond rate) to account for the stance of monetary policy, prevailing financing conditions, and the average level of interest rate margins. For an overview of all our variables and the respective data sources we refer to table A1 in the Appendix.

4.3.4 Descriptives and Univariate Analysis

In Table 4.1 we present some descriptive statistics for the basic variables of our analysis. By construction, Amihud liquidity is always negative, with values closer to zero indicating higher liquidity. Consistent with other studies, our liquidity variables demonstrate significant skewness –negative for the Amihud ratio, positive for the quoted spread respectively – which is mainly induced by periods of extreme marketwide liquidity drops[21] . Moreover, all our liquidity measures demonstrate higher variation across rather than within markets, suggesting that there are substantial differences in the level of trading activity, particularly between developed and emerging markets (e.g. Eleswarapu, and Venkataraman, 2006). *Tobin's Q* demonstrates less dispersion across countries, varying from a low of 0.91 to a maximum of 1.35. Based on Table 4.1, the average market value of bank assets is almost at parity with their replacement cost (1.04), the average stock price trades at an average of 19.3 times its earnings, whereas the median bank is able to generate 0.73 cents per additional dollar in balance sheet assets. The average income generated from non-interest related activities contributes 30.3% to total operating income, very close to the value reported by Demirgüç-Kunt, and Huizinga (2010) which is 35.3%. This can be attributed to the fact that unlike the aforementioned study, our sample extends to the post crisis period between 2008 – 2012, during which most banks have refocused to their core activities in part due to regulatory pressures, but also due to diminishing returns from those alternative activities during the crisis period (e.g. securities trading). The average share of non-deposit funding in our sample of banks (*funding fragility*) is 18.5% of their total short term demandable funding, which lies between the values reported by Demirgüç-Kunt, and Huizinga (2010) and Beltratti, and Stulz (2012). We observe that the average ratio of impaired loans (assets) over total customer loans (assets) demonstrates substantial variation, ranging from a low of 0.05% (0.00%) to a maximum of 15.5% (9.86%). This is not surprising given the extensive time period of our sample, which covers periods both of global economic expansion and of prolonged contraction, and given that loan delinquencies are extremely cyclical. Weekly stock market returns demonstrate similar dispersion, ranging from as a low as -1.85% to as high as 2.61%. Year-to-year deposit growth for the average bank is

[21] The positive skewness of market turnover can be indicative of either rare liquidity crushes or periods of extreme investor euphoria.

11.13%, which translates to an average of 9.77% (9.69%) annual growth in total customer loans (assets); both numbers compare closely to figures provided by other papers (e.g. Demirgüç-Kunt, and Huizinga, 2010; Foos, Norden, and Weber, 2010). The share of tangible equity varies comparably within and across countries, whereas the average bank has 8.56% tangible equity over assets. Tangible equity demonstrates positive skewness which is naturally attributed to the obligatory capital restrictions imposed by regulators across all the countries.

In figures 4.1 and 4.2 we use a graphical interface to examine the relation between liquidity and certain variables of interest, both in a static as well as in a dynamic framework that investigates how the relation develops over the years. In more detail, for every year in our sample we aggregate banks listed in the U.S. (they account for more than half of our sample) on the basis of their ranking in one of the four liquidity quartiles the previous year, and then compute the average of each variable within every portfolio over time or aggregate across all the years. Figure 4.1 presents the top (75%) and bottom (25%) quartiles, which correspond to the low and upper end of the liquidity spectrum respectively, since computations are made using the quoted spread liquidity measure. Except for issues related to reverse causality and spurious correlation, there is also another reason to sort banks on the basis of past liquidity. Since liquidity proxies for the extent of investors' direct or indirect involvement in monitoring managerial conduct and the investment strategy followed, it is natural to assume that certain time needs to lapse before the benefits (disadvantages) of stringent (loose) monitoring start to manifest in bank performance or efficiency. The graphs show that the portfolio of bank stocks at the upper-end of the liquidity spectrum (below the 25th percentile of the quoted spread) almost always display superior performance (higher *ROA*) and efficiency (lower *Cost/Income*), lower credit risk (*Impaired Loans/Loans*), and higher market valuation of assets (*Tobin's Q*) compared to banks at the low-end of the spectrum (above the 75th percentile of the quoted spread). We also see that bank profitability declined dramatically during the peak years of the recent financial crisis (2007 – 2008), only to start recovering from 2009 and onwards. Similar to performance, the share of non-performing loans in banks' loan portfolio is surging during the financial crisis. It is noticeable however, that the credit risk of banks with more liquid stock recovers much faster compared to banks with illiquid stock, indicating that the portfolio of banks that were more closely monitored by markets had better credit quality and had thus weathered the financial storm being less affected. In Figure 4.2 we report the time average of the aforementioned bank characteristics for each portfolio of bank stocks. Now we use both the quoted spread and the Aminud ratio to assign banks to the respective liquidity quartile. We observe that bank performance and market valuation increase (decrease) almost monotonically with the (il) liquidity quartile, whereas the opposite applies for credit risk and the inefficiency ratio. Table 4.2 presents the unconditional Pearson correlations between our baseline variables. The Amihud ratio and the quoted spread have a substantial negative correlation, with statistical significance above the 10% level. On the other hand, stock turnover demonstrates very weak correlation with the other two liquidity proxies. All our liquidity measures correlate more than 10% with *Tobin's Q*, at a statistically significant level and with a sign denoting that market valuation constitutes a higher multiple of book value in banks with higher stock liquidity. Consistent with our reasoning, liquidity has also an unconditional negative correlation with both bank cost inefficiency and credit risk. Moreover, the share of non-interest income and non-core financing are positively correlated with liquidity as well as with *Tobin's Q* and bank size. It is natural to expect that large banks tap wholesale markets to a larger extent compared to small banks, and also rely relatively less on traditional lending to produce their profits. The aforementioned activities can generate more visibility among investors which can result in higher liquidity. Hence, accounting for differences in the financing model and income structure across banks is important in order to isolate the liquidity effect and avoid any spurious inference.

Table 4.3 provides a more detailed univariate comparison between our three liquidity measures and several bank characteristics, this time including banks from all the countries in our sample. Our variables of interest account for bank performance (*Tobin's Q*, *ROA*), credit risk (*Impaired Loans*), on-balance sheet liquidity (*Cash/Assets*), and bank size ((*log*) *Total Assets*). In more detail, for each year in our sample we rank banks in one of the four liquidity quartiles on the basis of their stock liquidity, separately for each country, and then compute the pooled equally-weighted average of each of the aforementioned bank characteristics for the year following the sort in each of the four bank portfolios, and across time. To be able to construct each of the four groups of banks in every country, we require a minimum of ten banks with non-missing information for the particular variable of interest. We also compute the difference between the top (Q4) and bottom (Q1) (il)liquidity quartiles, and test both for the equality of means of the respective quartiles (*t-test*), as well as the equality of medians (χ^2-*test*). Overall, we observe that liquidity demonstrates an almost monotonic relation with all the aforementioned bank characteristics, regardless of the particular liquidity measure we employ for the portfolio construction. These relations are significant both in statistical and economic terms. For example, in the case of our inefficiency ratio we notice that a drop from the top (il)liquidity quartile to the bottom translates to an increase (decrease) of the inefficiency ratio by 8.05% (6.08%) according to the *Amihud ratio* (*Quoted Spread*), which is 12.38% (9.36%) of the unconditional sample mean. In the case of profitability (*ROA*), banks that rank at the top quartile demonstrates higher profitability by 0.11% according to the *Amihud Ratio* (14.77% of the unconditional average[22]), whereas the corresponding difference in the case of credit risk is 1.51% which represents the 48.47% of the unconditional mean. Our measures of bank size and on-balance sheet liquidity are also positively associated with liquidity, which further supports the necessity to control for these factors in our multivariate setup.

4.4. Econometric analysis and results

In this section we examine the relation between our liquidity measures and bank risk-taking, performance, and operating efficiency, using a number of empirical models and after accounting for all other possible determinates of the aforementioned characteristics.

4.4.1 Baseline Specification

The previous section employs a univariate setup to establish the view that banks with higher stock liquidity are more cost efficient, demonstrate superior profitability and have lower credit risk in their loan portfolio. In other words, our earlier findings indicate that more stringent monitoring by equity markets translates into more skilful credit provision and monitoring, lower operating costs per unit of income generated, and superior ability to generate profits for shareholders. These findings however can just be the result of omitted bank characteristics incidentally correlated with liquidity, or unobserved country factors that explain both the variation in stock liquidity and the differences in our measures of bank performance across countries. To address such concerns, this section investigates the liquidity – bank performance nexus using a multivariate setting. We begin our analysis using a market based measure of performance, namely *Tobin's Q*, which evaluates bank assets by assigning the appropriate discount rate over expected cash flows and then relates them to their respective accounting value. In that respect, it reflects the risk-adjusted market consensus over a bank's ability to generate value conditional on the size of this balance sheet. We account for any unobserved cross-country heterogeneity using country fixed effects, whereas we capture any common variation in bank performance that relates to global shocks during particular years

[22] Summary statistics for the variables not reported in Table 4.1 are available by authors upon request.

by including year fixed effects. We also control for differences in the particular type of bank charter (commercial banks, savings banks, real estate and mortgage banks, bank holding companies) using dummy variables. Equation (4.4) below defines the baseline empirical model we have just described.

$$Q_{i.j,t} = c_j + b \cdot LIQ_{i,j,t-1} + \sum_{k=1}^{K} d_k \cdot Bank_{i,j,t-1}^{k} + \sum_{m=1}^{M} e_m \cdot Macro_{j,t-1}^{m} + Type_i + Time_t + \epsilon_{i.j,t} \quad (4.4)$$

where $Q_{i.j,t}$ is *Tobin's Q*, $LIQ_{i,j,t}$ is one of our liquidity measures (*Quoted Spread, Amihud Ratio*, and *Stock Turnover*), and $Bank_{i,j,t}^{k}$ corresponds to one of our *K* bank level control variables for bank i, country j, and year *t* respectively. $Macro_{j,t}^{m}$ is one of our M macroeconomic control variables for country j, during year t, $Type_i$ accounts for the particular bank type, and $Time_t$ for the year fixed effects. To avoid concerns related to the potential of joint determination of our regressors, and our liquidity variable in particular, with the measure of bank performance, we lag our regressors by one year, and thus implicitly assume they are predetermined. Moreover, one year seems to be a sufficient amount of time that is necessary to lapse before the benefits (disadvantages) of stringent (loose) market monitoring start to manifest in bank performance. Similar to previous studies (e.g. Demirgüç-Kunt, and Huizinga, 2010), we estimate equation (4.4) as a pooled cross-sectional time-series model using *OLS* with clustering of the standard errors at the bank level. Table 4.4 presents the estimates of the basic model in equation (4.4). To facilitate the interpretation of our findings, all the regressors are normalized by their unconditional standard deviation (SD). We observe that with the exception of column 10, the coefficients of the *Amihud ratio* and of the *Quoted Spread* are always statistically significant at the 1% level. When we exclude the 2007 – 2012 crisis period, statistical significance is reduced to 10% for *Quoted Spread* (and *Turnover*[23]), whereas the Amihud ratio remains significant at the 1% level. In the case of the extended regression model presented in Columns (7)-(9), we find that 1SD increase in the *Quoted Spread* (*Amihud Ratio*) translates to a 0.67% (1.7%) decrease (increase) in *Tobin's Q*, which corresponds to a 0.64% (1.03%) decrease (increase) compared to the unconditional mean. Results for turnover are still significant but weaker both in statistical and economic terms. From a different perspective, the impact of liquidity (*Amihud Ratio*) is larger than the impact of our measure for global risk aversion (*VIX*), and almost twice the magnitude of the real *GDP* growth variable. Hence, stock liquidity appears to be an important determinant of bank performance. Regarding our control variables, funding

[23] Results for *Turnover* are not presented due to space limitation. They are, however, available from the authors upon request.

fragility seems to have a particularly strong effect on market performance, with a 1SD increase in the share of non-core financing to be associated with a 0.98% decrease in market performance the following year (Column (8)). Market performance and balance sheet liquidity have both a strong positive effect on performance, whereas bank size is also positively correlated to market performance alluding to advantages associated with scale economies in the banking sector. The implied volatility index demonstrates the most pronounced effect among our macro variables, indicating that an increase in global risk aversion weighs negatively on bank performance.

The basic disadvantage of a market-based measure is that cash flow expectations or market consensus over the respective discount rate can change due to fluctuations in investor sentiment. In addition, banks might seek to exploit favourable economic conditions and investor's euphoria by increasing leverage, thus boosting expected profits, and further enhancing market valuations. To disentangle the role of liquidity from the aforementioned effects and shed more light upon the liquidity – bank performance nexus, we follow Fang et al. (2009) and decompose *Tobin's Q* as follows:

$$Q_{i.j,t} = \underbrace{\frac{MV\_Equity_{i.j,t}}{Net\_Oper\_Inc_{i,j,t}}}_{P/_E} \cdot \underbrace{\frac{MV\_Assets_{i,j,t}}{MV\_Equity_{i,j,t}}}_{Leverage^{-1}} \cdot \frac{Net\_Oper\_Inc_{i,j,t}}{BV\_Assets_{i,j,t}} \qquad (4.5)$$

where $MV\_Equity_{i.j,t}$ corresponds to the market value of equity, $Net\_Oper\_Inc_{i,j,t}$ is the net operating income, $MV\_Assets_{i,j,t}$ is the market value of assets, and $BV\_Assets_{i,j,t}$ is the book value of assets of bank *i*, at country *j*, during year *t*. The first component can be interpreted as a sentiment indicator[24], the second component is the inverse of financial leverage, and the third demonstrates the ability of a bank to generate profits after adjusting for the size of its respective balance sheet. Hence, among the aforementioned *Tobin's Q* components, it is the third ratio that captures most clearly the extent of managerial skill in the allocation of economic resources.

We now repeat our estimation of equation (4.4), by replacing *Tobin's Q* with each of the components indicated in equation (4.5). Table 4.5 presents the respective results. If the relation between liquidity and performance is driven by their joint correlation with investor sentiment, it is natural to expect that banks with higher stock liquidity will trade at a higher multiple of their net income compared to banks with low stock liquidity. If that is the case, it would be the sentiment component that was mainly responsible for our earlier results. Table 4.6 shows that with the exception of *Stock Turnover*, both the *Amihud Ratio* and the *Quoted*

[24] The *P/E* ratio is widely used as a barometer of investor sentiment.

Spread have no explanatory power over a bank's *PE* ratio. Conversely, the latter liquidity measures are strongly associated with the other two components of *Tobin's Q*, with statistical significance always at the 1% level. In more detail, a 1SD increase in the *Amihud's Ratio* (*Quoted Spread*) predicts a 49.5% (19.8%) increase (decrease) of net income over its unconditional average, and a 16% (10.8%) decrease (increase) in financial leverage respectively. Hence, the effect of liquidity on *Tobin's Q* documented in Table 4.4 is mainly due the former's positive association with profitability and its negative relation to financial leverage. The effect of (*Amihud*) liquidity on profitability (Column 2) is almost equivalent to the effect of economic growth, which previous studies identify as one of the most important determinants of bank performance (e.g. Iannotta et al., 2007; Demirgüç-Kunt and Huizinga, 2010). Only the most crude of our liquidity measures, namely *Stock Turnover*, does not seem to validate our hypothesis, namely that market monitoring can enhance bank operating performance without a subsequent increase in risk or leverage. In that respect, it is not without relevance that stock turnover is often used by previous studies as a proxy for investor sentiment (e.g. Baker and Stein, 2004; Baker, Wurgler, and Yuan, 2012). Among our remaining variables, we notice that banks with a higher share of non-interest related activities demonstrate higher profitability but trade at a lower multiple of their earnings. One interpretation might be that non-core revenue sources are perceived by equity investors as more risky and less reliable, although they account for an increasing proportion of bank profits. On the other hand, funding fragility is negatively associated both with profitability and investor sentiment, whereas more on-balance sheet liquidity is only (positively) correlated with future profits at a statistically significant level. It is noteworthy that stock returns are strongly related to all three components of *Tobin's Q*, significantly at the 1% level. This finding further supports our earlier intuition regarding the added value of stock liquidity as a more refined predictor of future bank performance, given that market returns typically reflect a much wider mix of signals. Consistent with previous studies, we also find that better capitalized banks are able to generate higher profits, and tend to trade at a higher multiple of their earnings, perhaps indicating the predominance of overoptimistic investors or due to demand pressure attributed to clientele effects.

4.4.2 Stock liquidity, bank performance, and risk

We now turn our attention to the relation between liquidity, leverage, and bank performance in more detail. Our findings so far indicate that banks at the upper-end of the liquidity spectrum have lower financial leverage and higher profitability compared to banks at the bottom-end. However, the significant relation between the aforementioned components of *Tobin's Q* and liquidity, which we have already documented, is not sufficient for concluding the existence of a causal relationship between them. For example, in the case of financial leverage one argument might be that our measure demonstrates a mechanical correlation with liquidity since it uses the market value of equity for its construction which already incorporates an illiquidity discount. We address this concern by computing leverage based on accounting values, and then repeat our earlier estimation. Moreover, leverage figures can conceal substantial differences in the riskiness of balance sheet assets which might not be properly captured by accounting values. So we try to verify our conclusions using a risk-adjusted version of accounting leverage. Another concern relates to the problem of endogeneity. One argument is that investors might shun away from banks that typically resort to higher leverage in order to boost their earnings, thus lowering their distance to default, and implicitly back-loading any adverse market valuation effects. In the case of performance, investors might refrain from holding stocks of banks lagging behind in terms of competitiveness or market share which are thus expected to deliver relatively low profits in the future. This behaviour can in turn induce low trading volume and result in thin markets. To address such concerns we instrument bank stock liquidity, and complement our analysis with a two-stage least squares estimation (*2SLS*). Our set of instruments consists of the type of bank charter, and the average idiosyncratic volatility of two other banks with the closest possible market value to that of the instrumented bank. It is reasonable to assume that banks with different charters adopt distinct business models, which in turn translates to differences over the extent of their dependence on equity financing, and thus different depth in the secondary market. It is also natural to assume that a bank's charter is exogenously determined. On the other hand, the level of idiosyncratic volatility typically reflects the extent of private information flow that is incorporated into stock prices through informed trading (Roll, 1988), and as such it directly relates to liquidity. Ferreira and Laux (2007) for example document that stocks with high idiosyncratic volatility correspond to companies with better governance standards, and fewer anti-takeover provisions, and as such induce more trading by institutional investors. Moreover, given that the set of candidate banks used to construct our idiosyncratic volatility instrument extends to all the countries in our sample, it is difficult to argue that an adverse shock affecting both liquidity and leverage can systematically correlate with the extent of informed trading of stocks listed across different exchanges. Hence, it is reasonable to argue that both our instruments are closely related to bank stock liquidity, and are exogenous.

Table 4.6 presents our findings regarding the relation between leverage (accounting), the ratio of interest expenses, the cost of debt financing, and bank stock liquidity. Except for the last specification, stock liquidity is always negatively associated both to leverage and the cost of debt financing significantly at the 1% level. In unreported results we find the same relation holds if we replace our measure of leverage with one that takes into consideration the riskiness of different assets by weighting them accordingly (risk weighted assets over equity). Our findings are also significant in economic terms. According to Column (2), one standard deviation increase in the *Amihud* ratio is associated with a decrease in leverage of 34.8% compared to its mean[25], and a decline in the cost of debt by 6.5% over its unconditional mean. The tenor of our findings remains unchanged when we resort to *2SLS* estimation to explicitly address endogeneity concerns. The partial R^2 indicates that our set of instruments captures a meaningful share of the variation in bank stock liquiditiy, whereas the *F-test* always rejects the null that the coefficients of our instruments are jointly equal to zero. Our findings are thus consistent with earlier studies showing that companies with higher stock liquidity have lower leverage and typically favour equity issuance over alternative sources of external financing (e.g. Lipson and Mortal, 2004). Our findings also suggest that banks with shares trading in more liquid markets not only benefit from a smaller illiquidity discount in the price of their shares, but also from a lower cost of debt.

In Table 4.7 we present our findings over the relation between bank stock liquidity and future performance using a number of measures. Stock liquidity is always positively associated with future profitability, significantly at the 1% level. In the last two columns we use a cross-sectional measure of performance resembling the Sharpe ratio in which average profits are adjusted with their respective volatility. A one standard deviation increase in the quoted spread predicts a decline of 0.13% (1.88%) in next year's *ROA* (*ROE*), and a 17.6% decline in the *Sharpe* ratio (Columns (1), (5), and (9) respectively). We note that our instruments typically capture a larger share of the variation in the *Amihud* ratio compared to *the Quoted Spread*, but the *F-test* always rejects the null of our instruments being jointly zero for both measures of liquidity. Consistent with intuition, our findings suggest that banks that are better capitalized, with more diversified sources of revenue, and less dependence on non-deposit financing typically demonstrate superior profitability. General economic conditions are also equally important determinants of bank performance as manifested by our *GDP Growth* variable. Interestingly, the liquidity effect (*Amihud*) dominates that of economic growth (*GDP*) across all our models. In unreported results we find that

[25] The unconditional means for (accounting) leverage and the cost of debt are 13.9779% and 3.1640% respectively.

stock turnover is only weakly associated with performance, demonstrating mixed sign, whereas it is not robust to alternative specifications.

It is commonly perceived that banks can *ex-ante* improve expected profitability by increasing their leverage or by engaging in riskier activities. Hence, the positive relation between market liquidity and performance might merely reflect an indirect association of the former with either leverage or risk. Since our earlier findings establish the opposite relation between stock liquidity and leverage, we now explicitly investigate the potential link with bank risk-taking. In Tables 4.8, and 9 we present our findings using two different measures of risk, namely (on balance sheet) credit risk and the bank distance-to-default as dependent variables, respectively. Similar to our earlier specifications, we explicitly account for potential endogeneity between liquidity and risk using a *2SLS* approach using the instruments we have already discussed. We also control for the growth rate of loans and the expansion rate of the balance sheet (*Total Assets Growth*) since earlier studies identify excessive lending as an important driver of bank risk (Foos et al., 2010). Both tables document a negative relation between stock liquidity and bank risk-taking, which remains robust and statistically significant across a number of specifications. We also find that banks depending more on non-interest income have lower credit risk, whereas larger reliance on funding from capital markets reflects riskier lending choices from banks. The latter finding is also confirmed by our cross-sectional regressions using the *z-score* and the overall variation in profits, *SD(ROA)*. Hence, banks rely to unsecured short-term financing to extend credit to less qualified borrowers, exposing themselves both in higher maturity risk and in higher credit risk. Interestingly, the growth rate of loans correlates negatively to credit risk, but is positively associated to average default risk. Our explanation is that since retail borrowers are more likely to default at some later stage following the issuance of the loan (e.g. close to maturity if they are unable to refinance), more time might be required for credit losses to start manifesting themselves. On average however, Table 4.9 shows that banks expanding more aggressively their lending operations are doing so at the expense of higher variation in profits and a lower distance-to-default. Moreover, Table 4.9 shows that banking sector insolvency risk is positively related to the generosity of deposit insurance and the concentration of the banking sector. In that respect, our findings are aligned with previous studies arguing that public guarantees to the banking sector can create perverse incentives and lead to moral hazard.

Now we turn our attention to the relation between liquidity and efficiency. If more intense market monitoring translates to higher profitability while at the same time being negatively related to leverage and risk-taking, this should demonstrate the ability to operate closer to the efficient frontier. We use two measures of efficiency, namely cost efficiency which is constructed as the ratio of total overhead expenses over total operating income, and productive efficiency which we compute as the dollar amount of revenue produced per employee. Table 4.10 presents the respective results. We find that stock liquidity is positively associated with cost efficiency consistently across all our specifications, whereas evidence with respect to productive efficiency is less robust. In more detail, we find that 1SD increase in the *Quoted Spread* is associated with an increase of 2.31% in the ratio of costs per unit of revenue, which corresponds to a 3.55% increase over its unconditional sample mean and is significant at the 1% level (Column (1)). Non-interest income is negatively correlated to cost-efficiency but demonstrates no significant relation to productive efficiency. In Columns (2) and (5) we explicitly control for two of the most important components of non-interest income, namely revenues generated from securities trading and fees, but we find no evidence of a significant contribution on cost efficiency[26]. We also find that more tangible equity and a larger size of the balance sheet are both positively correlated to efficiency, with the latter probably alluding to the ability of larger banks to take advantage from economies of scale.

4.4.3 Liquidity, Agency frictions, and Institutional Quality

In this section we investigate in more detail the different mechanisms through which stock liquidity can affect bank operating performance, giving particular emphasis to the governance based interpretation. Agency theory posits that firms with an abundance of cash are more susceptible to principal-agent type of conflicts since managers are less subject to monitoring by capital markets as they are able to use cash to finance new investment (Jensen, 1986). We believe that similar arguments can be used in the case of banks. It is intuitive to argue that cash-rich banks are typically perceived as more safe and are thus less subject to monitoring by creditors, whereas they also depend less on capital markets to finance the expansion of their balance sheet. Moreover, a greater share of cash on the balance sheet can allow banks to engage in risk-shifting faster and with less cost. Hence, we rank each country's banks into terciles depending on the average ratio of their cash holdings relative to assets, and then examine the impact of stock liquidity on profitability, cost-efficiency and credit risk for the top and bottom tercile separately. Table 4.11 presents the respective results. We find that stock liquidity is much stronger predictor of performance and credit risk for banks that

[26] Only the share of fees in total operating income is negatively related to productive efficiency at a statistically meaningful level.

are more susceptible to agency frictions (top tercile) according to our ranking. The difference between the two terciles is particularly pronounced when we use *Quoted Spread* as our liquidity measure. We also note that with the exception of Column (2), both our liquidity measures are always significantly associated to profitability, credit risk, and cost-efficiency at a statistically significant level.

As we have already discussed in the literature section, stock liquidity can benefit corporate governance by allowing activist investors to increase their influence through the accumulation of shares at a low cost, or by increasing the credibility of their exit threat. Assuming the threat of exit is a more efficient governance mechanism, we would expect that the disciplinary effect of liquidity becomes more pronounced during periods of poor market performance rather than the opposite. Hence, we formulate the aforementioned conjecture into an empirical test by identifying those individual bank-years with disappointing stock market performance[27] and investigate whether the marginal impact of liquidity increases during those years. Table 4.12 displays the corresponding results. With the exception of Column (1), the interaction term between stock liquidity and our indicator of bottom returns is not significant in any of our models. Thus, our empirical setup provides no support to the notion that the disciplinary role of liquidity is a manifestation of an exit threat by shareholders. However, our findings should be interpreted with caution since valuation shocks are rarely exogenous to liquidity. As a result, disappointing returns might correlate to factors that are also associated to liquidity, in which case our current setup cannot produce a conclusive answer regarding the importance of the exit threat over bank performance. Such concerns however do not seem to be substantiated in our data since years of low returns have a negligible correlation with years of low liquidity (bottom quartile).

Another channel through which liquidity can improve bank governance is by fostering the participation of informed traders. As we have already argued, enhanced liquidity increases the marginal benefit from information acquisition, and thus encourages trading by informed investors. As a result, market prices reflect future growth prospects and performance more accurately and thus reduce the cost of monitoring by activist investors, but also facilitate the structuring of more efficient compensation schemes for managers. Hence, by accommodating the trades of informed traders, liquid markets reduce agency frictions in the governance of banks and better align the interests of managers with those of the shareholders. To assess whether the liquidity effect is operating through the aforementioned information channel we follow the example of Llorente at al. (2002) and construct a

[27] As years with disappointing performance we classify those that lie at the bottom quartile of the annual stock return distribution for each bank. For this purpose, we only consider banks with at least 10 years of available annual stock returns.

measure of information based trading by estimating the following time-series relation for each bank-year in our sample:

$$R_{i,d+1} = c_{0,i} + c_{1,i} \cdot R_{i,d} + c_{2,i} \cdot R_{i,d} \cdot TV_{i,d} + \varepsilon_{i,d+1} \qquad (4.6)$$

where $R_{i,d}$ is the stock return, and $TV_{i,d}$ is the detrended[28] log turnover of bank i, during day d. The estimated coefficient $c_{2,i}$ is our measure for information-driven trading, and is obtained for all the bank-years in our sample. Table 4.13 reports the time-series average of our information driven trading measure, aggregated each year across banks sorted in the same quartile based on the ranking of their stock liquidity the year before. We find no indication of a monotonically increasing relation between any of our measures of stock liquidity and the extent of information driven trading. Interestingly, in the case of the *Amihud Ratio* and *Stock Turnover*, the relation with informed trading seems to be of the opposite direction. Moreover, we find no evidence of any significant relation between liquidity and informed trading when we employ a multivariate setup, similar to that of equation (4.4), in which we use $c_{2,i}$ as our dependent variable. Hence, our empirical analysis so far lends little support to the idea that liquidity is operating through the information channel.

To investigate the market discipline channel of liquidity, we examine the sensitivity of deposit growth and debt financing costs over a number of dimensions, namely the bank's share of tangible equity (*Tangible Equity*), its credit risk (*Impaired Loans*), and profitability (*ROA*). Similar to previous studies (e.g. Demirgüç-Kunt, and Huizinga, 2004) we conjecture that greater responsiveness of deposits and borrowing costs over changes in the aforementioned factors is indicative of closer monitoring by investors, and thus reflects greater market discipline. For this purpose we separate banks into two groups depending on whether the time-series average of their stock liquidity (*Quoted Spread*) ranks above or below the corresponding country median. Table 4.14 presents our findings. We notice that with the exception of Columns (7) – (8) that refer to the relation between debt costs and capitalization, the high liquidity group of banks demonstrates significantly higher responsiveness in both deposit growth and debt costs over capitalization, credit risk and profitability. The differences observed between the two groups are also substantial in economic terms. For example, a 1SD positive shock to profitability leads to an increase in deposit growth by 27.6% of its unconditional mean for the high liquidity group (*Quoted Spread* below the country median), and an increase of 16.6% for the low liquidity group. Moreover, a 1SD

[28] Similarly to Llorente at al. (2002) we detrend by subtracting the corresponding 200 trading days moving average.

increase in the share of impaired loans is associated with a decline of 10.4% in deposit growth over its unconditional mean for the high liquidity group, and a corresponding decline of 6.9% for banks with below median stock liquidity. However, one caveat of our present setup is the significantly lower number of observations in the low liquidity group of banks which could potentially increase the noise in the measurement of respective variables and thus undermine the magnitude of the results compared to the high liquidity group.

Naturally, a definitive test of the bank stock liquidity-performance nexus would ideally involve an exogenous shock to liquidity, and would thus seek to exploit the cross-sectional variation in respective liquidity increments to isolate their effect over bank risk and profitability. Given the close relation between liquidity and performance however, such a task is by no means trivial, whereas the fact that our sample spans a large number of countries only increases the complexity of such undertaking. In unreported results, we pursue the aforementioned natural experiment approach using the exogenous increase in market liquidity for bank stocks listed on the NYSE, due to the decimalization of the exchange that became effective in January 2001 (e.g. Fang et al., 2009; Bharath et al., 2012). Our approach involves two types of empirical tests. The first one employs changes in measures of performance and efficiency calculated between the year following and the year before the decimalization, over corresponding changes in stock liquidity and control variables. The second test is based on a difference-in-difference type of analysis using variables in levels and focusing on the interaction between liquidity and an indicator that separates the sample between pre and post decimalization periods. Both our tests however do not produce any significant results. Our explanation is that the lack of significance should be attributed either to reduced power due to limited sample size or to potential asymmetries in the impact of positive versus negative liquidity shocks, with the latter having more important ramifications on performance. In other words, a decline in the extent of monitoring by equity investors originating from a negative liquidity shock might generate a more pronounced impact on performance compared to a marginal increase in market monitoring due to a positive shock, similar to the aforementioned.

4.5. Conclusions

In this paper we investigate the relation between bank stock liquidity, risk, and performance across a number of dimensions. In theory, high stock liquidity is associated with more intense market monitoring, greater benefits from private information collection, more informative prices, more efficient contractual arrangements with managers, lower agency frictions, and lower cost of capital. As a consequence, there are a number of potential channels through which bank stock liquidity can influence bank behaviour and affect performance, none of which has been investigated by the literature to date. To the best of our knowledge, the present study is the first to provide evidence of such a relation, but also the first that tries to explore its implications and identify the underlying mechanisms through which it operates in the context of the banking sector.

To assess the role of liquidity, we construct a detailed dataset with balance sheet information for more than 1,100 banks, spanning 31 countries around the world. We find that banks with higher stock liquidity enjoy a superior market valuation. A decomposition of *Tobin's Q* reveals that liquidity is inversely related to leverage and positively associated with the ability to generate profits. However, our main measures of liquidity demonstrate no association with *Tobin's Q* sentiment component, further supporting our intuition regarding the existence of material benefits due to greater monitoring by shareholders. We proceed with our analysis showing that liquidity is negatively associated to risk-taking, measured both in terms of realized credit risk, and using the distance-to-insolvency. We also show that banks at the top end of the liquidity spectrum are able to operate closer to their efficient frontier, both in terms of average cost per unit of generated income (cost efficiency), as well as in terms of income produced per employee (productive efficiency). The main body of our results is confirmed using both a time-series as well as a purely cross-sectional framework, and by employing a large number of alternative measures for performance. Our findings are also robust to a *2SLS* approach in which we explicitly account for potential endogeneity by instrumenting stock liquidity with the type of bank charter, and the average idiosyncratic volatility of two other banks matched in terms of size.

Next, we show that the liquidity effect is more pronounced in the case of banks with a greater share of cash in their balance sheet, which we interpret as evidence that the liquidity effect operates by mitigating principal-agent frictions within banks. In support of the market discipline channel, we also show that higher liquidity implies greater responsiveness of deposits and borrowing costs over changes in tangible equity, credit risk, and profitability. Nevertheless, our data reveal no link between liquidity and the extent of informed trading, whereas we also find no evidence in support of an exit threat by shareholders as a means of discipline.

Except for its contribution to the academic debate regarding the role of markets as moderators of bank risk-taking and performance, we believe our study will also provide useful insights to policy-makers and regulators who typically employ market signals to develop forward-looking indicators of potential vulnerabilities in the banking sector. Especially when compared to accounting information which is backward-looking and only periodically released, market based indicators like stock liquidity have the additional advantage that they can be constructed on a daily basis, and thus provide supervisors with timely warning signs over potential problems in specific banks.

Table 4.1: Summary statistics of bank specific and macroeconomic variables

This table presents summary statistics of bank specific and macroeconomic variables for 31 countries in our sample, over the period 1997 – 2012. The first column reports the number of available observations per variable. The next four columns contain the pooled average, and standard deviation, we well the within and between variation of the corresponding series. The last five columns contain the minimum, 25th, 50th and 75th percentiles, as well as the maximum value of each of the variables respectively. The within variation is computed as the cross sectional average of the time series standard deviation of each bank. The between variation is computed as the standard deviation of the annual average of each bank. Detailed definitions of all our variables are provided in the Appendix.

	Obs.	Mean	SD	Within SD	Between SD	Minimum	25%	Median	75%	Maximum
Amihud	13,865	-0.0927	0.2419	0.0417	0.2002	-1.3607	-0.0583	-0.0033	-0.0001	0
Quoted Spread	14,731	0.0473	0.0817	0.026	0.0767	0.0007	0.0062	0.0189	0.0488	0.4469
Turnover	15,056	0.0165	0.0362	0.025	0.0313	0.0001	0.0018	0.0051	0.0143	0.2215
Tobins Q	13,691	1.0405	0.0816	0.0874	0.0588	0.9158	0.9881	1.0225	1.0711	1.351
Net Income/Book Value of Assets (%)	7,410	0.6746	1.1913	1.1685	0.8513	-3.4771	0.2353	0.7277	1.1224	4.7011
Market Value Equity/Market Value Assets (%)	6,808	12.7582	15.1638	17.3656	14.7053	0.7699	4.7117	9.252	14.7256	92.3309
Price/Earnings	11,443	19.3253	16.0599	13.6292	10.7675	3	11.2	15	20.5	91.5
Non-Interest Income (%)	7,395	30.3127	22.1969	19.0151	20.5063	-0.09	15.4625	24.7	38.24	98.37
Loans and Committed Credit Lines (%)	7,328	65.0932	18.1267	17.7163	17.3622	7.5269	58.019	67.6719	76.443	95.982
Funding Fragility (%)	7,258	18.5209	22.1843	20.4375	22.0354	0.016	4.193	11.3334	23.1907	100
Overhead (%)	7,405	2.8756	2.28	2.146	2.1529	0.7469	1.4732	2.4409	3.2752	13.5815
Cost-of-Debt	12,328	3.164	1.6149	1.4449	1.0527	0	1.9689	3.2884	4.2571	7.0373
Interest Expense (%)	5,434	2.6616	2.0139	1.4402	1.7937	0.021	1.1655	2.4	3.71	9.54
Cost/Income (%)	7,369	65.0058	17.9268	16.0332	14.1356	30.056	54.756	63.657	72.591	128.571
Impaired Loans/Loans (%)	6,371	3.1333	3.4849	2.6478	2.7225	0.05	0.59	1.86	4.4	15.46
Non-Performing Assets/Assets (%)	12,709	1.6565	2.1475	1.703	1.5662	0	0.2848	0.774	2.1248	9.8563
Distance to Default	686	2.8578	0.9676	0	0.9676	0.8217	2.2186	2.8542	3.5464	4.7522
Sharpe Ratio	686	2.1545	2.6656	0	2.6656	-0.4528	0.2848	1.3286	2.9628	11.8541
Market Return (%)	15,174	0.2056	0.7899	0.8161	0.2383	-1.8522	-0.1767	0.1712	0.5807	2.6076
Idiosyncratic Volatility	15,072	2.4704	2.1724	1.0968	1.3747	0.507	1.3228	1.8258	2.6783	12.7329

Table 4.1: continued

	Obs.	Mean	SD	Within SD	Between SD	Minimum	25%	Median	75%	Maximum
Deposits Growth (%)	13,426	11.1356	17.9873	19.7426	10.0236	-17.6293	1.2935	6.5702	15.6208	82.4094
Loan Growth (%)	6,660	9.7703	17.9688	16.988	11.1349	-21.73	-0.4	5.695	16.005	76.08
Total Assets Growth (%)	6,774	9.6876	15.7915	15.1683	9.8886	-16.86	0.69	5.6	15.12	68.2
Cash and Balances with CB (%)	6,498	3.818	4.3378	3.5867	3.8156	0.1612	1.3821	2.433	4.1954	21.586
Tangible Equity (%)	7,432	8.5641	6.0118	6.5216	5.7083	1.9906	5.3401	7.2154	9.475	36.9095
Total Assets (log)	6,785	10.4787	2.4449	1.7992	2.4217	6.635	8.4131	10.0091	12.3812	16.0494
GDP growth (%)	17,585	2.4775	2.5884	2.282	1.5604	-3.5413	1.6668	2.5015	4.0613	10.288
Inflation	16,613	2.5689	1.7116	1.198	1.5768	-0.3114	1.6439	2.6659	3.2302	9.6781

Table 4.2: Correlation matrix of baseline specification variables

This table reports the pairwise Pearson correlations between our baseline specification variables. Definitions of all the variables can be found in Table A1 of the Appendix. * Indicates significance the above the 10% level (5% or 1%).

	Tobins Q	*Amihud*	*Quoted Spread*	*Turnover*	*Tangible Equity*	*Cash and Balances with CB*	*Non-Interest Income Share*	*Funding Fragility*	*Cost-of-Debt*	*Interest Expense*	*Cost/Income*	*Impaired Loans/Loans*	*Total Assets*
Amihud	0.1395*												
Quoted Spread	-0.1068*	-0.8249*											
Turnover	0.1332*	0.0547*	-0.0349*										
Tangible Equity	0.1540*	-0.0138	0.0300*	-0.0165									
Cash and Balances with CB	0.1293*	-0.0149	0.1269*	-0.0007	0.2296*								
Non-Interest Income Share	0.2325*	0.0622*	-0.0390*	0.2120*	0.3078*	0.2355*							
Funding Fragility	0.0862*	0.0753*	-0.0602*	0.1329*	0.3241*	0.0342*	0.4773*						
Cost-of-Debt	0.1429*	-0.0378*	0.0825*	-0.0287*	0.0620*	-0.0186	0.0523*	0.0817*					
Interest Expense	-0.0520*	0.026	-0.0433*	-0.0393*	-0.0742*	-0.2112*	0.0157	0.2436*	0.0893*				
Cost/Income	-0.2432*	-0.2468*	0.1758*	-0.0875*	-0.0357*	-0.021	0.0610*	-0.0340*	-0.0326*	0.0707*			
Impaired Loans/Loans	-0.2789*	-0.0754*	0.0713*	-0.0028	-0.1059*	0.1780*	-0.0426*	-0.0619*	-0.0289*	-0.1357*	0.2061*		
Total Assets	-0.0403*	0.3424*	-0.2988*	0.2990*	-0.3415*	0.0132	0.2143*	0.1509*	-0.1377*	0.0423*	-0.2440*	0.1679*	
Z-score	-0.0621	0.1555*	-0.1084*	-0.1113*	0.0790*	-0.1484*	-0.1194*	-0.0288	-0.0339	-0.0913*	-0.3455*	-0.4348*	-0.0382

Table 4.3: Bank Performance Characteristics by Liquidity Quartile

This table presents bank performance (*Tobin's Q, ROA*), credit risk (*Impaired Loans/Loans*), and other characteristics (*Cash/Assets, Log_Assets*) for each of the four liquidity quartiles. Each year, we create four portfolios of bank stocks based on the ranking of the respective liquidity measure (*Quoted Spread*, *Amihud Ratio*, and *Stock Turnover*) during the preceding year in one of the four liquidity quartiles. Within each portfolio we compute the equally weighted average of our variable of interest across all banks, and then we compute the annual average for each quartile. We also compute the difference between the values of the top and bottom liquidity quartiles (*Q4-Q1*). *T-stat* reports the t-statistic from the equality of means test between the top and bottom quartiles, *Q4* and *Q1* respectively, whereas *Chi-Square stat* reports the *Chi-Square* statistic from the equality of medians test between the aforementioned liquidity quartiles. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Tobin's Q	*Quoted Spread*	*Amihud Ratio*	*Stock Turnover*	***Impaired Loans***	*Quoted Spread*	*Amihud Ratio*	*Stock Turnover*
Q1	1.0534	1.0225	1.0368	*Q1*	2.8495	4.3888	3.5722
Q2	1.0288	1.0238	1.0253	*Q2*	3.2462	3.4027	3.4224
Q3	1.0259	1.0333	1.0294	*Q3*	3.3987	3.3176	3.2448
Q4	1.0319	1.0609	1.0520	*Q4*	4.1154	2.8700	3.0565
Difference	-0.0214	0.0385	0.0151	*Difference*	1.2659	-1.5188	-0.5157
t-stat	-9.7775***	10.3672***	6.7840***	*t-stat*	8.1020***	-9.4884***	-3.3813***
Chi-Square stat	96.871044***	245.8380***	19.7790***	*Chi-Square stat*	11.0902***	41.1489***	20.7702***
Inefficiency Ratio	*Quoted Spread*	*Amihud Ratio*	*Stock Turnover*	***(Log) Assets***	*Quoted Spread*	*Amihud Ratio*	*Stock Turnover*
Q1	62.4854	69.8143	65.9328	*Q1*	11.2604	9.2961	9.7736
Q2	66.3830	67.6415	67.2623	*Q2*	10.0135	9.7387	9.6974
Q3	67.1397	66.1148	67.0559	*Q3*	9.7824	9.9280	10.0198
Q4	68.5723	61.7637	63.1553	*Q4*	9.7225	11.8718	11.4589
Difference	6.0869	-8.0506	-2.7775	*Difference*	-1.5379	2.5756	1.6853
t-stat (mean)	8.8980***	-11.4744***	-4.2856***	*t-stat*	-16.9732***	29.3943***	19.9435***
Chi-Square stat (median)	87.4091***	154.2386***	37.8182***	*Chi-Square stat*	63.3557***	184.5222***	131.0647***
ROA	*Quoted Spread*	*Amihud Ratio*	*Stock Turnover*	***Cash/Assets***	*Quoted Spread*	*Amihud Ratio*	*Stock Turnover*
Q1	0.6761	0.6232	0.7191	*Q1*	3.2895	4.1254	4.0508
Q2	0.6168	0.6253	0.6004	*Q2*	3.3047	3.6551	3.5261
Q3	0.6787	0.5931	0.5780	*Q3*	3.8182	3.1980	3.1911
Q4	0.7149	0.7302	0.7521	*Q4*	4.3251	3.3628	3.4828
Difference	0.0388	0.1070	0.0330	*Difference*	1.0356	-0.7626	-0.5680
t-stat (mean)	0.8446	2.2017**	0.7238	*t-stat*	6.2340***	-4.4591***	-3.5449***
Chi-Square stat (median)	11.4153***	78.9328***	3.9085**	*Chi-Square stat*	29.5414***	12.0704***	9.3696***

Table 4.4: Tobin's Q and Market Liquidity of Bank Stocks

This table presents *OLS* estimation results from equation (4). The dependent variable is Tobin's Q. Columns (1) – (8) present results for the whole time period (1997 -2012), whereas the last three columns exclude the recent crisis period, 2008 – 2012. Regressors are normalized by their unconditional standard deviation. Definitions of all the variables can be found in Table A1 of the Appendix. All the regressions include year fixed effects, country fixed effects, and fixed effects accounting for the different type of bank charters (commercial banks, savings banks, real estate and mortgage banks, bank holding companies). Standard errors are clustered at the bank level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Tobin's Q **Time Period**	**(1)** **1997-2012**	**(2)** **1997-2012**	**(3)** **1997-2012**	**(4)** **1997-2012**	**(5)** **1997-2012**	**(6)** **1997-2012**	**(7)** **1997-2012**	**(8)** **1997-2012**	**(9)** **1997-2012**	**(10)** **1997-2006**	**(11)** **1997-2006**
Constant	1.6995***	1.6906***	1.6706***	1.4321***	1.4754***	1.4218***	1.4620***	1.5060***	1.4464***	0.9079***	0.9818***
Quoted Spread	-0.0068***			-0.0071***			-0.0067***			-0.0120*	
Amihud		0.0071***			0.0118***			0.0107***			0.0308***
Turnover			0.0115***			0.0061**			0.0052*		
Loans and Committed Credit Lines							-0.0068***	-0.0065***	-0.0066***	-0.0047	-0.0052
Non-Interest Income Share							0.0012	0.0020	0.0018	0.0065	0.0090
Funding Fragility							-0.0086***	-0.0098***	-0.0093***	-0.0127***	-0.0144***
Market Return				0.0125***	0.0130***	0.0118***	0.0110***	0.0113***	0.0102***	0.0180***	0.0186***
Cash and Balances with CB				0.0089***	0.0099***	0.0086***	0.0097***	0.0101***	0.0095***	0.0181***	0.0188***
Tangible Equity				0.0009	0.0002	0.0019	0.0067*	0.0061	0.0082**	0.0176***	0.0178***
Overhead				0.0112***	0.0113***	0.0099**	0.0077	0.0078	0.0062	0.0007	-0.0008
Total Assets				0.0112***	0.0090**	0.0096**	0.0129***	0.0109***	0.0116***	0.0234***	0.0180***
VIX (Implied Volatility)	-0.1765***	-0.1768***	-0.1752***	-0.0995**	-0.1052**	-0.0966**	-0.0925**	-0.0966**	-0.0885**	0.0074	0.0050
Inflation	-0.0018	-0.0009	-0.0003	0.0028	0.0030	0.0040	0.0034*	0.0037**	0.0045**	0.0005	0.0017
GDP per Capita	-0.0034	-0.0028	-0.0001	-0.0276**	-0.0330***	-0.0290**	-0.0339***	-0.0405***	-0.0356***	0.0068	-0.0097
GDP growth	0.0031	0.0033	0.0032	0.0067**	0.0067**	0.0069**	0.0055*	0.0055*	0.0056*	-0.0026	-0.0028
Time FE	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*Yes*
Bank Type FE	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Country FE	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
# Countries	31	31	31	31	31	31	31	31	31	28	27
# Banks	1003	996	1004	771	759	772	752	740	753	457	448
Observations	11,673	10,845	11,687	5,576	5,372	5,626	5,401	5,202	5,451	2,035	1,919
Adj. R^2	0.253	0.262	0.262	0.333	0.344	0.335	0.369	0.382	0.373	0.277	0.301

Table 4.5: Tobin's Q Decomposition

This table presents *OLS* estimation results from equation (4) replacing Tobin'Q to its respective components as illustrated in equation (5). Estimation is performed for the whole sample period, 1997 -2012. Regressors are normalized by their unconditional standard deviation. A detailed definition of all the variables can be found in Table A1 of the Appendix. All the regressions include year fixed effects, country fixed effects, and fixed effects accounting for the different type of bank charters (commercial banks, savings banks, real estate and mortgage banks, bank holding companies). Standard errors are clustered at the bank level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Dependent Variable	(1) *Net Income / Assets*	(2) *Net Income / Assets*	(3) *Net Income / Assets*	(4) *P/E*	(5) *P/E*	(6) *P/E*	(7) *Financial Leverage*	(8) *Financial Leverage*	(9) *Financial Leverage*
Constant	-4.3048	-5.3688**	-5.4726**	-2.8433	7.8566	-3.8071	19.0477	19.5695	16.2543
Quoted Spread	-0.1334***			-0.0197			-1.3878***		
Amihud		0.3342***			0.8079			2.0403***	
Turnover			0.0092			0.8341**			0.0143
Loans and Committed Credit Lines	-0.0166	-0.0256	-0.0160	-1.1845***	-1.1202**	-1.1395***	-1.1703***	-1.1193***	-1.1171***
Non-Interest Income Share	0.0975**	0.0908**	0.1110***	-1.2803**	-1.2625**	-1.3659**	-0.2972	-0.1636	-0.1393
Funding Fragility	-0.0547*	-0.0549*	-0.0619**	-1.1748***	-1.1171***	-1.1466***	-0.1371	-0.2451	-0.1709
Market Return	0.2725***	0.2857***	0.2610***	2.2347***	2.1206***	2.0702***	1.4032***	1.4127***	1.2924***
Cash and Balances with CB	0.0943**	0.1118***	0.0917**	-0.1805	-0.0942	-0.1482	0.8502	0.9384	0.8953
Tangible Equity	0.3541***	0.3301***	0.3850***	3.1267***	3.0830***	3.0059***	8.3409***	8.3014***	8.6296***
Overhead	-0.0119	-0.0062	-0.0378	-0.0115	-0.0783	0.0111	2.6827***	2.6226***	2.4172***
Total Assets	0.0981***	0.0515	0.1221***	0.7875	0.7115	0.4723	1.2951***	0.9999**	1.4487***
VIX (Implied Volatility)	0.9699	1.3497*	1.2467	9.6183	5.8788	9.8933	-7.9511	-7.1826	-7.2007
Inflation	0.0147	0.0016	0.0136	0.5997	0.4323	0.5264	-0.5300	-0.5985*	-0.4695
GDP per Capita	-0.1423	-0.1708	-0.1942	-4.7768**	-3.7721**	-4.6050**	0.0757	-0.5127	-0.5175
GDP growth	0.3465***	0.3522***	0.3707***	-1.4935	-1.3556	-1.5219*	0.9770***	0.8968***	0.8733***
Time FE	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Bank FE	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Country FE	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
# Countries	31	31	31	31	31	31	31	31	31
# Banks	740	734	746	733	722	736	740	734	746
# Observations	4,820	4,647	4,895	4,734	4,567	4,791	4,820	4,647	4,895
Adj. R^2	0.337	0.359	0.343	0.150	0.155	0.150	0.664	0.667	0.659

Table 4.6: Leverage, Cost of Debt and Bank Stock Liquidity

This table presents estimation results from regressions of (accounting) leverage, cost of debt financing, and the average interest expense on bank stock liquidity and other regressors. A detailed definition of all the variables can be found in Table A1 of the Appendix. Estimation is performed for the whole sample period, 1997 -2012. Regressors are normalized by their unconditional standard deviation. Regressions are estimated using *OLS* and include country, bank charter and year fixed effects, unless otherwise indicated. Columns (3), (6) and (9) are estimated using *2SLS*. We instrument stock liquidity using the different types of bank charter, and the average idiosyncratic volatility of the two closest banks in terms of equity market valuation. Standard errors are clustered at the bank level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Dependent Variable	**Book Assets/Equity**	**Book Assets/Equity**	**Book Assets/Equity**	**Cost-of-Debt**	**Cost-of-Debt**	**Cost-of-Debt**	**Interest Expense**	**Interest Expense**	**Interest Expense**
Estimation	***OLS***	***OLS***	***2SLS***	***OLS***	***OLS***	***2SLS***	***OLS***	***OLS***	***2SLS***
Quoted Spread	2.6066***			0.1750***			0.1333***		
Amihud		-2.8286***	-4.8619***		-0.2060***	-0.2239**		-0.1415***	0.1198
Loans and Committed Credit Lines	-0.1509	-0.1636	-0.3020	0.0628**	0.0492*	0.0493*	0.1258**	0.1239**	0.1293***
Non-Interest Income	-0.7927**	-0.6914**	-0.7870**	0.0267	0.0339	0.0350	-0.0116	-0.0218	-0.0349
Funding Fragility	0.3582	0.2393	0.1624	0.0336	0.0225	0.0255	0.5112***	0.5039***	0.5001***
Cash and Balances with CB	0.1286	-0.0024	-0.0818	-0.1543***	-0.1680***	-0.1777***	-0.0444	-0.0399	-0.0330
Overhead	-1.2772***	-1.2810***	-1.2915***	-0.0687	-0.0794	-0.0761	-0.0695	-0.0593	-0.0554
Deposits Growth (%)	-0.2655*	-0.2545*	-0.2510	-0.0377*	-0.0343	-0.0319	0.0610	0.0583	0.0451
Total Assets Growth (%)	-0.1670	-0.2029	-0.1336	-0.0489*	-0.0545**	-0.0556**	0.0015	-0.0020	-0.0067
Market Return	-0.7347***	-0.8837***	-1.0034***	-0.1128***	-0.1313***	-0.1337***	-0.0408	-0.0448*	-0.0357
Total Assets	2.4998***	2.5319***	2.9872***	-0.1701***	-0.1700***	-0.1642***	0.0331	0.0420	-0.0049
Short Interest Rate (3m)	-1.3529***	-1.3821***	-1.4371***	-0.2434***	-0.2551***	-0.2709***	0.4446***	0.4648***	0.4379***

Table 4.6: continued

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable	**Book Assets/Equity**	**Book Assets/Equity**	**Book Assets/Equity**	**Cost-of-Debt**	**Cost-of-Debt**	**Cost-of-Debt**	**Interest Expense**	**Interest Expense**	**Interest Expense**
Estimation	***OLS***	***OLS***	***2SLS***	***OLS***	***OLS***	***2SLS***	***OLS***	***OLS***	***2SLS***
Long Interest Rate (10yr)	1.2775***	1.5985***	1.7285***	0.7964***	0.8234***	0.8283***	0.0718	0.0514	0.0251
VIX (Implied Volatility)	-8.2250	-11.3218**	-1.0165	7.6609***	7.9432***	-0.5311*	-6.3500***	-7.2403***	-0.2574
Inflation	-0.7536***	-0.7225***	-0.5660***	0.0156	0.0246	0.0227	0.0929**	0.0987**	0.0790*
GDP per Capita	2.2589*	3.0518**	3.1624**	-0.2392	-0.1716	-0.1792	0.5951***	0.7553***	0.7854***
GDP growth	0.0167	-0.0326	0.0257	-0.0625	-0.0672	-0.0668	0.1856***	0.1869***	0.1947***
Partial R^2			0.1569			0.1582			0.126
F-Statistic (Instruments)			13.5827***			13.8629***			10.5673***
# Countries	31	31	31	31	31	31	31	31	31
# Banks	712	705	699	712	705	699	554	550	545
# Observations	4,789	4,624	4,550	4,736	4,583	4,513	3,793	3,668	3,603
Adj. R^2	0.375	0.383	0.362	0.650	0.654	0.653	0.679	0.674	0.668

Table 4.7: Profitability and Bank Stock Liquidity

This table presents estimation results from regressions of various measures of bank profitability on bank stock liquidity and other regressors. A detailed definition of all the variables can be found in Table A1 of the Appendix. Estimation is performed for the whole sample period, 1997 -2012, except for Columns (9) and (10) in which we run cross-sectional regressions using the annual average of the corresponding variables. Regressors are normalized by their (between) standard deviation. Unless otherwise indicated, regressions are estimated using *OLS*. Columns (2), (4) and (6) and (8) are estimated using *2SLS*. We instrument stock liquidity using the different types of bank charter, and the average idiosyncratic volatility of the two closest banks in terms of equity market valuation. Standard errors are clustered at the bank level, unless otherwise indicated (Columns (9) and (10)). Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Dependent Variable	***ROA***	***ROA***	***ROA***	***ROA***	***ROE***	***ROE***	***ROE***	***ROE***	***Sharpe ROA***	***Sharpe ROA***
Estimation	***OLS***	***2SLS***	***OLS***	***2SLS***	***OLS***	***2SLS***	***OLS***	***2SLS***	***OLS***	***OLS***
Quoted Spread	-0.1308***	-0.5233***			-1.8771***	-7.3441***			-0.1761***	
Amihud			0.3209***	0.4308***			4.0579***	4.9509***		0.4604***
Loans and Committed Credit Lines	-0.0049	0.0292	-0.0135	0.0337	-0.0746	0.3169	-0.1890	0.3626	0.3025	0.3226
Non-Interest Income	0.1161***	0.0575	0.1117***	0.0301	1.5495***	1.0606**	1.4367***	0.7966	0.3145**	0.3115**
Funding Fragility	-0.0548*	-0.0473	-0.0565*	-0.0363	-0.5327**	-0.6033*	-0.4878*	-0.4809	0.0194	0.0241
Cash and Balances with CB	0.0898*	0.1135**	0.1090**	0.1159**	1.0779***	1.0914**	1.2670***	1.0616**	-0.1520	-0.1504
Overhead	-0.0034	0.0650	0.0008	0.0774	-1.6822***	-0.8186	-1.6667***	-0.8713	-0.5549**	-0.5420**
Loan Growth Rate		0.0317		0.0460**		0.2185		0.3911		
Non-Performing Assets		-0.1868***		-0.1875***		-2.3851***		-2.3924***		
Market Return	0.2948***	0.2197***	0.3093***	0.2391***	3.5168***	2.8367***	3.7517***	3.0920***	-0.0595	0.1364
Tangible Equity	0.3800***	0.2677***	0.3568***	0.2643***	0.6012	-0.1055	0.3904	0.1098	0.3438***	0.2905**
Total Assets	0.1029***	0.0481	0.0559	0.0643	1.1349***	0.2477	0.6536	0.7156	-0.0959	-0.2225
Short Interest Rate (3m)	0.4319***	0.3222***	0.4314***	0.3107***	5.8019***	3.8127***	5.9633***	3.9598***		

Table 4.7: continued

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Long Interest Rate (10yr)	-0.4242***	-0.4889***	-0.4522***	-0.4867***	-6.5399***	-7.3017***	-7.0809***	-7.3329***		
VIX (Implied Volatility)	-0.3985	-0.1017	-0.3136	-0.2156	-9.3045	-0.6469	-8.5401	-1.7557		
Inflation	-0.0008	-0.0936***	-0.0029	-0.0808***	-0.1379	-1.3827***	-0.2382	-1.2686***	-0.0304	-0.0947
GDP per Capita	-0.0715	-0.1093	-0.1112	-0.0874	-1.3582	-1.1594	-1.8369	-1.1275	0.1048	0.1055
GDP growth	0.2168***	0.1614***	0.2109***	0.1372***	2.8263***	2.2072***	2.7582***	1.9538***	0.9800***	0.9700***
Time FE	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***no***	***no***
Bank Type FE	***yes***	***no***	***yes***	***no***	***yes***	***no***	***yes***	***no***	***yes***	***yes***
Country FE	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***no***	***no***
Clustering Level	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Country***	***Country***
Partial R^2		0.0497		0.1145		0.0495		0.1143		
F-Statistic (Instruments)		4.83444***		5.04129***		4.82453***		5.03469***		
# Countries	31	30	31	30	31	30	31	30	30	30
# Banks	740	655	734	649	740	655	734	649	641	637
# Observations	4,757	3,918	4,578	3,774	4,753	3,915	4,574	3,771	641	637
Adj. R^2	0.363	0.400	0.383	0.438	0.322	0.387	0.345	0.437	0.173	0.193

Table 4.8: Credit Risk and Bank Stock Liquidity

This table presents estimation results from regressions of balance sheet credit risk, on bank stock liquidity and other regressors. Our measures of credit risk include the share of impaired loans over total loans, and the share of non-performing assets over total assets. A detailed definition of all the variables can be found in Table A1 of the Appendix. Estimation is performed for the whole sample period, 1997 -2012. Regressors are normalized using their unconditional standard deviation. Regressions are estimated using *OLS*, unless indicated otherwise. All the regressions include year fixed effects, country fixed effects, and fixed effects accounting for the different type of bank charters (except in the *2SLS* estimation). Columns (3), (5) and (8) and (10) are estimated using *2SLS*. We instrument stock liquidity using the different types of bank charter, and the average idiosyncratic volatility of the two closest banks in terms of equity market valuation. Standard errors are clustered at the bank level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	*Share Impaired Loans*	*Share Impaired Loans*	*Share Impaired Loans*	*Share of Non-Performing Assets*	*Share of Non-Performing Assets*	*Share Impaired Loans*	*Share Impaired Loans*	*Share Impaired Loans*	*Share of Non-Performing Assets*	*Share of Non-Performing Assets*
Estimation	*OLS*	*OLS*	*2SLS*	*OLS*	*2SLS*	*OLS*	*OLS*	*2SLS*	*OLS*	*2SLS*
Quoted Spread	0.7262***	0.6709***	1.5445**	0.2673**	0.8761**					
Amihud						-0.9452***	-0.9233***	-0.7937*	-0.3333***	-0.5865**
Loans and Committed Credit Lines	0.0980	0.1454	0.1826	0.3489***	0.3615***	0.1063	0.1568	0.1704	0.3380***	0.3521***
Non-Interest Income	-0.5045***	-0.5272***	-0.5656***	-0.4334***	-0.4413***	-0.4587***	-0.4833***	-0.5024***	-0.4234***	-0.4297***
Funding Fragility	0.3312**	0.3934**	0.6214***	0.1371	0.1579*	0.2936*	0.3683**	0.6253***	0.1546	0.1947**
Loans Growth Rate(%)		-0.3354***	-0.2908***				-0.3387***	-0.3213***		
Total Assets Growth (%)				-0.2384***	-0.2083***				-0.2504***	-0.2396***
Market Return	-0.7292***	-0.7504***	-0.7569***	-0.4401***	-0.4758***	-0.7669***	-0.7878***	-0.7896***	-0.4736***	-0.5138***
Cash and Balances with CB	-0.0796	-0.0386	-0.0858	-0.0886	-0.1271	-0.1354	-0.1077	-0.0574	-0.1281	-0.1233
Tangible Equity	-0.2147	-0.1640	-0.0424	-0.2448**	-0.1520	-0.1834	-0.1256	-0.1225	-0.2315**	-0.1891

Table 4.8: continued

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Overhead	0.7698***	0.7052***	0.6794***	0.5254***	0.4901***	0.7983***	0.7366***	0.7262***	0.5415***	0.5202***
Total Assets	0.1908*	0.2117*	0.4323**	0.0723	0.2330**	0.2435**	0.2676**	0.2479	0.1044	0.1824*
Short Interest Rate (3m)	-1.7695***	-1.8526***	-1.8628***	-1.1271***	-1.1214***	-1.7210***	-1.7858***	-1.8220***	-1.1763***	-1.1792***
Long Interest Rate (10yr)	0.8266*	1.0341**	1.1350**	0.5985**	0.6143**	0.8463*	1.0323**	1.0872**	0.6448**	0.6331**
VIX (Implied Volatility)	-12.9199***	-13.2023***	-5.8764***	-4.7441**	-0.4581	-13.4111***	-13.4722***	-6.0526***	-5.5234**	-0.7365
Inflation	-0.2572*	-0.3499**	-0.3168**	-0.3000***	-0.2603***	-0.2564*	-0.3633**	-0.3775**	-0.2941***	-0.2736***
GDP per Capita	2.5341***	2.8609***	2.8469***	1.2380***	1.1936**	2.5768***	2.8524***	2.8760***	1.3549***	1.3447***
GDP growth	-0.8743***	-0.7909***	-0.7652***	-0.4035***	-0.3884***	-0.8561***	-0.7662***	-0.8033***	-0.3569***	-0.3448***
Partial R^2			0.044		0.0896			0.1169		0.1503
F-Statistic (Instruments)			5.53364***		7.00389***			5.56548***		6.64442***
# Countries	31	30	30	30	30	31	30	30	30	30
# Banks	686	671	667	669	664	682	668	662	661	657
Observations	4,227	3,908	3,842	4,369	4,306	4,094	3,786	3,722	4,210	4,150
Adj. R^2	0.445	0.462	0.438	0.439	0.420	0.449	0.469	0.459	0.447	0.444

Table 4.9: Default Distance and Bank Stock Liquidity

This table presents estimation results from regressions of the distance-to-default, *log*(*z-score*), and the variation in profitability, *ST(ROA),* on bank stock liquidity and other regressors. A detailed definition of all the variables can be found in Table A1 of the Appendix. All variables are constructed as the annual average of each respective series for every bank. Regressors are normalized using the (between) standard deviation. Regressions are estimated using *OLS*, unless indicated otherwise. All the regressions include country fixed effects, and fixed effects accounting for the different type of bank charters (except in the *2SLS* estimation). Columns (2), (5) and (7) and (9) are estimated using *2SLS*. We instrument stock liquidity using the different types of bank charter, and the time series average of the mean idiosyncratic volatility of the two closest banks in terms of equity market valuation. Standard errors are clustered at the country level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Dependent Variable	***Z-score***	***Z-score***	***Z-score***	***Z-score***	***Z-score***	***Z-score***	***SD(ROA)***	***SD(ROA)***	***SD(ROA)***	***SD(ROA)***
Estimation	***OLS***	***2SLS***	***OLS***	***OLS***	***2SLS***	***OLS***	***2SLS***	***OLS***	***2SLS***	***OLS***
Quoted Spread	-0.0821**	-0.5872***	-0.0631***				-0.5250***	-0.0886***		
Amihud				0.2180***	0.4301***	0.1824***			0.4540***	0.2422***
Loans and Committed Credit Lines	-0.0288	0.0058	-0.0357	-0.0242	0.0116	-0.0385	-0.0098	0.0885**	0.0038	0.0946**
Non-Interest Income	0.0059	0.0770	-0.1106	0.0104	0.0361	-0.1026	-0.0082	0.0057	-0.0402	0.0197
Funding Fragility	-0.1206	-0.1728	-0.1511**	-0.1315	-0.1676	-0.1715***	0.1509**	0.1169**	0.1530**	0.1020
Loans Growth Rate (%)			-0.1699***			-0.1858***		0.1023***		0.1037***
Impaired Loans			-0.1867***			-0.1909***		-0.0867**		-0.0933**
Market Return	-0.0867**	0.0330	-0.0686**	0.0265	0.1323***	0.0354	0.1488***	0.0414	0.2739***	0.1720***
Cash and Balances with CB	-0.0837*	-0.0476	-0.0240	-0.0727	-0.0695	-0.0229	0.1092	0.0639	0.0925	0.0627
Tangible Equity	0.3154***	0.2344***	0.3938***	0.3066***	0.2731***	0.3845***	0.2343	0.3692*	0.2532	0.3433
Overhead	-0.3065**	-0.3105**	-0.1718**	-0.3246**	-0.3131**	-0.1831**	0.2695***	0.3424**	0.2724***	0.3325**
Total Assets	-0.0449	-0.2604	0.0590	-0.1096	-0.2079	0.0102	-0.1330*	0.1233	-0.1170*	0.0617

Table 4.9: continued

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Inflation			-0.1683			-0.2774		-0.0828		-0.2582
GDP per Capita			-0.0206			-0.0384		-0.1080		-0.1365
GDP growth			0.2113			0.2436		-0.0538		-0.0108
Bank Concentration			-0.6824*			-0.8305*		0.4855		0.2478
Market Capitalization			0.0239			0.0158		0.2070*		0.2157*
Governance			0.1155			0.1971		-0.2337		-0.1584
Deposit Insurance			-0.1242**			-0.1364**		0.0276		0.0144
Bank Type FEs	*yes*	*no*	*yes*	*yes*	*no*	*yes*	*no*	*yes*	*no*	*yes*
Country FEs	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Clustering Level	*Country*	*Country*	*Country*	*Country*	*Country*	*Country*	*Country*	*Country*	*Country*	*Country*
Partial R^2		0.0931			0.2181		0.0931		0.2181	
F-Statistic (Instruments)		448.227***			139.509***		448.227***		139.509	
# Countries	30	30	25	30	30	25	30	25	30	25
Observations	641	639	561	637	636	557	639	561	636	557
Adj. R^2	0.255	0.0951	0.345	0.291	0.255	0.381	0.321	0.377	0.420	0.398

Table 4.10: Cost-Efficiency and Bank Stock Liquidity

This table presents estimation results of cost and productive efficiency on stock liquidity and other regressors. Cost efficiency is computed as the ratio of total overhead expenses over total operating income, whereas productive efficiency is computed as the (*log*) ratio of operating income over the number of employees. A detailed definition of all the variables can be found in Table A1 of the Appendix. Estimation is performed for the whole sample period, 1997 -2012. Regressors are normalized using their unconditional standard deviation. Regressions are estimated using *OLS*, unless indicated otherwise. All the regressions include year fixed effects, country fixed effects, and fixed effects accounting for the different type of bank charters (except in the *2SLS* estimation). Columns (3), (6) and (8) and (10) are estimated using *2SLS*. We instrument stock liquidity using the different types of bank charter, and the average idiosyncratic volatility of the two closest banks in terms of equity market valuation. Standard errors are clustered at the bank level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Dependent Variable	***Cost Efficiency***	***Cost Efficiency***	***Cost Efficiency***	***Cost Efficiency***	***Cost Efficiency***	***Cost Efficiency***	***Productive Efficiency***	***Productive Efficiency***	***Productive Efficiency***	***Productive Efficiency***
Estimation	***OLS***	***OLS***	***2SLS***	***OLS***	***OLS***	***2SLS***	***OLS***	**2SLS**	***OLS***	**2SLS**
Quoted Spread	2.3069***	2.2034***	5.2753**				-0.0287	-0.0020		
Amihud				-5.3057***	-5.0020***	-6.4135***			0.0496***	0.0848
Loans and Committed Credit Lines	-2.0444***	-2.2138***	-1.9301***	-2.0487***	-2.2777***	-2.0312***	-0.0215	-0.0173	-0.0242	-0.0186
Non-Interest Income	1.9454***		2.0530***	2.0059***		2.1914***	-0.0021	-0.0027	-0.0043	-0.0078
Funding Fragility	-0.0014	0.3465	-0.4170	-0.2111	0.0782	-0.6463	0.0509**	0.0594***	0.0583**	0.0680***
Cash and Balances with CB	-1.4120**	-1.2179	-1.6037**	-1.8696***	-1.7403**	-1.9747***	-0.0163	-0.0117	-0.0096	-0.0024
Overhead	7.0594***	7.8698***	7.0973***	7.1832***	7.7957***	7.2258***	-0.0432*	-0.0464*	-0.0481*	-0.0475*
Fee Income		0.3299			0.4042					
Trading Income		1.5685			1.0102					
Personnel Costs		-0.2494			0.0585					
Market Return	-3.4112***	-3.2375***	-3.6277***	-3.6068***	-3.3595***	-3.8679***	0.0420***	0.0465***	0.0421***	0.0490***

Table 4.10: continued

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Tangible Equity	-5.2418***	-5.3937***	-5.1605***	-4.9233***	-5.2066***	-4.9804***	0.1173***	0.1309***	0.1150***	0.1211***
Total Assets	-5.6031***	-5.0855***	-5.1201***	-4.8895***	-4.4062***	-4.7826***	0.2236***	0.2320***	0.2199***	0.2171***
Short Interest Rate (3m)	-2.6887***	-2.8341***	-2.7955***	-2.8773***	-3.0149***	-2.9617***	0.0509**	0.0511**	0.0609***	0.0583***
Long Interest Rate (10yr)	2.7196**	2.2580	2.9511**	3.4511**	3.0479**	3.5939**	-0.0991***	-0.1017***	-0.1120***	-0.1143***
VIX (Implied Volatility)	13.2068	10.7120	-4.1863	9.9859	8.2383	-4.4369	0.0949	-0.4138**	0.2282	-0.4089**
Inflation	-0.1037	-0.1479	0.0714	0.0729	0.0360	0.2618	0.0156	0.0055	0.0090	-0.0037
GDP per Capita	-0.7498	-0.2725	-1.2055	0.5197	0.9838	0.2619	0.0964*	0.1239**	0.0624	0.0919
GDP growth	-1.1949**	-1.3515**	-0.9070*	-0.9198*	-1.0879**	-0.6917	0.0064	-0.0007	0.0044	-0.0049
Time FEs	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***
Bank Type FEs	***yes***	***yes***	***no***	***yes***	***yes***	***no***	***yes***	***no***	***yes***	***no***
Country FEs	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***
Clustering Level	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***
Partial R^2			0.0365			0.103		0.0269		0.081
F-Statistic (Instruments)			4.39445***			4.92262***		2.0863*		1.89259*
# Countries	31	31	31	31	31	31	29	29	29	29
# Banks	740	631	735	734	627	727	621	614	618	609
Observations	4,745	4,376	4,655	4,566	4,210	4,478	3,560	3,487	3,420	3,347
Adj. R^2	0.422	0.421	0.407	0.439	0.439	0.430	0.534	0.532	0.537	0.535

Table 4.11: Stock Liquidity and Agency Frictions

This table presents *OLS* estimation results of cost efficiency, credit risk (***Impaired Loans***) and performance (***ROA***), on bank stock liquidity and a number of control variables. We rank banks at the top (bottom) tercile group if the respective time average of their available *Cash and Balances with the CB* is above (below) the corresponding 33% percentile of all the banks in the country (we limit our sample to countries with a minimum of 10 banks with non-missing information). A detailed definition of all the variables can be found in Table A1 of the Appendix. Estimation is performed for the whole sample period, 1997 -2012. Regressors are normalized using their unconditional standard deviation. All the regressions include year fixed effects, country fixed effects, and fixed effects accounting for the different type of bank charters. Standard errors are clustered at the bank level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Quoted Spread	***Top-Tercile***	***Bottom-Tercile***	***Top-Tercile***	***Bottom-Tercile***	***Top-Tercile***	***Bottom-Tercile***	***Top-Tercile***	***Bottom-Tercile***	***Top-Tercile***	***Bottom-Tercile***	***Top-Tercile***	***Bottom-Tercile***
Dependent Variable	***Cost Efficiency***	***Cost Efficiency***	***Share Impaired Loans***	***Share Impaired Loans***	***ROA***	***ROA***	***Cost Efficiency***	***Cost Efficiency***	***Share Impaired Loans***	***Share Impaired Loans***	***ROA***	***ROA***
Quoted Spread	2.5989**	1.9128	1.0854***	0.7038**	-0.2290***	-0.1474**						
Amihud							-3.7355***	-4.8140***	-0.8273***	-0.5446*	0.2963***	0.2902***
Loans and Committed Credit Lines	-2.3165***	-2.1083**	0.3115	0.1817	-0.0289	0.0329	-2.5927***	-2.0386**	0.3083	0.1839	-0.0202	0.0174
Non-Interest Income	3.6102***	2.1088	-0.4549	0.0086	0.0505	0.1002	3.0768***	2.0263	-0.4212	-0.0349	0.0977	0.1031
Funding Fragility	-0.5714	0.4796	0.7782**	-0.0376	-0.0854*	0.0723	-0.5002	0.4997	0.7542**	0.0221	-0.1035**	0.0520
Cash and Balances with CB	-1.7707*	-0.1040	0.2651	-1.0893*	0.1111*	0.1871	-1.7001*	0.0870	0.2174	-1.0517*	0.0941	0.1556
Overhead	5.3758***	10.3016***	0.7562**	0.2030	0.0573	-0.0227	5.7144***	10.1956***	0.7650**	0.2808	0.0221	-0.0044
Market Return	-2.6586***	-3.3113***	-0.5096***	-0.7921***	0.2416***	0.2595***	-2.7469***	-3.4916***	-0.5193***	-0.8214***	0.2536***	0.2783***
Tangible Equity	-5.0705***	-3.2535***	0.1048	-0.2022	0.3576***	0.2733***	-5.7508***	-2.8452***	0.0861	-0.2359	0.4084***	0.2348***
Total Assets	-8.2488***	-7.5265***	0.0316	0.0566	0.2806***	0.0968	-7.2325***	-6.5192***	0.0017	0.0150	0.2039***	0.0395

Table 4.11: continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Short Interest Rate (3m)	-5.2300***	-0.4988	-2.6823***	-1.1444***	0.6578***	0.2476	-5.3501***	-0.8305	-2.5819***	-1.2492***	0.6555***	0.2930**
Long Interest Rate (10yr)	2.7927	3.0604	1.5724**	-0.5517	-0.7642***	-0.2125	3.2191*	3.7576*	1.5513**	-0.2676	-0.7944***	-0.3148
VIX (Implied Volatility)	-16.1159	31.9425	-28.9829***	-13.1024*	0.8405	0.9944	-24.3399	29.4109	-29.0953***	-14.6153*	1.0476	0.7058
Inflation	0.6249	1.2186	-0.0081	0.3542*	-0.0130	-0.0641	0.5326	1.4729*	-0.0538	0.3371*	0.0101	-0.0667
GDP per Capita	6.4513*	4.0142	7.5104***	1.8807	-0.7850**	-0.5461**	8.0999*	3.9480	7.4918***	2.2603	-0.8115**	-0.5126**
GDP growth	-0.8771	-0.6051	-1.0368***	-0.7981***	0.2957***	0.1547**	-0.9184	-0.7892	-1.0519***	-0.8519***	0.2933***	0.1863**
Time FEs	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***
Bank Type FEs	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***
Country FEs	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***
Clustering Level	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***	***Bank***
# Countries	16	16	15	16	16	16	16	16	15	16	16	16
# Banks	222	214	200	208	222	214	221	213	200	207	221	213
Observations	1,423	1,254	1,245	1,162	1,427	1,257	1,344	1,244	1,181	1,153	1,348	1,247
Adj. R^2	0.481	0.419	0.520	0.432	0.406	0.345	0.481	0.423	0.502	0.443	0.416	0.358

Table 4.12: Stock Liquidity and periods of low returns

This table presents *OLS* estimation results of cost efficiency, credit risk (***Impaired Loans***) and performance (***ROA***), on bank stock liquidity, its interaction with periods of low stock returns, and a number of control variables. We classify bank-years with low returns as those at the bottom quartile (25th percentile) of the respective annual return distribution. The bottom quartile is computed only for banks with a minimum of 10 years with available information on stock returns. A detailed definition of all the variables can be found in Table A1 of the Appendix. Estimation is performed for the whole sample period, 1997 -2012. Regressors are normalized using their unconditional standard deviation. All the regressions include year fixed effects, country fixed effects, and fixed effects accounting for the different type of bank charters. Standard errors are clustered at the bank level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Dependent Variable	***ROA***	***Share Impaired Loans***	***Cost Efficiency***	***ROA***	***Share Impaired Loans***	***Cost Efficiency***
Quoted Spread	-0.1576***	0.7502***	2.3549***			
Quoted Spread x Ret_Bottom25%	0.1066*	-0.0931	-0.1819			
Amihud				0.3261***	-0.9780***	-4.9762***
Amihud x Ret_Bottom25%				-0.0293	0.1928	-1.9016
Ret_Bottom25%	-0.0234	0.0705	-0.2391	0.0032	0.0364	-0.4494
Loans and Committed Credit Lines	-0.0047	0.0980	-2.0456***	-0.0135	0.1065	-2.0542***
Non-Interest Income	0.1164***	-0.5050***	1.9470***	0.1115***	-0.4580***	1.9982***
Funding Fragility	-0.0559*	0.3323**	0.0011	-0.0567*	0.2946*	-0.2206
Market Return	0.3003***	-0.7214***	-3.4909***	0.3115***	-0.7681***	-3.6214***
Cash and Balances with CB	0.0901*	-0.0802	-1.4150**	0.1091**	-0.1352	-1.8711***
Tangible Equity	0.3808***	-0.2144	-5.2480***	0.3572***	-0.1855	-4.9080***
Overhead	-0.0031	0.7691***	7.0628***	0.0008	0.7969***	7.1928***
Total Assets	0.1037***	0.1900*	-5.6036***	0.0564	0.2395**	-4.8529***
Short Interest Rate (3m)	0.4379***	-1.7752***	-2.6944***	0.4326***	-1.7307***	-2.7911***
Long Interest Rate (10yr)	-0.4201***	0.8195*	2.7276**	-0.4522***	0.8418*	3.4973**
VIX (Implied Volatility)	-0.3599	-12.9666***	13.2861	-0.3038	-13.5094***	10.9905
Inflation	-0.0010	-0.2566*	-0.1068	-0.0030	-0.2554*	0.0643
GDP per Capita	-0.0673	2.5296***	-0.7623	-0.1113	2.5768***	0.5019
GDP growth	0.2135***	-0.8688***	-1.2009**	0.2109***	-0.8543***	-0.9405*

Table 4.12: continued

Model	(1)	(2)	(3)	(4)	(5)	(6)
Time FEs	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Bank Type FEs	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Country FEs	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
Clustering Level	*Bank*	*Bank*	*Bank*	*Bank*	*Bank*	*Bank*
# Countries	31	31	31	31	31	31
# Banks	740	686	740	734	682	734
Observations	4,757	4,227	4,745	4,578	4,094	4,566
Adj. R^2	0.363	0.445	0.422	0.383	0.449	0.439

Table 4.13: Information Driven Trading by Liquidity Quartile

This table presents the time series average of our measure for information driven trading (Equation (6)) for each of the four liquidity quartiles. Each year, we create four portfolios of bank stocks based on the ranking of the respective liquidity measure (*Quoted Spread*, *Amihud Ratio*, and *Stock Turnover*) during the preceding year in one of the four liquidity quartiles. Within each portfolio we compute the equally weighted average of our information driven trading measure across all banks, and then we compute the annual average for each quartile. We also compute the difference between the values of the top and bottom liquidity quartiles (*Q4-Q1*). *T-stat* reports the t-statistic from the equality of means test between the top and bottom quartiles, *Q4* and *Q1* respectively, whereas *Chi-Square stat* reports the *Chi-Square* statistic from the equality of medians test between the aforementioned liquidity quartiles. We limit our sample to countries with a minimum of 10 banks with non-missing information over bank stock liquidity. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Information Driven Trading Measure	***Quoted Spread***	***Amihud Ratio***	***Stock Turnover***
Q1	0.0098*	0.0356***	0.0384***
Q2	0.0162***	0.0112*	0.0123**
Q3	0.0139**	0.0122**	0.0099***
Q4	0.0200***	-0.0023	-0.0002
Difference (Q4-Q1)	0.0102	-0.0379***	-0.0386***
t-stat	1.2182	-3.509	-3.1244
Chi-Square statistic	3.5717*	7.3181***	6.6479***

Table 4.14: Stock Liquidity and Market Discipline

This table presents *OLS* estimation results of bank deposit growth and cost of debt on bank capitalization (***Tangible Equity***), credit risk (***Impaired Loans***) and performance (***ROA***), and a number of control variables. We rank banks at the top (bottom) liquidity group if the respective time average of their *Quoted Spread* is below (above) the corresponding median of bank stocks in the country (we limit our sample to countries with a minimum of 10 banks with non-missing information). A detailed definition of all the variables can be found in Table A1 of the Appendix. Estimation is performed for the whole sample period, 1997 -2012. Regressors are normalized using their unconditional standard deviation. All the regressions include year fixed effects, country fixed effects, and fixed effects accounting for the different type of bank charters. Standard errors are clustered at the bank level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Quoted Spread	*High-Liq.*	*Low-Liq.*	*High-Liq.*	*Low-Liq.*	*High-Liq.*	*Low-Liq.*	*High-Liq.*	*Low-Liq.*	*High-Liq.*	*Low-Liq.*	*High-Liq.*	*Low-Liq.*
Dependent Variable	*Deposit Growth*	*Deposit Growth*	*Deposit Growth*	*Deposit Growth*	*Deposit Growth*	*Deposit Growth*	*Cost Debt*	*Cost Debt*	*Cost Debt*	*Cost Debt*	*Cost Debt*	*Cost Debt*
Loans and Committed Credit Lines	-0.9591	0.5079	-0.8265	1.6952**	-1.0670	0.0930	0.0783	-0.1330***	-0.1180***	0.0494	-0.1122***	0.0998*
Non-Interest Income	0.0592	-0.5366	0.0721	-0.5341	-0.1141	-1.2045	0.1444	0.0347	0.0265	0.0293	0.0418	0.1849
Funding Fragility	1.1287*	1.9874	-0.2602	3.2902**	-0.3877	2.2002	0.0626	-0.0416	0.0151	0.0939	0.0299	0.0576
Cash and Balances with CB	1.3536*	-2.0592	1.2348*	0.5108	1.9092***	-2.3586	-0.1583**	0.0462	0.1463***	-0.1117	0.0330	-0.1434**
Overhead	2.1150***	0.2466	1.5919***	1.6626	1.3438***	1.3390	-0.0901	-0.1346***	-0.1174***	-0.0424	-0.0753***	-0.1392
Market Return	0.6628	1.5249**	0.8863	1.0450*	2.0074*	0.9067	-0.0475	0.0563	0.0713	-0.0143	0.0008	0.0153
Total Assets	0.5990	0.3430	0.2858	-0.3564	-0.3092	-0.7154	-0.1505	-0.1914***	-0.2011***	-0.1326	-0.1760***	-0.1067
VIX (Implied Volatility)	-10.2407	3.2363	-13.6520	-0.1773	-10.0979	3.7635	-10.0849***	8.5355***	8.1533***	-9.6826***	8.6390***	-10.3286***
Inflation	-1.3270**	-0.5967	-1.2883**	-1.7996*	-1.7210***	-0.7748	0.0820	0.0397	0.0565	0.0229	0.0688	0.0998

Table 4.14: continued

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Short Interest Rate (3m)	2.8145**	2.4111	-0.2351	1.9017	1.7304	1.7419	-0.3338**	-0.4497***	-0.3305**	-0.1913	-0.3733***	-0.2672**
Long Interest Rate (10yr)	-5.8443***	1.5290	-5.4715***	1.9293	-5.7364***	1.5070	0.8508***	1.0673***	1.0264***	0.8755***	1.0276***	0.8328***
GDP per Capita	-2.5600	0.1944	-4.0626	2.2490	-3.1197	-0.0161	0.3119	-0.1310	-0.1075	0.4103	-0.1445	0.3132
GDP growth	0.5222	2.5150*	-0.6212	2.8572*	-0.0709	2.1431	-0.1444*	-0.1458*	-0.1164	-0.2110**	-0.1064	-0.1148
Tangible Equity	4.3452***	2.3149**					-0.1146	-0.1159***				
Impaired Loans			-1.1746***	-0.7821***					0.0479***	0.0104		
ROA					3.1233***	1.8744**					-0.2102***	-0.1695***
# Countries	16	16	16	16	16	16	16	16	16	16	16	16
# Banks	411	238	395	222	411	238	250	421	403	226	421	250
Observations	3,191	1,536	2,971	1,312	3,191	1,536	1,584	3,214	2,979	1,318	3,214	1,584
Adj. R^2	0.101	0.171	0.104	0.142	0.104	0.175	0.613	0.698	0.707	0.623	0.708	0.622

Figure 4.1: Bank Performance vs. Quoted Spread

In this figure we present the time development of basic measures of bank performance (*Tobin's Q, ROA*), efficiency (*Cost/Income*), and credit risk (*Impaired Loans/Loans*) for each group of banks. Each year, we create four portfolios of bank stocks based on the ranking of their Quoted spread during the preceding year in one of the four quartiles. Within each portfolio we aggregate the corresponding variable of interest by computing the equally weighted average across banks. For illustration purposes, we report the results for the 1st (75%) and 4th (25%) illiquidity percentiles. Definitions of all the variables can be found in the Appendix.

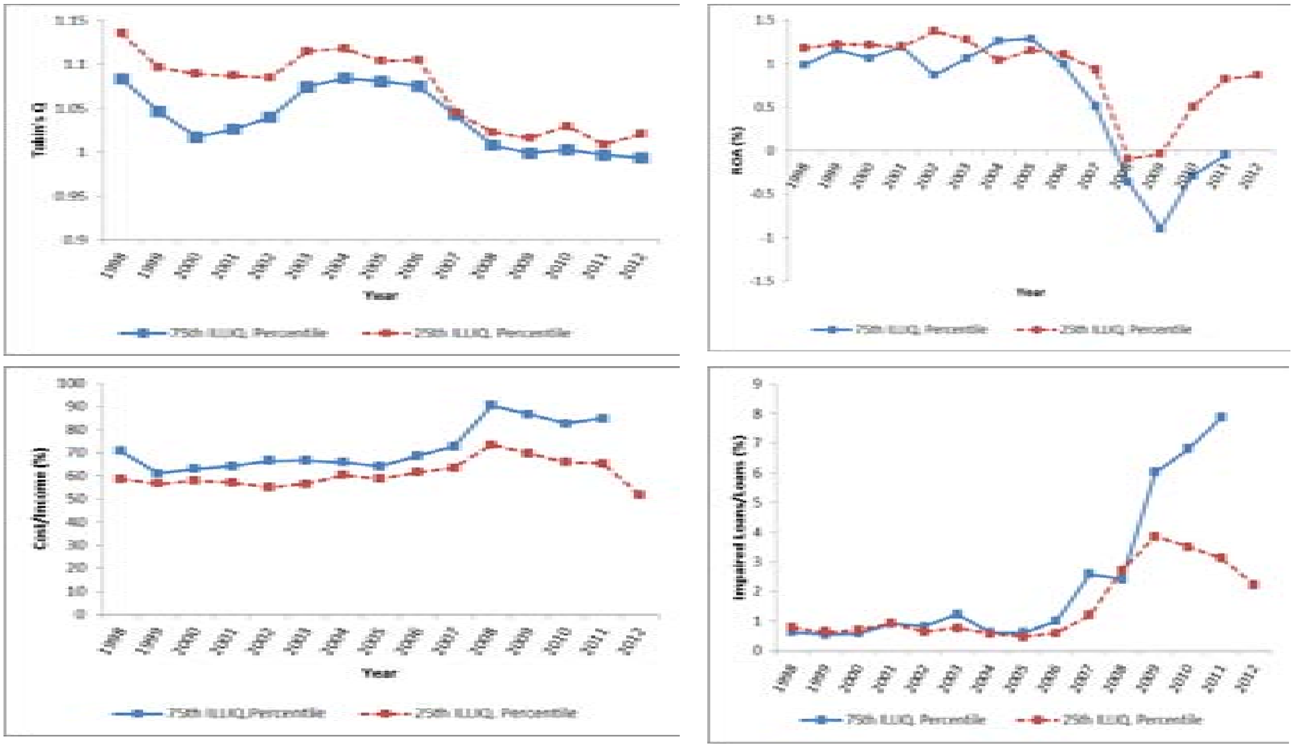
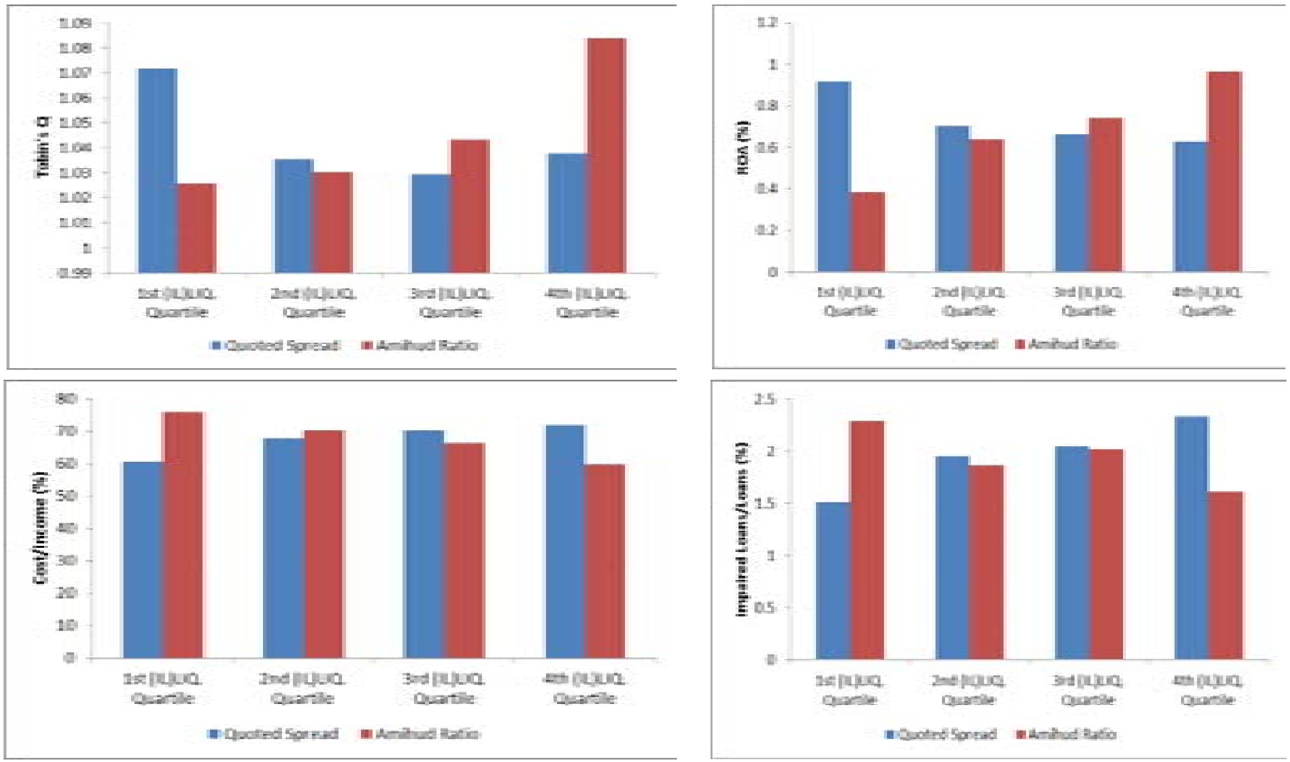


Figure 4.2: Bank Performance per Quoted Spread Quartile

In this figure we present the time average of basic measures of bank performance (*Tobin's Q, ROA*), efficiency *(Cost/Income)*, and credit risk (*Impaired Loans/Loans*) for each portfolio of banks. Each year, we create four portfolios of bank stocks based on the ranking of their Quoted spread and Amihud ratio during the preceding year in one of the four (il) liquidity quartiles. Within each portfolio we compute the equally weighted average of our variable of interest across all banks, and then we compute the annual average of each quartile. Definitions of all the variables can be found in the Appendix.



Appendix

Table A4.1: Variable Description and Data Sources

Variable	Description	Sources
Quoted Spread	We compute the daily (log) ratio of the prevailing ask quote minus the prevailing bid quote, standardized relative to the midpoint of the prevailing bid-ask quote. More specifically, our computation is based on the formula: $\boldsymbol{SPD_{i,d}} = \boldsymbol{log}\left(\mathbf{1} + \frac{\boldsymbol{ask_{i,d} - bid_{i,d}}}{\boldsymbol{(ask_{i,d} + bid_{i,d})/2}}\right)$. Then we compute the time-series average for each bank-year. Data for the daily bid, ask, and midpoint quotes are obtained from Bloomberg.	Own Computations
Amihud	We compute the Amihud ratio as the (-log) ratio of the absolute value of weekly returns over the value of weekly trading volume expressed in local currency: $\boldsymbol{LIQ_{i,t}} = -\boldsymbol{log}\left(\mathbf{1} + \frac{\boldsymbol{\lvert Ret_{i,t}\rvert}}{\boldsymbol{P_{i,t} \cdot VO_{i,t}}}\right)$. Then we compute the time-series average for each bank-year. Data on weekly returns, $\boldsymbol{Ret_{i,t}}$, weekly stock prices, $\boldsymbol{P_{i,t}}$, and weekly trading volume, $\boldsymbol{VO_{i,t}}$, are obtained from Datastream.	Own Computations
Stock Turnover	We compute stock turnover as the (*log*) ratio of weekly trading volume divided by the respective number of outstanding shares: $\boldsymbol{TV_{i,t}} = \boldsymbol{log}\left(\mathbf{1} + \frac{\boldsymbol{VO_{i,t}}}{\boldsymbol{NOSH_{i,t}}}\right)$. Then we compute the time-series average for each bank-year. Data on the weekly trading volume, $\boldsymbol{VO_{i,t}}$, and the number of shares outstanding, $\boldsymbol{NOSH_{i,t}}$, are obtained from Datastream.	Own Computations
Idiosyncratic Volatility	We compute each bank's idiosyncratic volatility as the standard deviation of the residual component, $\varepsilon_{i,d}$, obtained from regressing the daily excess stock return, $r^e_{i,d}$, on the daily excess market return, $r^e_{m,d}$: $r^e_{i,d} = c + \beta \cdot r^e_{m,d} + \varepsilon_{i,d}$. We discard bank-years with more than 200 days of missing stock returns. We compute the daily market return based on the domestic market index provided by Datastream. As the risk-free rate we use the yield of the 3-month U.S. T-Bill.	Own Computations
Tobin's Q	Computed as the ratio of the market value of equity plus the book value of liabilities divided by the book value of assets.	Bloomberg
P/E	Annual ratio of the market value of equity, scaled by total earnings.	Datastream
Financial Leverage	Computed as the ratio of the market value of assets over the market value of equity. The former is computed as the book value of assets plus the market value of equity minus the book value of equity.	Bankscope
Z-score	Computed as the natural logarithm of one plus the sum of the mean *ROA* plus the mean ratio of equity capital over assets, CAR, divided by the standard deviation of the *ROA*, $SROA$: $\log\left(1 + \frac{mean(ROA+CAR)}{SROA}\right)$. For our computations we require a minimum of four observations for every bank in our sample. Data are obtained from Bankscope.	Own Computations
ROA	Annual net income over average total assets.	Bankscope
ROE	Annual net income over average total equity.	Bankscope
STD(ROA)	Standard deviation of annual net income over average total assets, *ROA*. For our computations we require a minimum of four observations for every bank in our sample. Data are obtained from Bankscope.	Own Computations
Sharpe(ROA)	Computed as the annual net income over average total assets, *ROA*, over its corresponding standard deviation. For our computations we require a minimum of four observations for every bank in our sample. Data are obtained from Bankscope.	Own Computations
Cost Efficiency	Computed as the ratio of annual overhead costs over total operating income.	Bankscope
Productive Efficiency	Computed as the annual ratio of total operating income over total number of bank employees. Data are obtained from Bankscope and Bloomberg.	Own Computations

Table A4.1, continued

Share of Impaired Loans	Computed as the annual ratio of the total value of loans with an impairment (e.g. non-accrued, restructured, overdue etc.) over the total gross value of all outstanding loans.	Bankscope
Share of Non-Performing Assets	Annual ratio of non-performing assets divided by the total value of bank assets.	Bloomberg
Cost-of-Debt	Weighted average yield to maturity of all outstanding bank debt.	Bloomberg
Interest Expense	Computed as the annual ratio of total interest expenses over the aggregate value of interest bearing liabilities.	Bankscope
Loans and Committed Credit Lines	Computed as the ratio of the total value of outstanding loans, and committed credit lines over the total value of assets.	Bankscope
Non-Interest Income	Computed as the ratio of total non-interest operating income over total operating income. Non-interest operating income includes net trading income, insurance income, revenues from fees and commissions etc.	Bankscope
Funding Fragility	Computed as the share of short term non-core liabilities that consist of deposits from other banks (also loans and repos), short term borrowing (e.g. money market instruments and CDs), and financing obtained from capital markets over the dollar value of total short term liabilities which also include total customer deposits (Beltratti, and Stulz, 2012).	Bankscope
Cash and Balances with CB	Computed as the ratio of total cash and non-interest-earning balances with central banks over the value of total assets.	Bankscope
Overhead	Computed as the ratio of total overhead expenses over the value of total assets.	Bankscope
Fee Income	Computed as the ratio of total income from fees and commissions not related to loans over total operating income.	Bankscope
Trading Income	Computed as the dollar value of total marketable securities and short term investment over the value of total assets.	Bloomberg, and Bankscope
Personnel Costs	Computed as the ratio of total personnel expenses over the value of total assets. Personnel expenses include wages, salaries, social security costs, pension costs and other staff costs.	Bankscope
Market Return	Computed as the annual time-series average of the weekly stock return.	Datastream
Tangible Equity	Computed as the total value of common equity minus the value of intangible assets (include whenever available), over the value of total assets. Intangible assets include goodwill, mortgage servicing assets and purchased credit card relationships.	Bankscope
Total Assets	Natural logarithm of the value of total assets deflated by the consumer price index of the corresponding year.	Bankscope, and Haver Analytics
Short Interest Rate (3m)	Annual average of the quarterly rate on the 3 month T-Bill of each country.	Haver Analytics
Long Interest Rate (10yr)	Annual average of the quarterly rate on the 10 year government bond of each country.	Haver Analytics
VIX (Implied Volatility)	Annual average of the daily implied volatility based on S&P 500 index options.	Bloomberg
Inflation	Time-series average of the quarterly, year-to-year, growth rate of the consumer price index of each country.	Consensus Economics
GDP per Capita	Annual ratio of a country's nominal GDP divided by the size of its population.	Haver Analytics
GDP growth	Time-series average of the quarterly, year-to-year, real and seasonally adjusted GDP for each country.	Consensus Economics

Table A4.1, continued

Information Driven Trading	Our measure of information driven trading, $\boldsymbol{c_{2,i}}$, is obtained by regressing daily stock returns, $\boldsymbol{R_{i,d+1}}$, on the respective lag-1 stock return, $\boldsymbol{R_{i,d}}$, and its product with the (detrended) stock turnover, $\boldsymbol{TV_{i,d}}$, for all the bank-years in our sample: $\boldsymbol{R_{i,d+1} = c_{0,i} + c_{1,i} \cdot R_{i,d} + c_{2,i} \cdot R_{i,d} \cdot TV_{i,d} + \varepsilon_{i,d+1}}$ Detrending is performed by removing the moving average of the past 200 trading days of (Llorente at al., 2002). From our computations we exclude bank stocks without trading information for at least 22 days in a year, and/or stocks with zero return days for more than 90% of the trading days during each year. Data on the daily trading volume, and daily returns are obtained from Datastream.	Own Computations
Bank Concentration	Computed as the fraction of assets held by the three largest banks in each country, averaged over the sample period. Data are constructed by Beck, Demirguc-Kunt, and Levine, "Bank Concentration and Crises", *Journal of Banking and Finance* ,2003, and provided by the World Bank.	World Bank
Market Capitalization	Computed as the time series average of the annual ratio of stock market capitalization over GDP. Data are obtained from the Database on Financial Development and Structure, which is constructed by Beck, Demirguc-Kunt, Levine, Cihak, and Feyen, and provided by the World Bank.	World Bank
Governance	Composite of six governance indicators (1998 data): voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and corruption. Individual factors are weighted equally to determine overall score of economic freedom. Data are obtained from the Database on Financial Development and Structure, which is constructed by Beck, Demirguc-Kunt, Levine, Cihak, and Feyen, and provided by the World Bank.	World Bank
Deposit Insurance	Principal component indicator measuring the generosity of deposit insurance, based on co-insurance, coverage of foreign currency and interbank deposits, type and source of funding, management, membership and level of explicit coverage. Data are obtained from the Database on Financial Development and Structure, which is constructed by Beck, Demirguc-Kunt, Levine, Cihak, and Feyen, and provided by the World Bank.	World Bank

Chapter 5
The Determinants of Liquidity Contagion Across Markets

5.1 Introduction

In modern financial parlance, few words are as closely associated to market efficiency as liquidity. This notion is not completely unwarranted given that liquidity has ramifications extending beyond the price discovery process, affecting functions as distant and important as the market for corporate control and the efficient allocation of capital across different sectors (e.g. Tadesse, 2004). Yet, to the detriment of investors and regulators alike, there are times when liquidity simply disappears across many markets simultaneously. Although rather infrequent, synchronous liquidity crashes are typically accompanied by pervasive price distortions, and thus carry substantial costs both for investors and the real economy. Moreover, such episodes undermine the benefits of diversification at a time when they are most needed, casting doubt over one of financial theory's most acclaimed presumptions. Yet, although one must acknowledge significant progress in identifying the origins of contagion in a number of occasions (e.g. Peek and Rosengren, 1999; Christiansen and Ranaldo, 2009; Boyson, Stahel, and Stulz, 2010; Schnabl, 2012), extant literature offers little guidance when it comes to synchronous liquidity dry-ups. In the present study we attempt to furnish a better understanding of the circumstances behind these episodes, and investigate the mechanism through which adverse liquidity shocks propagate from one market to another.

Our goal in this paper is twofold. First, we investigate the extent of clustering of adverse liquidity shocks within and across particular geographic regions. Given that geographic distance typically correlates positively with information frictions (Portes, and Rey, 2005; van Nieuwerburgh and Veldkamp, 2009), it is reasonable to expect liquidity shocks to have a disproportionate effect over markets in a certain geographic proximity. Second, we try to assess the relative importance of a number of channels that previous studies have solicited as important determinants of liquidity, both for the aggregate market as well as across subsets of the cross-section organized on the basis of different stock characteristics. This way we are able to evaluate a number of empirical predictions generated by theory regarding the type of stocks that are more susceptible to adverse liquidity shocks originating from abroad. To the best of our knowledge, this is the first paper to pursue such a task. Our ultimate goal is to shed more light on the importance of different mechanisms through which liquidity shocks propagate from one market to another. We believe this task of paramount interest since liquidity spillovers can exert a re-pricing of risk, and cause a reallocation of capital in global markets, thus undermining global economic growth. As a result, we believe the aforementioned questions are of importance not only for investment professionals (especially for their risk management operations), but also for central banks and policymakers responsible for safekeeping financial stability. The former are delegated to diversify their holdings in a way that reduces the concern of having to liquidate their positions simultaneously across many markets, aggravating their losses even further (Duffie, and Ziegler, 2003). Central banks on the other hand need to remain alert to boost liquidity conditions and prevent market crashes, since if intervention is delayed they might need to endorse more dramatic actions at the expense of a larger cost to taxpayers (Freixas, Parigi, and Rochet, 2000).

Most of the extant literature on contagion focuses on currency, stock market or banking crises. These are identified as unanticipated, extreme currency depreciations, stock market declines or failures of systemically important financial institutions respectively (Pericoli, and Sbracia, 2003). Depending on the particular context of contagion, a number of different explanations have been advanced to date. Glick and Rose (1999) for example argue that the transmission of currency crises can be explained by the extent of trade relations across countries, whereas other studies (Kaminsky and Reinhart, 2000; van Rijckeghem, and Weder, 2003; Liu) show that financial sector linkages are of equivalent if not superior importance. Goldstein (1998), and Ahluwalia (2000), favor the "wake-up-call" explanation according to which, similarities across countries can lead to a reassessment of fundamentals, and potentially trigger a "snowball" effect typically observed in currency markets. Regarding stock market contagion, King, Sentana, and Wadhwani (1994) provide some early evidence of contagion, arguing that a large portion of the covariance across stock markets cannot be attributed to observable economic factors. More recently, Cumperayot, Keijzer, and Kouwenberg (2006), and Christiansen, and Ranaldo (2009) document the existence of negative spillover effects between the U.S. stock market and markets in Asia and Europe, as well as between the new and the old EU member states, respectively. Regarding the role of banks in the transmission of financial shocks, Peek and Rosengren (1999) show that Japanese banks contracted their lending in the U.S. as a response to the decline in their domestic stock holdings. Other papers focus on hedge fund contagion (e.g. Klaus, Benjamin, and Rzepkowski, 2009; Boyson, Stahel, and Stulz, 2010), and show that the observed clustering in performance across different styles increases with funding shocks or when the rate of redemptions rises. In the area of banking contagion, Cifuentes, Ferrucci, and Shin (2010) show that contagious failures of interconnected financial institutions can result from small shocks in their illiquid holdings, whereas a number of other studies (e.g. Gropp, Duca, and Vesala, 2009; Lucey, and Sevic, 2010) empirically demonstrate the existence of extreme excess co movement within the banking sector.

In this paper we deviate from the aforementioned examples and decide to examine financial contagion from a perspective that has not been considered to date, namely that of market liquidity. At this point, one question that might naturally arise is whether liquidity contagion is possible in the first place. In other words, is there any reason to expect liquidity shocks to propagate beyond their epicenter and adversely affect other markets? In that respect, financial crises of the past provide us with considerable anecdotal evidence indicating that liquidity can diminish quickly and often simultaneously across different markets. In theory, liquidity contagion can be produced due to a common lender effect. One such channel is associated with the presence of global prime brokers or banks that operate internationally. Such institutions can amplify the transmission of liquidity shocks both indirectly, as a consequence of deleveraging that adversely affects the balance sheet of their peers abroad through (Brunnermeier and Pedersen, 2009), or directly, by contracting their lending through their affiliated branches as a response to domestic losses (Peek and Rosengren, 1997, 2000). Liquidity crises can also spread as a result of imperfect liquidity sharing across banks, under the assumption of incomplete interregional bank claims (Allen, and Gale, 2000). Another reason can be information cascades concerning interregional assets with similar underlying fundamentals. A liquidity drop in one market can impair liquidity in other markets by making prices of related assets less informative (Cespa, and Foucault, 2011; Bernhardt, and Taub, 2008). As a result, market makers will generally face higher costs in their inference of factors that commonly determine the price of securities they trade domestically with those in the affected market. In addition, following the perspective advanced by Kodres and Pritsker (2002), liquidity contagion can emerge as the result of cross market portfolio rebalancing or hedging that is mistakenly perceived as information driven by domestic market makers or uninformed investors (Genotte, and Leland, 1990). Overall, as several of the aforementioned studies imply, rising information asymmetries in foreign markets can potentially impair liquidity conditions in the home market through a number of implicit as well as explicit transmission mechanisms.

Our first contribution in this paper comes from providing evidence of liquidity contagion both within as well as across regions. This is certainly not a trivial undertaking since contagion is an ambiguous concept that is intrinsically difficult to identify precisely. Our task complicates further by the fact that market behavior differs markedly during periods of stress compared to normal times (Borio, 2004). This, however, is another way our analysis abstracts from research to date and particularly from the recent literature on liquidity commonality. Given that papers on this topic are principally concerned with liquidity co movement across the whole range of liquidity's empirical distribution, they tend to focus on average rather than extreme correlations (Chordia, Roll, and Subrahmanyam, 2000; Brockman, Chung, and Perignon, 2009; Karolyi, Lee, and van Dijk, 2012). Since contagion is typically perceived as s temporary increase in the linkages of different markets (Longstaff, 2010) our analysis is based on weekly data (e.g. Hameed, Kang, and Viswanathan, 2010). Our preference for a weekly frequency is further justified by the necessity to overcome variation in time conventions across markets or phenomena related to microstructure noise that are typically prevalent in higher frequencies and could potentially compromise our inference. Thus, to pursue our task we construct weekly stock market liquidity indexes (Amihud, 2002), based on data for 38,808 different individual stocks from 39 markets, for the period from January 1995 until December 2008. Given the large number of arguments against earlier methodologies that typically generate an overidentification of contagious events (e.g. Forbes and Rigobon, 2002), our definition of contagion is purposefully conservative. Following the example of recent studies (e.g. Bekaert, Harvey, and Ng, 2005; Boyson et al., 2010), we attribute to contagion any correlation over and above what can be explained by own market fundamentals, and as such is manifested in the synchronicity of unexpected adverse (negative) liquidity shocks (exceedances) across markets. Our filtering regressions control for an extensive set of factors the literature has elicited as determinants of market liquidity, namely market performance, general uncertainty, aggregate order flow, funding liquidity conditions, and sentiment. In the case of no contagion our approach implies zero correlation between the probability of a liquidity exceedance and the extent of clustering in liquidity shocks across other markets.

Our findings indicate that local turmoil carries the seeds of liquidity contagion to other markets within the region. Except for evidence of within-region contagion, our analysis also demonstrates that deteriorating liquidity conditions in systemically important markets exert, in certain cases, a disproportionate impact over foreign markets. Our findings are substantial in statistical as well as economic terms. For example, the probability of a liquidity exceedance in Emerging Europe rises more than twofold when all our Global markets experience a liquidity co-exceedance the same week. When we try to identify the liquidity factors with the greatest explanatory power over the likelihood of a liquidity exceedance, our proxy for investor sentiment (*market-to-book*) together with aggregate volatility stand out as the ones with the most pronounced effect. Interestingly, even though global aggregates are important in their own respect, (orthogonalized) regional aggregates demonstrate a leading role when it comes to explain liquidity exceedances in the same region.

Next, we move a step forward and investigate the extent of cross-sectional heterogeneity in the clustering of adverse liquidity shock across groups of stocks with particular characteristics. Our goal is to furnish a better understanding of those characteristics that make certain stocks more resilient while others more susceptible to liquidity contagion. For this purpose we sort stocks on the basis of their market capitalization, idiosyncratic volatility, the extent of information-driven order flow, and sensitivity over sentiment. Our findings at this point are also particularly interesting. Contrary to initial expectations, we show that liquidity contagion is more pronounced in “high” rather than “low quality” stocks. Our conjecture is that market makers or sophisticated investors operating across many markets typically invest in the top-end of the market spectrum in terms of quality for reasons related to clientele effects, as well as due to moderate transaction costs and lower information impediments associated with stocks of this category. As a result, during periods of market distress liquidity drops are more correlated across stocks of “high quality”. This is another example indicating how the pursuit of diversification at the micro-level can compromise diversity at the macro-level and thus impair the stability of the financial system during periods of crises (Wagner, 2010).

We also investigate the relative importance of different factors that previous papers elicit as important determinants of aggregate liquidity. The most consistent results in that respect concern the *Variance Premium* and the volatility of our index of Global prime brokers. Our findings suggest that an increase in the implied risk aversion reflected in the *Variance Premium*, together with higher uncertainty regarding the state of financial intermediaries is associated with a greater extent of liquidity contagion within a number of regions. Another important determinant is the cost of funding typically reflected by the *Credit Spread*. Our analysis lends further support to the notion that commonality in liquidity becomes particularly pronounced in periods of deteriorating global funding conditions as well as downbeat investor sentiment. Furthermore, we investigate the role of international investors and financial intermediaries as channels through which liquidity crises propagate from one market to another. We study to what extent foreign equity flows and cross-border bank lending can provide a mechanism of transmission of potential liquidity shocks. Consistent with intuition, our findings suggest that markets receiving more investment either in the form of equity purchases or in the form of cross-border bank lending demonstrate a greater extent of liquidity contagion once global risk aversion increases. However, our coefficient estimates of other factors are more challenging to interpret in that respect.

5.2 Data description

In this section we describe the data sources we use, as well as and the screening procedures we apply to construct our set of variables. We give particular emphasis to our measure of market liquidity, since it is the variable employed for the identification of tail events that occur simultaneously across countries.

5.2.1 Data sources and variable definitions

In the present study, our prime goal is to investigate to what extent adverse liquidity shocks tend to cluster across international markets, but also identify the relative importance of a number of potential channels in explaining the time series of synchronous liquidity drops. To perform our analysis we collect data from a total of 39 countries around the world, covering the period from January 1995 until December 2008. From the 39 countries in our sample, 12 countries belong to Developed Europe (Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden, Switzerland), 7 belong to Emerging Europe (Cyprus, Greece, Hungary, Israel, Poland, Portugal, Turkey), 11 belong to Asia/Pacific (China, Hong Kong, India, Indonesia, Malaysia, New Zealand, Philippines, Singapore, South Korea, Taiwan, Thailand), and 5 belong to Latin America (Argentina, Brazil, Chile, Mexico, Peru). To classify the aforementioned markets as Developed or Emerging we follow the categorization suggested by the International Finance Corporation (*IFC*). We also collect data for four additional markets, namely Australia, Japan, United Kingdom, and the United States which we classify in a separate category (Global) due to their dominant role in the global financial system. Although the selection of the aforementioned countries is, to some extent, arbitrary, it is beyond doubt that they exert substantial influence over neighboring markets both due to the overwhelming volume of transactions they accommodate, as well as the size of their respective economies. As an indication, these four markets account for approximately 75% of the total market capitalization, and more than 50% of the total economic output at the beginning of our sample period (both figures are computed in 1995 U.S. dollars).

We use DataStream to collect the daily adjusted price (*P;* closing price in local currency, which is adjusted for splits and dividends), the daily total return index (*RI*), trading volume at a monthly frequency (*VO*; expressed in 1,000 shares), number of shares outstanding (*NOSH*; expressed in thousands of shares), and the monthly market capitalization (*MV*; expressed in millions of local currency) for all individual stocks in the 39 countries of our sample. In line with Karolyi et al. (2012) we only include stocks from major stock exchanges. These are the exchanges on which the majority of each country's stocks are listed. In the case of the U.S., we only use data from the NYSE, since volume definitions are different in NASDAQ. Countries for which we collect data from more than one stock exchange include China (Shenzen and Shanghai), Japan (Osaka and Tokyo), and Germany (Frankfurt and Xetra). In the case of Brazil, and Germany we only collect data following 1999 due to issues related to different volume definitions and missing data for the earlier part of our sample (Karolyi et al., 2012). Similar to previous studies (Chordia, Roll, and Subrahmanyam, 2001; Pastor and Stambaugh, 2003), we exclude stocks with special features, such as depository receipts (DRs), real estate investment trusts (REITs), closed-end funds, and preferred stocks. To avoid survivorship bias, we also include dead and delisted stocks. We use the same source to collect daily returns of bank indexes[29], as well as the daily market-to-book ratio for the respective markets in our sample. In addition, we construct an index of global prime broker returns by computing the equally weighted average of the 26 leading prime brokers that operate internationally[30]. We obtain the conditional volatility of our global prime broker return index by estimating a GARCH(1,1) process.

As a short term rate we typically use the domestic 1 month interbank offered rate unless it is not available, in which case we replace it with data on the corresponding bank deposit rate (Argentina, Australia, Brazil, and India), the commercial paper rate (Japan, Korea, and the U.S.), the money market rate

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[29] Due to missing data, in the case of New Zealand, China, and Indonesia we use the market capitalization-weighted average bank index return from the remaining markets in the same region, namely Hong Kong, Singapore, India, Malaysia, Philippines, South Korea, Taiwan, and Thailand.

[30] Our list of global prime brokers consists of ABN AMRO, BANCO ESPIRITO SANTO, BANK OF AMERICA, BARCLAYS, BEAR STEARNS, BNP PARIBAS, CITIGROUP, CREDIT SUISSE, DEUTSCHE BANK, DRESDNER BANK , FORTIS, GOLDMAN SACHS, JEFFERIES, JP MORGAN CHASE, LEHMAN BROS, MORGAN STANLEY, NORDEA BANK, NORTHERN TRUST, ROYAL BANK OF SCOTLAND, ROYAL BANK CANADA, RABOBANK, BANK OF NOVA SCOTIA, UBS, CANADIAN IMPERIAL BANK OF COMMERCE, SOCIETE GENERALE, and CREDIT AGRICOLE.

(Taiwan), or the market capitalization-weighted average of short term interest rates of all the other countries in the same region[31]. Our preference among each of the aforementioned alternatives is determined solely on the basis of data availability. Following previous studies (e.g. Bekaert, Harvey, and Lumsdaine, 2002) we compute the global interest rate as the market capitalization-weighted average of the short-term interest rate of all the countries in our sample using country's market value the respective year. The data for the market capitalization (in current U.S. dollars) are collected from the DataStream.

We use Bloomberg to collect daily data on the VIX index which is constructed from the implied volatilities of index options on the S&P 500, as well as data on the U.S. *TED* spread which corresponds to the difference between the 3-month LIBOR rate and the rate on the U.S. Treasury bill with the same maturity. We use the same source to compute the U.S. Credit Spread which we define as the difference between the yield of the US High-Yield Bond Index (BB-B) and that on the 10 year Treasury bond.

To proxy for changes in the external flow of funding liquidity we use the quarterly change in cross-border holdings of U.S. banks (in millions of U.S. dollars) obtained from Haver Analytics. The aforementioned dataset is based on the Bank of International Settlements' (*BIS*, 2003a) consolidated banking statistics and consists of aggregate contractual lending[32] (consolidated) of banks in the reporting country (U.S.), along with all their foreign branches and subsidiaries, *vis-à-vis* to the rest of the world. Consequently, foreign claims are net of inter-office positions. The aforementioned information provides a comprehensive coverage of cross-border financial exposure from the perspective of the creditor country and is collected by domestic central banks or monetary authorities through their resident commercial banks (BIS, 2003a). The majority of the reporting claims consist of standard bank loans extended to non- affiliated banks and non-banks, but also credit lines, and securities holdings (e.g. bonds, equities, money market instruments) issued by banks and the non-financial sector of the recipient country. Since data before the second quarter of 1999 are incomplete, we only include bank flow information from that date onwards. Naturally, we convert U.S. bank foreign holdings in real terms by using the *GDP* deflator of the recipient country (Papaioannou, 2009). The formula we use is the following:

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[31] In the case of Cyprus, Hungary, Portugal, and Turkey we use the market capitalization-weighted average of short term rates from Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, and Spain. Similarly, in the case of Indonesia we use the market capitalization-weighted average of short term rates from Hong Kong, New Zealand, Singapore, India, Malaysia, Philippines, South Korea, Taiwan, and Thailand.

[32] Naturally, the dataset accounts only for on-balance sheet positions and as a result might underestimate the true exposure of reporting banks.

$$Bank\_Flows_q^C = \frac{\Delta(Bank\_hlds_q^C)}{GDP_y} \tag{5.1}$$

where Δ denotes the first order change between subsequent quarters, $Bank\_Flows_q^C$ is our measure of foreign bank flows, $Bank\_hlds_q^C$ is the unscaled measure of aggregate bank holdings between U.S. banks and country C in million U.S. dollars in quarter q, and GDP_y corresponds to the GDP of country C (in current U.S. dollars), the year y.

Furthermore, we use the U.S. Treasury International Capital (TIC) reporting system to obtain monthly data on cross-border equity portfolio flows (expressed in million US$) between the U.S. and the remaining 38 countries in our sample. These data consist of financial transactions of at least $50 million (gross purchases and sales of foreign stocks) between the U.S and foreign residents. U.S. residents include branches or subsidiaries of foreign entities located in the U.S. Branches of U.S. companies incorporated outside the U.S. are considered foreign residents. Direct cross-border investment activities are not included in the data. Similar to our measure of bank flows, we calculate net equity portfolio flows by scaling the sum of monthly net purchases – purchases minus sales – of foreign equity by U.S. investors during each quarter, with the *GDP* of the recipient country the respective year. The formula we use is the following:

$$NetFlows_q^C = \frac{\sum_{t:t\in q}(Purchases_t^C - Sales_t^C)}{GDP_y} \tag{5.2}$$

where $NetFlows_q^C$ is our standardized measure of net equity flows, $Purchases_t^C$ ($Sales_t^C$) indicates gross purchases (sales) of foreign equity between U.S. investors and the residents of country C during quarter q, and GDP_y is the GDP (in current U.S. dollars) of country C the respective year y. Data on *GDP* are collected from the *World Development Indicators* database of the World Bank.

5.2.2 Liquidity measure

The market microstructure literature has produced a number of alternative measures for liquidity to date. However, there is little consensus on which one is the most appropriate, mainly because different measures capture different aspects of liquidity. Since the most refined of these measures (e.g. quoted spread, effective bid-ask spread etc.) are based on detailed microstructure information that is generally not available for markets outside the U.S. without compromising the quality of the data, we decide to use a modified version of the Amihud's (2002) price impact measure as our proxy for market liquidity. The Amihud ratio is designed to capture the impact of a unit of trading volume (in local currency) on the price of the stock, and is therefore associated with the illiquidity of the particular stock. It is computed as the ratio of the absolute daily stock return divided by the trading volume of the respective stock measured in domestic currency.

A large number of recent empirical studies attest to the credibility of this particular proxy. Among other papers, Hasbrouck (2009), as well as Goyenko, Holden, and Trzcinka (2009) show that the Amihud measure performs quite well relative to other proxies, especially when it comes to daily transaction level data for the U.S. market. Lesmond (2005) reports a high correlation between this measure and bid-ask spreads for 23 emerging markets. Examples of other studies that have been using the Amihud measure include Acharya and Pedersen (2005), Spiegel and Wang (2005), Avramov, Chordia, and Goyal (2006), Kamara, Lou, and Sadka (2008), Watanabe and Watanabe (2008), and Karolyi et al. (2012).[33]

We follow previous studies (Karolyi et al., 2012) and transform the Amihud (2002) liquidity ratio in a way that is increasing with stock liquidity. Thus, according to our modified measure, the liquidity of stock i on day t is defined as follows:

$$LIQ_{i,t}^{C} \equiv -log\left(1 + \frac{|R_{i,t}^{C}|}{P_{i,t}^{C} VO_{i,t}^{C}}\right), \tag{5.3}$$

where $LIQ_{i,t}^{C}$ is the modified Amihud liquidity measure, $R_{i,t}^{C}$ is the return, $P_{i,t}^{C}$ is the adjusted closing price, and $VO_{i,t}^{C}$ is the trading volume of stock i on day t, for country C.

Similar to previous studies, we perform a number of data screens in order to mitigate the effect of reporting errors (e.g. Karolyi et al., 2012)[34]. Then, we construct our daily market-wide liquidity index as the equally-weighted average of all individual stock liquidity using the following relation:

$$LIQ_{M,t}^{C} \equiv \frac{1}{N}\sum_{i=1}^{N} LIQ_{i,t}^{C} , \tag{5.4}$$

where $LIQ_{M,t}^{C}$ is our daily liquidity index, $LIQ_{i,d}^{C}$ is the modified daily Amihud liquidity measure, of stock i on day t, for country C.

To control for changing patterns in the trading behaviour of investors, as well as the impact of trading volume on inventory risk which should both be reflected on aggregate liquidity conditions, we compute the daily turnover, first for each particular stock and then for the whole market. To address any non-stationarity concerns typically associated with the turnover series, we use the following trend-adjusted definition of turnover which is also used in previous studies (Karolyi et al., 2012):

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33 We refer to Hasbrouck (2009), Korajczyk and Sadka (2008), and Goyenko, Holden, and Trzcinka (2009) for a detailed discussion of different liquidity measures.

34 For a detailed account of the various filters we refer to Vagias and van Dijk (2011).

$$TV_{i,t}^{C} \equiv log\left(1+\frac{VO_{i,t}^{C}}{NOSH_{i,t}^{C}}\right)-\frac{1}{N}\sum_{k=1}^{22} log\left(1+\frac{VO_{i,t-k}^{C}}{NOSH_{i,t-k}^{C}}\right), \quad (5.5)$$

where $TV_{i,t}^{C}$ is the daily stock turnover, $VO_{i,t}^{C}$ is the trading volume, and $NOSH_{i,t}^{C}$is the number of shares outstanding for stock i at day t, in country C. Similar to liquidity, we then construct the market-wide turnover series as the equally-weighted average of daily stock turnover on each day.

To address any complications due to different time conventions across markets, and moderate the increasing noise of daily estimates, we aggregate our daily measures into weekly frequency by computing the corresponding time series average. We also winsorize all our variables at the 2% level in order to mitigate the effect of outliers in our inference.

5.2.3 Identifying adverse liquidity shocks

Although the term "contagion" is frequently encountered in the financial press, literature to date has produced a number of alternative definitions, some of which have ambiguous interpretations and are notoriously difficult to implement[35]. In the present study, we follow the example of Boyson et al. (2010) and define contagion as the simultaneous realization of an extreme liquidity shock across a number of markets, in excess of what could be anticipated after controlling for market specific fundamentals. Since market makers or any type of investors operating as liquidity providers can offset anticipated liquidity shocks, we assume that it is only unanticipated shocks that can trigger spillover effects due to the inefficient liquidation of otherwise profitable positions or the inability to provide liquidity at a cost that would effectively clear the market. In this way, we also implicitly account for the possibility of mistakenly identifying as contagion shocks that can be attributed to deteriorating own market fundamentals, and might only appear to relate to adverse liquidity shocks in other markets due to common exposure to certain latent factors. Even though our approach is admittedly restrictive, it nevertheless asserts that we only identify truly contagious shocks rather than reflections of interdependence. Hence, we construct our variable of liquidity shocks using the following regression model that we estimate separately for every market in our sample:

$$LIQ_{M,t}^{C} = \alpha^{C} + \beta_{1,C} LIQ_{M,t-1}^{C} + \beta_{2,C} R_{M,t-1}^{C} + \beta_{3,C} Vol_{M,t-1}^{C} + \beta_{4,C} TV_{M,t-1}^{C} + \beta_{5,C} TV\_Vol_{M,t-1}^{C} + \beta_{6,C} Bank\_R_{M,t-1}^{C} + \beta_{7,C} Rate_{M,t-1}^{C} + \beta_{8,C} M/B_{M,t-1}^{C} + \varepsilon_{t}^{C} \quad (5.6)$$

[35] For a more detailed discussion we refer to King, Sentana, and Wadhwani (1995), Allen and Gale (2000), Claessens and Forbes (2001), Karolyi (2003), and Dungey, Fry, and Gonzalez-Hermosillo (2010).

where $LIQ^{C}_{M,t}$ is our daily liquidity index, $R^{C}_{M,t}$ is market return, $Vol^{C}_{M,t}$ is market volatility, $TV^{C}_{M,t}$ is market turnover, $TV\_Vol^{C}_{M,t}$ is turnover volatility, $Bank\_R^{C}_{M,t}$ corresponds to the return of the bank index, $Rate^{C}_{M,t}$ is the short term interest rate, and $M/B^{C}_{M,t}$ is the aggregate market-to-book ratio of country C during week t. The aforementioned model includes an extensive number of factors that account for the most commonly identified determinants of liquidity, namely market conditions ($R^{C}_{M,t}$, $Vol^{C}_{M,t}$), inventory risk arising from changing trading behaviour ($TV^{C}_{M,t}$, $TV\_Vol^{C}_{M,t}$), funding liquidity conditions ($Bank\_R^{C}_{M,t}$, $Rate^{C}_{M,t}$), and investor sentiment ($M/B^{C}_{M,t}$)[36]. We also account for the persistence of liquidity series by including an autoregressive term in the regression.

We arbitrarily define an extreme liquidity shock (exceedance) as one that corresponds to 1 standard deviation (SD) drop below the empirical mean of the corresponding filtered liquidity series. We decide to restrict our attention to extreme liquidity shocks, since interdependence across capital markets becomes more prevalent during periods of stress as opposed to periods when market advances (Yuan, 2005; Nieuwerburgh, and Veldkamp, 2006). Hence, by limiting our attention to extreme events we aim to isolate the causes and implications of common liquidity shocks from patterns that appear under ordinary market conditions. In this way we hope to elicit the factors or channels that emerge as particularly important under adverse market conditions. Moreover, using 1SD distance from the mean as a threshold enables us to identify a substantial number of liquidity events in the left tail of the empirical distribution for each country. In unreported results however, we find that the tenor of our results holds if we choose different cutoff points for our identification (e.g. 0.8 or 0.5 SD), and therefore the choice of the particular threshold has no material impact on the conclusions we draw in our present study[37].

To model liquidity contagion within and between regions we adopt the approach suggested by Bae et al. (2003). Studying coexceedances has the advantage that it is both parsimonious as a measure and straightforward in its interpretation. In this way, we overcome the problem of multiple and, many times, conflicting definitions of contagion found in the literature (Corsetti, Pericoli, and Sbracia, 2005). An additional advantage of our approach is that we implicitly account for the inherent differences in liquidity's higher moments across markets, whereas by controlling for conditional volatility in our filtering regressions we are also able to address the heteroskedasticity bias illustrated by Forbes and Rigobon

[36] For more information regarding our motivation for the selection of the aforementioned variables we refer to Chordia, Roll, and Subrahmanyam (2001) and Chordia, Sarkar, and Subrahmanyam (2005).
[37] In earlier versions of the current paper we used the 5% percentile as a cutoff threshold.

(2002). Hence, we count the number of joint realizations of weekly liquidity shocks 1SD below the mean for countries in a particular region, and then use it as our variable of interest in a limited dependent variable framework. We model liquidity coexceedances as a polychotomous variable that distinguishes between 3 categories, namely no liquidity exceedance or just in one market, liquidity coexceedances between two markets, and liquidity coexceedances including 3 or more countries (zero or one exceedances is considered the category of reference). Our decision to truncate coexceedances in more than three countries and include them in one group is made to retain the parsimony of the estimated model and to obtain a sufficient number of instances for each category. Because of the natural ordering of our dependent variable we decide to estimate an ordered logit model which is described as follows:

$$P\left[LIQ\_CX_{R,t} = j|X_{R,t}\right] = Pr\left[\mu_{R,j-1} < \beta_R' X_{R,t} + u_{R,t} \leq \mu_{R,j}\right] = \\ = F\left(\mu_{R,j} - \beta_R' X_{R,t}\right) - F\left(\mu_{R,j-1} - \beta_R' X_{R,t}\right) \quad (5.7)$$

where $LIQ\_CX_{R,t}$ corresponds to the category of liquidity coexceedances (0 to 2) in region R, at day t, β_R' is the vector of coefficients, $X_{R,t}$ is the vector of covariates determining the number of coexceedances, $u_{R,t}$ is the error term that is assumed to follow a logistic distribution, and $\mu_{R,j}$'s denote the unknown cutoff parameters to be estimated together with the coefficients.

5.2.4 Descriptive statistics

In Table 1 we present summary statistics of the variables discussed earlier, separately for every country in our sample. As it can be easily observed, our variables demonstrate substantial cross-sectional variation. At this point, it is important to underline though that our liquidity ratio is not comparable across markets. This is due to the absence of consistent trading volume definitions, but also because our price impact ratio is expressed in units of local currency. In terms of market performance, Turkey is the top performer with average weekly returns of 17.69bps, followed by Brazil with 7.65bps. This corresponds to an average annualized weekly return of almost 10% for Turkey and approximately 4% for Brazil. Japan is at the bottom of the cross-sectional distribution with an average weekly return of 0.02bps, followed by Thailand with 0.58bps. With respect to the performance of the banking sector, Turkey still ranks at the top with average weekly returns of 21.02bps, followed by Hungary with 12.38bps. The market with the worst performing banking sector is, not surprisingly, Japan with an average weekly return of -1.38bps, followed by Thailand with -0.65 bps. The two most volatile markets are Turkey and Korea, whereas New Zealand and Chile rank at the bottom in that respect. The market with the highest market-to-book ratio is, not surprisingly, the U.S. (more than 1.5 times higher compared to the cross-sectional average) illustrating its superior efficiency in generating future profits for a given level of investment.

The biggest recipient of equity portfolio flows is Cyprus with an average quarterly rate of almost 40 bps over its *GDP*, with Hong Kong ranked second in that respect, demonstrating a quarterly ratio of 25.81 bps. The countries favored less in that respect are the Netherlands, and Belgium in which U.S. investors have been net sellers at the average quarterly rate of -7.62bps and 3.87bps respectively. On the other hand, the average stock of U.S. bank claims of foreign assets is the highest in the case of Singapore and Hong Kong, corresponding to an average ownership ratio (*asset-to-GDP*) of 17.40% and 12.52% respectively. At the bottom-end of the cross-sectional distribution in that respect we find China, which perhaps can be explained by the dominant role of the domestic banking sector in the provision of credit and the absence of an institutional framework that would allow arms-length financing to develop in the country.

In table 2, we report descriptive statistics from the filtering regressions described in equation (6). To render our liquidity ratios comparable, we first scale them with the standard deviation of the respective empirical distribution. As explained in the section above, our purpose is to investigate the extent of clustering of unanticipated liquidity shocks across markets. Shocks of this kind cannot be hedged by domestic liquidity providers and as such can create pervasive price distortions with substantial costs for investors. The lagged nature of our empirical model allows us to overcome issues associated with endogeneity or concerns of reverse causality assuming we can now consider our covariates as predetermined. This way we are also able to evaluate the relative importance of different contagion channels without the concern of a spurious correlation between persistent components of market liquidity and our proxies for contagion. Consistent with intuition, market return is a positive conditional predictor of next week's liquidity for the vast majority of cases. This can be attributed both in the declining capacity of domestic markets makers to provide liquidity, but also in the increasing demand for immediacy by investors which are expected to have a disproportionate effect in down markets. There is only a minority of cases in which market return appears to have a negative correlation with liquidity, but none of them is significant at the 5% level. Equally conclusive is the share of markets in which aggregate volatility has a negative effect on future liquidity (approximately 77%). This is again in line with previous work (e.g. Hameed, Kang, and Viswanathan, 2010) and can be interpreted as a positive associate between the cost of funding or prevailing margin requirements and the general level of uncertainty in the market. When volatility exceeds certain levels, generally employed risk models typically dictate the offloading of risky securities increasing the demand for immediacy among investors which can only be satisfied at the expense of a higher cost even assuming unchanged capacity to supply liquidity by market makers. On the other hand, increasing volatility would typically lead to tighter funding conditions and an increase in the risk aversion of domestic market makers which would now require higher (*ex-ante*) compensation for assuming their market clearing role (Nagel, 2012). We also find that turnover and turnover volatility on average demonstrate a negative and positive conditional correlation with liquidity respectively, which is admittedly counterintuitive. However, interpretation of the aforementioned finding is complicated both by the detrending we imposed at the beginning, as well as by the fact that the share of markets demonstrating turnover (and turnover volatility) coefficients with opposite sign is almost equal. As a result, we believe that the aforementioned finding should be treated with caution.

Moreover, the sign of estimated coefficients of our bank index return variable and of the short term interest rate both indicate that increasing funding costs as reflected in underperforming intermediators or rising borrowing rates will eventually erode the capacity of liquidity providers to fulfill their role. Market-to-book ratio is a positive and statistical significant predictor of future liquidity for the vast majority of markets. This confirms intuition that improving sentiment is associated with a higher participation of retail investors in the market, thus decreasing the risk of informed order flow and consequently the cost of liquidity provision. The strongly significant *AR(1)* term also confirms the persistent nature of our liquidity series as it has been already illustrated by a number of previous studies (e.g. Karolyi et al., 2012). By performing the aforementioned analysis separately between our groups of Developed and Emerging markets we find that the tenor of our aggregate results remains mostly unchanged.

Having performed our filtering regressions we now plot the share of countries experiencing a liquidity exceedance separately for the whole sample, and our groups of Developed and Emerging markets. In figure 1 exceedances are first identified using the *AR(1)*-adjusted liquidity series whereas in figure 2 we use our filtered liquidity series based on the model described in equation (6). Both figures highlight the existence of substantial clustering in the share of countries experiencing an adverse liquidity shock, which peaks in periods of global turmoil typically associated with adverse events of global importance (e.g. LTCM crisis, 9/11 attacks, burst of dot-com bubble, and the onset of the recent financial crisis). Another observation is that with the exception of few occasions mostly identified in the earlier period of our sample, the share of Developed markets experiencing liquidity co-exceedances mostly dominated the equivalent share for the Emerging markets. We attribute this finding to the increasing extent of integration that has been taking place among Developed markets over the past couple of years, enabling foreign capital to move across markets at a minimum cost. On the other hand, the abolishment of capital controls has benefited local economies substantially in view of the subsequent decline in the cost of capital, only however at the expense of higher commonality across markets due to herding, clientele effects, portfolio rebalancing by global investors, varying global risk-aversion, common funding practices, and an increasing exposure over global risk factors. In addition, we notice our un-filtered liquidity series typically demonstrates a larger share of countries experiencing a liquidity co-exceedance when compared to our filtered series, which clearly manifests that the extent of clustering of liquidity shocks can be, to some extent, attributed to market-specific factors that are themselves correlated with potential contagion channels and whose expected impact over local liquidity can be forecasted, in many cases. As discussed earlier, our identification strategy appears to be particularly conservative implying that our findings concerning the importance of potential contagion channels can be even more pronounced than what is indicated in our empirical framework. However, we do not expect this to undermine the core findings of the present analysis which is mainly concerned with evaluating the relative rather than the absolute importance of alternative contagion channels.

Table 3 presents the frequency of different types of liquidity exceedances separately across markets in the Developed and Emerging group. This way we can obtain a more informed perspective regarding potential differences in the extent of liquidity contagion across the two groups, as well as identify the markets that appear to be more susceptible (resilient) to contagion within each group. Interestingly, Emerging markets demonstrate significantly less liquidity co-exceedances in the top categories compared to Developed Markets, both in the case of filtered as well as in the case of unfiltered liquidity series. In the case of filtered liquidity series for example, Switzerland is the only market in the category of Developed demonstrating zero co-exceedances, whereas in the group of Emerging Markets 14, 12 and 6 markets demonstrate zero co-exceedances in the categories of (>=) 6, 5, and 4, respectively. This can be considered as an early indication that Emerging Markets are significantly less responsive to common liquidity shocks when compared to Developed Markets. Regarding the countries with the highest number of co-exceedances, Denmark ranks at the top with one third of its co-exceedances occurring simultaneously with at least 5 more Developed markets, whereas Indonesia ranks first among Emerging Markets in that respect.

5.3 Empirical Results

This section describes the modeling framework used to identify the determinants of contagion within and across regions, as well as the respective findings. To the best of our knowledge, this is the first paper to present evidence of liquidity contagion, both within specific regions and across markets otherwise distant. Our baseline approach is based on logistic regressions for the different regions in our sample. After investigating the extent of liquidity contagion across markets, we also try to ascertain the relative importance of a number of potential channels, as well as to evaluate the importance of foreign flows in transmitting adverse liquidity shocks from one market to another.

5.3.1 Contagion within Regions –Logistic Regressions

In an attempt to identify the channels through which crises tend to propagate from an epicenter to neighboring markets, a significant number of papers to date have focused primarily on the regional nature of many of the past crises. In view of the fact that geographic distance correlates positively with information frictions, and given the importance of the latter in the market for assets and/or goods (Portes, and Rey, 2005; van Nieuwerburgh and Veldkamp, 2009), it is hardly surprising to observe that crises spread primarily across countries within the same region. The two most commonly suggested explanations regarding the transmission mechanism concern the existence of strong trade and/or financial linkages, as well as the similarity of the underlying economic fundamentals that are typical between markets in geographic proximity. Glick and Rose (1999) for example show that the prevalence of currency crises within a region can be attributed to strong trade ties, even after controlling for a variety of macroeconomic effects. As far as capital markets are concerned, Forbes and Chinn (2004) argue that developments in the largest economy of a region exert substantial influence in the performance of other markets in the same region. The importance of financial linkages within a region is also manifested by the extent of cross-border bank lending, since it is generally observed that banks tend to be more active creditors within their own region. Hence, the existence of a common lender that contracts its lending as a response to a domestic crisis, can significantly impair the availability of funding in regional markets, and thus cause contagion (Kaminsky, and Reinhart, 2000; van Rijckeghem, and Weder, 2001). In addition, a number of previous studies argue that "*wake-up call*" effects can have a disproportionate impact over countries within the same region (e.g. Ahluwalia, 2000; van Rijckeghem, and Weder, 2003).

Our current empirical setup follows closely that of Boyson et al. (2010) and tries to assess the relative importance of contagious effects within and across regions by estimating whether a particular market is more likely to experience an adverse liquidity shock when the percentage of other markets experiencing similar a shock is higher. In Table 4 we model the probability of a liquidity exceedance in one market as a function of the share of markets (%) experiencing a liquidity exceedance the same week in the same region (excluding the market of interest), but also as a function of liquidity exceedances occurring in one of the remaining regions, as well as in our group named Global that consists of Australia, Japan, U.K., and the U.S. Our dependent variable indicates whether the filtered liquidity series of a particular market declines 1SD below its respective mean (by construction the mean value is always zero). Under the hypothesis of no contagion, the extent of liquidity co-exceedances in a region should have no significant explanatory power over the probability of a liquidity exceedance in another market. Thus, we pertain that, in the context of our analysis, a positive and statistically significant coefficient on the share of countries experiencing a liquidity co-exceedance corresponds to a correlation over and above what can be attributed to own market fundamentals, and as a result should be considered as evidence of contagion (Bekaert et al., 2005; Boyson et al., 2010). To control for time-invariant heterogeneity across markets we introduce dummy variables for each market, whereas year dummies are included to account for any unobserved periodic effects. Except for a logistic framework we also employ a complementary logarithmic setup which, contrary to the logistic transformation, assumes that the respective cumulative distribution function is asymmetric around zero ($F(x) = 1 - exp\big(-exp(x)\big)$). As it can be easily observed, the tenor and significance of our results remain unchanged regardless of the estimation methodology employed.

Table 4 presents the results of the aforementioned estimation. We observe that within-region contagion is statistically significant at the 1% level in the case of Developed Europe and marginally significant in the case of Latin America (10% level), but does not seem to be of any importance in the case of Emerging Europe and Asia. It is also noticeable that markets in Developed Europe are susceptible to adverse liquidity shocks both from Asia and Global markets with the former demonstrating a more pronounced effect even when compared to within-region contagion. It is also noteworthy that with the exception of markets in Latin America, the extent of negative liquidity shocks in our group of Global markets carries the seeds of contagion to other regions as well. Our finding confirms the common perception that developments in markets of systemic importance for the global financial system such as the aforementioned have implications extending far beyond their own geographic limits. Our results are particularly impressive also in economic terms. In the case of Emerging Europe for example, the probability of a market experiencing a liquidity exceedance rises from almost 15%, when none of the Global markets has an exceedance, to almost 37% when all four markets (Austrlia, Japan, U.K., and U.S.) experience a liquidity co-exceedance the same week. Cross-regional contagion is also substantial. In the case of Asia (Panel C, Column 5), the probability of a market experiencing a liquidity exceedance increases from 3.3% when none of the markets in Developed Europe have a liquidity exceedance, to approximately 17.5% when all the markets in Developed Europe experience a coexceedance. Hence, as the aforementioned findings illustrate, liquidity contagion is not only important in statistical terms, but is also substantial in economic terms in many of the regions considered in our analysis.

Now we move a step further and try to assess the relative importance of different factors in explaining liquidity contagion within and across regions. Our set of liquidity determinants is similar to the one used in our filtering regressions. In our tests for within-region contagion (Columns 1, 4, and 7) each regressor is computed as the equally-weighted average of the same factor across all remaining markets in the specific region. In the case of Global markets, regressors are computed as the equally-weighted average of respective factors across Australia, Japan, U.K., and the U.S. In Columns 3, 6, and 9, we try to distinguish the relative importance of Global versus local determinants (own region) by first removing any global component from our set of local factors. As a result, own region determinants are orthogonalized on the respective global factors using an *OLS* estimation framework separately for each market. Similar to Table 4, our dependent variable is an indicator obtaining the value of 1 once the respective market experiences an adverse liquidity shock, whereas estimation is performed using a logistic framework. In Table 5 we present the respective results. It is noteworthy that the aggregate *market-to-book* ratio is the most consistent predictor of market liquidity exceedances. When we investigate the importance of local and global factors separately, the aforementioned variable is always statistical significant at least at the 5% level. However, when we orthogonalize the local factors on the respective global and introduce both in the regression, only the local component remains statistical significance. Our interpretation is that local sentiment dominates global as a determinant of liquidity exceedances of markets within a particular region, although the latter has also important ramifications. Another explanation however could be that our global averages, although orthogonal to respective regional factors, might still correlate with some of the remaining regional variables which could potentially underplay their statistical significance. The direction of the relation between sentiment and negative liquidity shocks is intuitive. When investor sentiment improves within a particular region or within our set of global markets, then the probability of a liquidity exceedance in an individual market is reduced, *ceteris paribus*. Our finding can have multiple interpretations. During periods of elevated sentiment, investors might increase their otherwise limited presence in foreign markets, particularly neighboring, and thus increase the share of non-informed trading flow in those markets, with positive implications over domestic liquidity. The same reasoning extends to market makers whose risk aversion will typically decline during such periods, and thus command a lower premium for providing liquidity in many of the markets they operate (Nagel, 2012). Alternatively, when the share of optimistic investors increases and prices overshoot[38], market makers operating across multiple markets will experience a positive shock in their net worth which, in turn, will increase their capacity to provide liquidity. When we estimate the model including all markets (Columns 1-3), aggregate volatility demonstrates positive and significant correlation with the probability of a liquidity exceedance (Columns 1 and 2). However, when we run the model including both regional and global factors, statistical significance is lost. Global market performance is also negatively correlated with the probability of a liquidity co-exceedance when we estimate our model including all markets or when we limit estimation to our sample of Developed markets. Nevertheless, statistical significance is again limited and does not survive the inclusion of our set of orthogonalized local factors (Columns 3, 6). Finally, our set of *chi-square* tests indicates that overall significance of (orthogonalized) regional factors is always superior to that of respective global factors.

After investigating the time-series of liquidity contagion in markets of different regions/categories (Developed Europe, Emerging Europe, Asia, and Latin America), we now turn our attention to the respective time-series properties of the cross-section of stocks. This way we try to identify particular stock characteristics associated with increasing susceptibility over adverse liquidity shocks originating from different markets within the same region or from our set of Global markets. Our selection of stock characteristics is motivated by theory as well as by previous empirical findings. First, it is intuitive to argue that during periods of financial turmoil, when the allocation of liquidity is scarce and the demand for immediacy increases, liquidity provision should be particularly subdued for stocks perceived as riskier or of inferior quality. In that respect, low capitalization stocks are, on average, associated with more pronounced information frictions since they typically demonstrate lower ownership by institutional investors and poorer governance structure. The same holds for stocks with low levels of idiosyncratic volatility which typically incorporate less private information and are thus associated with higher levels of information asymmetry (Ferreira and Laux, 2007). As a result, stocks in the aforementioned categories incorporate a greater extent of

[38] We assume some type of short-selling constraints are present (e.g. Bris,Goetzmann, and Zhu, 2007).

subjective valuations which deems more difficult the separation of transitory from information induced shocks by market makers. Hence, it is reasonable to except that the cost of liquidity provision will increase disproportionally for this type of stocks during periods of general financial turmoil. The same holds for stocks with lower extent of information driven trading, as well as for those more responsive to changes in investor sentiment. Overall, the aforementioned characteristics account for a different extent of prevalence of trading frictions in the cross-section of the market and deem mispricing difficult to arbitrage due to increased noise trader risk, short-selling constraints, and asymmetric information impediments. As a result, it is reasonable to expect such stocks to be particularly susceptible to adverse liquidity shocks originating from abroad.

For this purpose, we create groups of stocks based on their ranking (above/below median) in one of the following four dimensions, namely market capitalization, idiosyncratic volatility, the extent of trading on private information, and overreaction to sentiment. For the first three categories we create separate liquidity indices by assigning every stock of a particular market in one of the aforementioned groups depending on whether it ranks above or below the cross-sectional median of market capitalization, idiosyncratic volatility, and of our proxy for private information trading flow the previous year. The idiosyncratic volatility of a stock is computed as the standard deviation of the residual obtained from regressing daily stock returns on the daily market return every year. Our measure of trading based on private information follows Llorente at al. (2002) and is obtained by running the following regression every year for every stock in a market:

$$R_{i,d+1} = c_{0,i} + c_{1,i} \cdot R_{i,d} + c_{2,i} \cdot R_{i,d} \cdot TV_{i,d} + \varepsilon_{i,d+1} \quad (5.8)$$

where $R_{i,d}$ is the stock return, and $TV_{i,d}$ is the detrended log turnover of stock i, during day d. The estimated coefficient $c_{2,i}$ is our measure of information-driven trading. Overreaction to sentiment is assessed by running regressions of monthly stock returns on an *AR(1)* term and our (lagged) proxy of global sentiment for the whole time period. Our preference of a global rather than a local sentiment index in our effort to characterize stocks' responsiveness to sentiment induced trading is motivated by Baker, Wurgler, and Yuan (2012) who show that the global component from a number of local sentiment indicators is a particularly strong predictor (contrarian) of local market returns. We construct our proxy of global sentiment as the monthly *GDP*-weighted average of the closed-end fund discount across 24 countries in our sample[39]. A lower closed-end fund discount typically reflects elevated investor sentiment. Thus, stocks demonstrating a greater price

[39] Closed-end fund discount data are obtained from http://mathijsavandijk.com. We construct our global index only for the markets included in the present analysis.

reversal (increase) following months with high (low) investor sentiment are typically associated to noise trading and are also considered more difficult to arbitrage. As a result, stocks with a conditional correlation between performance and sentiment that is above the cross-sectional median are considered as high-sentiment, whereas stocks that rank below the respective median are considered as low sentiment.

After classifying each stock of a market in one of the aforementioned categories, we construct the respective liquidity index by computing the equally-weighted average of the Amihud ratio across all stocks in each group during the following year (with the exception of our sentiment indicator for which ranking is performed for the whole time period). To identify the corresponding liquidity coexceedances per index we perform the filtering regression described in Equation (6), and then use the identification strategy described earlier. In Table 6 we present the results from logistic regressions of liquidity exceedances separately for each group of stocks on the share of markets experiencing a liquidity exceedance within the same region and in our group of Global markets. Panels A and B report the estimation results including the share co-exceedances within the same region and in the group of Global markets separately, whereas panel C is estimated including both variables. As it can be easily observed, contagion within a region and from our group of Global markets is strongly significant in statistical terms in the whole cross-section of markets. In economic terms however, we notice that the within region term has always a more pronounced effect compared to Global markets. For example, the probability of a liquidity exceedance for stock indixes in the low-sentiment category is almost 15% when all the markets in the same region and 50% of Global markets are experiencing an exceedance, whereas the same probability declines to 11% when all Global markets and half of the markets in the same region are experiencing an adverse liquidity shock. Our finding confirms the perception that contagion is particularly strong within the geographic barriers of a region, even though systemically important markets also exert substantial influence in that respect. Contrary to intuition however, we observe that liquidity contagion is more pronounced in the case of big rather than small capitalization stocks. The same holds for stocks with more information-driven order flow the past year, and lower responsiveness over sentiment. This extends both for liquidity shocks originating from the same region as well as for shocks from Global markets. On the other hand, consistent with our expectations, stocks with lower idiosyncratic volatility are more susceptible to contagious shocks compared to stocks that rank higher in that respect. One potential explanation for the aforementioned puzzling result is that market makers or investors operating across several markets typically hold the most liquid end of the spectrum in those markets and thus extreme correlations will become more pronounce across assets of higher rather than lower quality during periods of a widespread liquidity shortage. This channel can operate through a portfolio-rebalancing effect, but also due to investors first cashing-out their most easily marketable, and thus liquid positions.

5.3.2 Channels of Liquidity Contagion

In Table 7 we investigate the relative importance of different factors that theory elicits as important determinants of aggregate liquidity (Brunnermeier and Pedersen, 2009; Boyson et al., 2010). These consist of the *TED* spread, the level of anticipated volatility on the S&P500 index (*Expected Volatility*), the *Variance Premium*, the return and volatility of our index of global prime brokers (*Prime Broker Returns*, and *Prime Broker Volatility*), the world interest rate (*World Rate*), and the spread between the US High-Yield Bond Index (BB-B) and the 10 year U.S. Treasury bond (*Credit Spread*). The *Expected Volatility* and *Variance Premium* account for a decomposition of the VIX index on an uncertainty component and a risk aversion component respectively. Since the VIX index has been already identified as commoving positively with the cost of liquidity provision[40] (Nagel, 2012), we believe it is meaningful to disentangle between the importance of the uncertainty component which is computed under the physical measure and that of risk aversion which alludes to changing risk preferences. The *TED* spread reflects the general borrowing terms of financial intermediaries when compared to riskless Treasury bonds, but also the extent of counterparty risk as perceived by the interbank market. As a result, it typically correlates negatively with market liquidity. Prime broker performance and volatility also reflect the ability of financial intermediaries to perform their role as liquidity providers. When their market performance is disappointing and investors are particularly uncertain about their outlook, prime brokers would typically curtail the supply of liquidity, effectively increasing the cost of immediacy. The world interest rate on the other hand captures general monetary conditions prevailing at each point in time, whereas the Credit Spread implicitly relates to the cost of borrowing by investors and financial intermediaries alike and as such should negatively relate to liquidity.

In Table 7 we try to assess the explanatory power of each of the aforementioned channels over the time-series evolution of liquidity contagion in each of our regions. Our dependent variable in this example reflects the extent of liquidity contagion within a particular region. Hence, we model coexceedances as a polychotomous variable that distinguishes between 3 categories of liquidity

[40] In unreported results we find VIX to be positively associated to the extent of contagion across all our regions in a statistically significant level.

contagion, namely zero or a single liquidity exceedance in the region, liquidity coexceedances between two countries, and liquidity coexceedances including 3 or more countries (zero or one exceedances is considered the category of reference). The test statistic reported in the last column investigates the joint significance of each factor across all regions. Interestingly, the factor most consistently explaining liquidity contagion in our regions (with the exception of Emerging Europe) is the *Variance Premium*. Consistent with intuition, an increase in implied risk aversion is associated with a greater likelihood of two or more coexceedances in the region compared to the base case. In addition, the joint test of the aforementioned factor being simultaneously zero across all regions is easily rejected at the 1% statistical level. *Prime Broker Volatility* is also positively associated with an increasing likelihood of at least two liquidity exceedances in the region in the case of Developed Europe and Latin America, whereas increasing borrowing costs in the category of high yield bonds is also a positive indicator of contagion but statistical significance is limited only in the case of Latin America. With the exception of Developed Europe, the sign of the *TED spread* is also consistent with intuition and is positively correlated with an increasing likelihood of two or more coexceedances in Latin America, and in our group of Global markets. Overall, our results show that adverse developments in funding conditions (e.g. an increase in borrowing costs, counterparty risk or uncertainty regarding the prospects of the intermediating sector), combined with an increase in aggregate risk aversion increase the likelihood of simultaneous liquidity shocks within a region. On the other hand, global monetary conditions seem to demonstrate much lower relevance in that respect.

After having investigated the importance of different contagion channels in explaining the clustering of adverse liquidity shocks at the index level we now try to furnish a better understanding regarding contagion in the cross-section of stocks in respective markets. Our goal is to assess whether the relative importance of each of the aforementioned channels differs when we condition our inference on particular stock characteristics. This time our dependent variable is the share (%) of liquidity coexceedances across all the markets in our sample. Given the censored nature of the variable, estimation is performed using a tobit model. In unreported results however we repeat our inference using a simple *OLS* estimator, but also an (ordered) logistic framework and results remain qualitatively unchanged. With the exception of the *TED spread*, the impact of the remaining factors is consistent with the intuition explained earlier. *Variance Premium* and *Expected Volatility* are always positively associated with a greater share of liquidity co-exceedances, significantly at the 1% level. Interestingly however, their impact is typically more pronounced in the case of “high” rather than “low” quality stocks, namely high market capitalization, those with more information-induced trading, and lower overreaction to sentiment. The same extends for stocks with lower levels of idiosyncratic volatility. An exception in that respect is the effect of *Expected Volatility* which is stronger in the case of stocks demonstrating less extensive information-induced trading. In addition, an increase in *Prime Broker Volatility* is associated with a greater extent of liquidity contagion across markets, which is mostly statistical significant among "high quality" stocks. As it has been already indicated, the negative sign in the point estimate of the *TED spread* is puzzling. Our explanation is that this reflects the residual correlation of the aforementioned factor and our dependent variable since the component reflecting changes in borrowing costs and counterparty risk is already captured by our other variables (e.g. *Credit Spread*, *Prime Broker Volatility*). Overall, our findings in this table confirm the importance of funding conditions and risk aversion in explaining the extent of contagion across aggregate liquidity indices as well as across the liquidity of different categories of stocks. However, we also confirm our puzzling finding that the majority of our contagion channels seem to be more pronounced among "high" rather than "low quality" stocks. Again, one potential explanation is that market makers or investors operating across many markets typically prefer high "quality stocks" for reasons related to clientele effects as well as due to moderate transaction costs and lower information impediments. If that is indeed the case, it would be reasonable to expect the aforementioned contagion channels to have a more dramatic effect over stocks of higher rather than lower quality during periods of general market turmoil.

Next we try to shed more light on the potential transmission mechanism of liquidity shocks across markets. Understanding how liquidity shocks propagate across markets is of utmost importance among policymakers that aspire to develop protective mechanisms that would offset such shocks. One such mechanism can be manifested through the positions of international investors and particularly through cross-border equity portfolio flows. Several empirical studies to date (e.g. Cao, Chen, Liang, and Lo, 2009; Aragon and Strahan, 2012) have identified certain types of sophisticated investors as performing the role of liquidity providers with the objective to cash-out from potential liquidity premia across many markets. As a result, it is reasonable to infer that during times of tightening margins and increasing borrowing costs such investors will most likely react by withdrawing liquidity simultaneously from the markets they operate, thus contributing to the transmission of contagion. Similar behavior can be triggered by a number of different reasons including "flight to quality" episodes, information cascades, or sudden spikes in risk aversion. Another important mechanism works through lending institutions and financial intermediaries operating in more than one market simultaneously. It is intuitive to argue that an adverse shock to the financial state of banks or deteriorating funding conditions of financial intermediaries in one market will undermine their capacity to extend credit not only in the domestic market but also abroad. This in turn will generate an adverse shock to funding conditions in markets other than the one initially experiencing the shock which can eventually translate to declining market liquidity abroad.

Table 9 investigates the predictions of the aforementioned arguments regarding the role of international equity investors and that of cross-border bank lending. If foreign equity or bank flows render a market more susceptible to contagion through sudden outflows, this means that markets attracting more foreign capital should demonstrate greater synchronicity in terms of liquidity shocks. In Table 9 we create two groups of markets every quarter, one that includes markets that have received above median equity or bank flows over the course of the respective quarter and those ranking below median in that respect. Then we compute the share of markets within each group experiencing a liquidity exceedance and regress it on our set of contagion determinants used in the previous tables. Once more our findings are not perfectly aligned with theoretical predictions. Consistent with intuition, the *Variance Premium* has a disproportionate effect over markets that have been above median recipients of equity and bank flows. In other words, markets receiving more investment either in the form of equity purchases or in the form of cross-border bank lending demonstrate a greater extent of liquidity contagion once global risk aversion increases. The same holds for *Prime Broker Volatility*, but only when we consider bank flows as the identifying characteristic for sorting. The *Credit Spread* however demonstrates a more pronounced effect in markets ranking below median both in terms of bank flows as well as stock purchases by foreign investors. The *TED spread* is again negative, whereas the world interest rate demonstrates little consistency in terms of the estimated sign. Overall, our findings suggest that markets receiving more investment either in the form of equity purchases or in the form of cross-border bank lending demonstrate a greater extent of liquidity contagion once global risk aversion increases. However, our coefficient estimates of other factors are more challenging to interpret in that respect.

5.4 Conclusions

In this paper we investigate the extent of liquidity contagion within, as well as across different geographic regions. To the best of our knowledge, this is the first paper to pursue such a task. Given the large number of arguments against earlier methodologies that typically generate an overidentification of contagious events (e.g. Forbes, and Rigobon, 2002), our definition of contagion is purposefully conservative and based on the clustering of adverse liquidity shocks (exceedances) in excess of what can be attributed to market specific determinants (Bekaert et al., 2005; Boyson et al., 2010). Our filtering regressions control for an extensive set of factors the literature has elicited as determinants of market liquidity. In the case of no contagion our approach implies zero correlation between the probability of a liquidity exceedance and the extent of clustering in liquidity exceedances across other markets.

Our analysis provides strong evidence of contagion across several regions in our sample. We also find that deteriorating liquidity conditions in systemically important markets like in Australia, Japan, the U.K. and the U.S. exert, in certain cases, a disproportionate impact over other markets. Our findings are substantial in statistical as well as economic terms. When we try to identify the liquidity factors with the greatest explanatory power over the likelihood of a liquidity exceedance, our proxy for investor sentiment (*market-to-book*) together with aggregate volatility stand out as the ones with the most pronounced effect. Interestingly, even though Global aggregates are important in their own respect, (orthogonalized) regional aggregates demonstrate a leading role when it comes to explain liquidity exceedances in the same region.

After investigating the time-series of liquidity contagion across markets of different regions/categories (Developed Europe, Emerging Europe, Asia, and Latin America), we next turn our attention to the respective time-series properties of the cross-section of stocks. Our effort is to identify particular characteristics that render stocks susceptible to adverse liquidity shocks originating from abroad. Our findings at this point are also interesting. Contrary to initial expectations, we show that liquidity contagion is more pronounced in “high” rather than “low quality” stocks. Our conjecture is that market makers or sophisticated investors operating across many markets typically prefer the top-end of the market spectrum in terms of quality for reasons related to clientele effects, as well as due to moderate transaction costs and lower information impediments associated with stocks of this category. As a result, during periods of market distress investors that otherwise provide liquidity increase the demanded payoff in return for supplying liquidity or, even worse, they demand immediacy themselves, thus hampering liquidity across their holdings.

We also investigate the relative importance of different factors that previous papers elicit as important determinants of aggregate liquidity. The most consistent results in that respect concern the *Variance Premium* and the volatility of our index of Global prime brokers. Our findings suggest that an increase in the implied risk aversion reflected in the *Variance Premium*, together with higher uncertainty regarding the state of financial intermediaries is associated with a greater extent of liquidity contagion within a number of regions. Another important determinant is the cost of funding typically reflected by the *Credit Spread*. Our analysis lends further support to the notion that commonality in liquidity becomes particularly pronounced in periods of deteriorating global funding conditions as well as downbeat investor sentiment. Finally, we investigate to what extent foreign equity flows and cross-border bank lending can provide a mechanism of transmission of potential liquidity shocks. Consistent with intuition, our findings suggest that markets receiving more investment either in the form of equity purchases or in the form of cross-border bank lending demonstrate a greater extent of liquidity contagion once global risk aversion increases.

Table 5.1: Summary Statistics

This table reports the number of unique stocks used in the computation of the Amihud (2002) liquidity ratio, as well as the average stock *market liquidity* (x10^6), *market return* (%), *market volatility*, *market turnover* (%), *bank index return* (%), *short term interest rate* (%), *market-to-book ratio*, *net equity flows* (%), and *bank flows* (%) for each of the 39 countries in our sample, over the period 1995-2008. With the exception of the variables in last two columns which are reported at a quarterly frequency, all the remaining variables are computed as the time-series average of daily values within a week. *Market liquidity* is computed as the equally-weighted average of the (modified) Amihud ratio (2002) across all the stocks in each market. *Market return* is the weekly average of the daily return of the respective market index. *Market volatility* is computed as the (annualized) average of daily squared returns during a week. *Market turnover* is the weekly average of the de-trended equally-weighted average of daily stock turnover. *Turnover volatility* is computed as the weekly average of daily squared turnover. The *bank index return* is the weekly average of daily return of the respective local bank index. As a *short rate* we typically use the 1 month interbank borrowing rate, unless otherwise indicated in section 2.1. *Market-to-book* is the ratio of aggregate market capitalization over the total book value of respective companies. *Net equity flows* are computed as the quarterly sum of monthly purchases minus sales of stocks to U.S. investors divided by the respective year's *GDP*. *Foreign bank claims* is the quarterly ratio of total lending extended by U.S. banks to each country in our sample, divided by the *GDP* of the recipient country the same year.

	#Unique Stocks	Amihud (x10^6)	Market Return	Market Volatility	Market Turnover	Turnover Volatility	Bank Index Return	Short Rate	Market-to-Book	Net Equity Flows	Foreign Bank claims
Austria	208	-0.8272	0.0227	6.0738357	-0.0045	1.3161664	0.0330	3.3723	1.6366	-0.0044	2.0545
Belgium	307	-26.8116	0.0287	6.5407499	-0.0141	0.8904009	0.0154	3.4382	1.2085	-0.0387	4.7883
Denmark	360	-0.0355	0.0408	6.9610464	-0.0195	1.7886972	0.0425	3.8113	1.9066	0.0106	4.3201
Finland	232	-0.4707	0.0654	12.895281	-0.0148	1.6547289	0.0788	3.4011	2.5982	-0.0027	1.5538
France	1,891	-0.4690	0.0424	8.1561478	-0.0197	0.6818044	0.0475	3.5643	2.0615	0.0226	2.0882
Germany	2,859	-4.5453	0.0336	7.8522316	-0.0275	1.4365575	0.0155	3.3696	2.0385	-0.0031	3.2195
Italy	643	-0.0965	0.0325	8.17616	-0.0152	0.8437307	0.0392	4.5739	1.8666	0.0017	1.7968
Netherlands	306	-0.8650	0.0317	7.934859	-0.0174	1.651893	0.0255	3.3217	2.2332	-0.0762	6.8287
Norway	483	-0.0328	0.0445	8.6082614	-0.0183	1.892118	0.0592	4.9674	1.6886	-0.0128	2.7739
Spain	285	-0.0467	0.0516	7.8939133	-0.0215	1.5654036	0.0567	4.2079	2.3040	-0.0134	2.0170
Sweden	903	-0.1617	0.0485	9.7181595	-0.0308	1.3955066	0.0595	4.0665	2.1572	0.0065	N/A
Switzerland	438	-0.0890	0.0359	6.9660563	-0.0332	2.3469107	0.0358	1.5775	2.4999	0.0549	N/A
U.K.	3,921	-0.0017	0.0328	6.8149761	-0.0105	0.5267149	0.0403	5.3569	2.2720	0.1842	8.6731
Greece	476	-0.6436	0.0488	9.7320307	-0.0290	1.5281819	0.0609	7.0046	2.4595	0.0070	3.3800
Poland	579	-0.9700	0.0538	10.796395	-0.0337	2.4578576	0.0822	12.9987	1.7161	0.0072	2.7512

Table 5.1: continued

	#Unique Stocks	Amihud ($x10^6$)	Market Return	Market Volatility	Market Turnover	Turnover Volatility	Bank Index Return	Short Rate	Market-to-Book	Net Equity Flows	Foreign Bank claims
Portugal	179	-1.9641	0.0306	6.0778	-0.0152	2.1047	0.0215	3.7465	2.1643	0.027	1.3335
Turkey	369	-1.3455	0.1769	18.2934	-0.1699	16.0972	0.2102	3.7465	1.826	0.0381	1.718
Hungary	86	-0.0115	0.0705	10.6773	-0.0164	3.4197	0.1238	3.7465	1.8442	0.0119	2.4391
Cyprus	121	-10.5203	0.0611	10.1678	-0.0376	2.5458	0.0832	3.7465	0.801	0.3962	2.4942
Israel	866	-0.7551	0.0521	8.4004	-0.0065	0.8869	0.0561	4.1647	1.7589	0.0869	0.981
Australia	2,677	-0.9232	0.0404	5.9316	-0.0056	0.6455	0.0581	5.6876	2.3154	0.0667	5.5326
Hong Kong	1,238	-0.089	0.0428	10.118	-0.0339	0.7889	0.0492	4.1312	1.6788	0.2581	12.5195
Japan	2,800	-0.0007	0.0002	8.6156	-0.0321	0.6371	-0.0138	0.3438	1.7375	0.0766	1.6868
New Zealand	232	-0.9729	0.0294	5.1065	-0.0069	0.5057	0.0427	6.8515	2.7487	0.006	2.4988
Singapore	935	-0.9059	0.0176	7.9563	-0.0579	1.3434	0.0327	2.1363	1.5298	0.0037	17.4027
China	1,666	-0.0006	0.0672	13.13	-0.0863	4.4236	0.0427	5.1491	1.4607	0.0098	0.4533
India	2,199	-1.1455	0.0592	10.631	-0.039	2.0427	0.0901	5.9825	2.1662	0.0179	2.1829
Indonesia	474	-0.0027	0.0499	11.7545	-0.0386	2.0863	0.0427	5.1491	3.0363	0.0105	1.8651
Malaysia	1,134	-0.3997	0.022	8.0767	-0.0369	1.4332	0.038	4.4135	1.7655	0.0488	7.6639
Philippines	303	-1.003	0.01	8.7971	-0.034	2.8424	0.0164	8.5773	1.6855	0.0323	4.9326
Korea	1,125	-0.0001	0.043	13.3794	-0.0471	4.2391	0.0264	7.8778	1.1993	0.0523	4.991
Taiwan	1,536	-0.0072	0.0197	10.9669	-0.019	2.6979	0.0181	3.836	2.3687	0.2341	4.7914
Thailand	901	-0.2101	0.0058	12.1921	-0.0795	3.4469	-0.0065	10.6243	2.4276	0.0122	3.1729
Argentina	115	-0.1452	0.0553	10.823	-0.0018	0.3623	0.0479	10.1365	1.4875	0.0034	5.6116
Brazil	649	-2.5551	0.0765	10.6134	-0.0405	2.1693	0.0762	26.3014	1.651	0.0757	3.8127
Chile	260	-0.001	0.0342	5.7097	-0.0109	1.9279	0.0418	0.6137	1.5978	0.0207	7.9748
Mexico	391	-0.1781	0.0696	8.7197	-0.0131	1.5463	0.104	15.1691	1.721	-0.0165	7.707
Peru	234	-0.3658	0.0482	6.868	-0.0211	3.5527	0.0594	8.4296	1.539	0.0505	3.1182
U.S.	4,427	-0.0155	0.0341	7.4716	-0.0137	0.9408	0.0456	4.222	3.2547	N/A	N/A

Table 5.2: Filtering Regressions

Columns 1-6 presents descriptive statistics of country-by-country *OLS* regressions of weekly market liquidity on lagged determinants described in Equation (6). Liquidity variables are first scaled by their respective standard deviation. In more detail, columns 1 and 2 contain the average and median values of respective coefficients, column 3 the percentage of markets with estimated coefficients that are positive and statistically significant at least at the 5% level, column 4 the percentage of markets with positive coefficient, column 5 the % of markets with negative coefficient that is statistically significant at least at the 5% level, and column 6 the percentage of markets with negative coefficient. Columns 7 and 8 contain the corresponding estimates obtained by running panel regressions with fixed effects and standard errors clustered at the market level.

Panel A: All Markets	**Avg. Coeff.**	**Median Coeff.**	**% Markets with >0 Coeff. Sign. 5% Level**	**% Markets with >0 Coeff.**	**% Markets with <0 Coeff. Sign. 5% Level**	**% Markets with <0 Coeff.**	**Panel Regression FEs Coeff.**	**Panel Regression FEs t-stat.**
Market Return	0.0309	0.0365	0.1282	0.6667	0.0000	0.3333	0.0468	3.6830
Market Volatility	-0.0102	-0.0072	0.0769	0.2308	0.3333	0.7692	-0.0134	-4.3145
Market Turnover	-0.0396	-0.0011	0.0256	0.4872	0.0256	0.5128	-0.0197	-0.7423
Turnover Volatility	0.0470	0.0521	0.4872	0.6923	0.1282	0.3077	0.0191	1.2427
Bank Index Return	0.0229	0.0249	0.0000	0.7179	0.0256	0.2821	0.0206	2.1694
Short Rate	-0.0003	-0.0016	0.2564	0.4872	0.2051	0.5128	0.0014	0.2603
M/B	0.2043	0.2169	0.7436	0.8462	0.0513	0.1538	0.1655	5.5242
AR(1)	0.5210	0.5339	0.8462	0.9744	0.0000	0.0256	0.5770	12.1715
Avg. Adj. R^2	0.4763	0.5019					0.4349	
Panel B: Developed Markets								
Market Return	0.0470	0.0642	0.1579	0.6842	0.0000	0.3158	0.0974	4.9502
Market Volatility	-0.0184	-0.0139	0.0526	0.1053	0.5263	0.8947	-0.0190	-4.3052
Market Turnover	-0.0194	-0.0225	0.0000	0.4211	0.0526	0.5789	0.0241	0.5622
Turnover Volatility	0.1105	0.1181	0.6316	0.7895	0.0526	0.2105	0.0934	4.2622
Bank Index Return	0.0261	0.0249	0.0000	0.7368	0.0526	0.2632	-0.0006	-0.0656
Short Rate	0.0176	0.0181	0.3684	0.6316	0.1579	0.3684	0.0066	0.4229
M/B	0.2334	0.2569	0.7895	0.8947	0.0526	0.1053	0.1527	4.4694
AR(1)	0.5176	0.4385	0.8947	1.0000	0.0000	0.0000	0.7236	14.5826
Avg. Adj. R^2	0.4788	0.4341					0.643	
Panel C: Emerging Markets								
Market Return	0.0427	0.0442	0.2000	0.8500	0.0000	0.1500	0.0633	4.5416
Market Volatility	-0.0053	-0.0052	0.0000	0.3000	0.2000	0.7000	-0.0046	-1.4646
Market Turnover	0.0063	-0.0047	0.0500	0.4500	0.0000	0.5500	-0.0253	-0.9433
Turnover Volatility	-0.0045	0.0102	0.4500	0.5000	0.2500	0.5000	0.0008	0.0599
Bank Index Return	0.0196	0.0179	0.0000	0.6500	0.0000	0.3500	0.0069	0.7179
Short Rate	-0.02	-0.0017	0.1500	0.5000	0.2000	0.5000	0.0010	0.1876
M/B	0.2044	0.1287	0.5500	0.8500	0.0500	0.1500	0.1509	3.7278
AR(1)	0.6282	0.745	1.0000	1.0000	0.0000	0.0000	0.6969	12.0315
Avg. Adj. R^2	0.6064	0.7314					0.588	

Table 5.3: Liquidity Co-Exceedances Across Markets

This table reports the overall ratio of simultaneous negative liquidity exceedances during a particular week, across the markets within each of the two categories, Developed and Emerging, for the sample period from 01/1995 until 12/2008. A negative or "bottom tail" liquidity exceedance corresponds to 1 standard deviation (SD) drop below the mean value of liquidity in that specific market. A coexceedance of i for market j means that $x\%$ of liquidity exceedances for market j are observed jointly with other $i-1$ markets the same week. Coexceedances are reported for i=1, 2, …, 5 separately, and for i equal to six or more as "≥ 6". The first six columns report the joint exceedances of the filtered liquidity series obtained from market-by-market regressions as described in Equation (6), whereas the last six columns report the joint exceedances of the respective AR(1)- adjusted liquidity series.

Panel A: Developed Markets	**Filtered Liquidity Series**						**AR(1)-Adjusted Liquidity Series**					
	>=6	**5**	**4**	**3**	**2**	**1**	**>=6**	**5**	**4**	**3**	**2**	**1**
Austria	4.546	13.636	13.636	13.636	27.273	27.273	13.793	10.345	6.897	17.241	24.138	27.586
Belgium	1.869	4.673	7.477	13.084	26.168	46.729	4.854	6.796	6.796	17.476	19.418	44.660
Denmark	33.333	22.222	11.111	11.111	11.111	11.111	66.667	0.000	8.333	8.333	8.333	8.333
Finland	12.903	9.677	9.677	22.581	25.807	19.355	17.647	11.765	8.824	26.471	20.588	14.706
France	7.229	13.253	6.024	21.687	28.916	22.892	18.072	7.229	8.434	15.663	31.325	19.277
Germany	4.918	8.197	11.475	27.869	32.787	14.754	16.393	4.918	11.475	21.312	26.230	19.672
Italy	5.128	23.077	12.821	15.385	28.205	15.385	22.917	14.583	10.417	12.500	25.000	14.583
Netherlands	11.364	9.091	6.818	15.909	25.000	31.818	16.667	4.167	6.250	20.833	22.917	29.167
Norway	12.766	21.277	14.894	17.021	19.149	14.894	24.074	14.815	9.259	24.074	14.815	12.963
Spain	3.636	10.909	3.636	21.818	29.091	30.909	9.836	6.557	4.918	11.475	29.508	37.705
Sweden	17.241	24.138	10.345	20.690	20.690	6.897	31.035	20.690	13.793	13.793	13.793	6.897
Switzerland	0.000	0.000	0.000	0.000	0.000	100.000	0.000	0.000	0.000	0.000	0.000	100.000
U.K.	11.905	9.524	14.286	21.429	19.048	23.810	25.000	4.546	11.364	20.455	18.182	20.455
Australia	8.537	7.317	9.756	19.512	32.927	21.951	16.456	8.861	7.595	17.722	21.519	27.848
Hong Kong	6.122	16.327	6.122	18.367	26.531	26.531	23.077	13.462	5.769	15.385	21.154	21.154
Japan	5.970	5.970	8.955	17.910	31.343	29.851	14.706	8.824	7.353	16.177	19.118	33.824
New Zealand	5.128	7.692	5.128	15.385	33.333	33.333	7.500	10.000	10.000	17.500	25.000	30.000
Singapore	8.197	8.197	4.918	14.754	21.312	42.623	18.033	6.557	3.279	13.115	22.951	36.066
U.S.	3.571	0.000	3.571	17.857	17.857	57.143	3.125	0.000	0.000	18.750	21.875	56.250
Max	33.333	24.138	14.894	27.869	33.333	100.000	66.667	20.690	13.793	26.471	31.325	100.000

Table 5.3: continued

Panel B: Emerging Markets	Filtered Liquidity Series						AR(1)-Adjusted Liquidity Series					
	>=6	**5**	**4**	**3**	**2**	**1**	**>=6**	**5**	**4**	**3**	**2**	**1**
Greece	1.266	2.532	3.798	12.658	36.709	43.038	0.000	2.703	4.054	13.514	40.541	39.189
Poland	0.000	0.000	6.977	23.256	48.837	20.930	0.000	0.000	6.122	32.653	48.980	12.245
Portugal	1.887	0.000	7.547	13.208	39.623	37.736	0.000	3.636	1.818	14.546	40.000	40.000
Turkey	0.000	0.000	2.500	15.000	37.500	45.000	0.000	0.000	2.326	18.605	51.163	27.907
Hungary	0.000	0.000	0.000	22.222	22.222	55.556	0.000	0.000	0.000	0.000	62.500	37.500
Cyprus	1.449	1.449	1.449	11.594	43.478	40.580	0.000	0.000	1.389	15.278	38.889	44.444
Israel	0.000	0.000	5.882	26.471	38.235	29.412	0.000	0.000	7.317	14.634	51.220	26.829
China	0.000	0.000	0.000	11.765	70.588	17.647	0.000	0.000	0.000	21.739	56.522	21.739
India	0.000	1.539	4.615	24.615	35.385	33.846	0.000	0.000	5.970	20.896	34.328	38.806
Indonesia	0.000	2.083	2.083	25.000	29.167	41.667	0.000	0.000	0.000	30.909	34.546	34.546
Malaysia	3.448	3.448	3.448	6.897	41.379	41.379	0.000	6.452	3.226	6.452	32.258	51.613
Philippines	0.000	0.000	0.000	24.000	44.000	32.000	0.000	0.000	3.704	22.222	44.444	29.630
Korea	0.000	5.263	0.000	26.316	31.579	36.842	0.000	0.000	4.762	19.048	38.095	38.095
Taiwan	1.613	0.000	1.613	12.903	38.710	45.161	0.000	2.857	1.429	10.000	38.571	47.143
Thailand	3.030	6.061	15.152	24.242	33.333	18.182	0.000	5.882	11.765	26.471	38.235	17.647
Argentina	0.000	3.226	12.903	19.355	51.613	12.903	0.000	0.000	13.158	26.316	44.737	15.790
Brazil	0.000	0.000	2.632	23.684	42.105	31.579	0.000	0.000	2.326	32.558	34.884	30.233
Chile	0.000	0.000	0.000	16.667	25.000	58.333	0.000	0.000	0.000	8.333	33.333	58.333
Mexico	0.000	0.000	11.765	17.647	41.177	29.412	0.000	0.000	11.765	17.647	41.177	29.412
Peru	0.000	0.000	0.000	8.333	66.667	25.000	0.000	0.000	0.000	15.385	76.923	7.692
Max	3.448	6.061	15.152	26.471	70.588	58.333	0.000	6.452	13.158	32.653	76.923	58.333

Table 5.4: Liquidity Contagion Across Countries

This table presents results from regressions of market exceedances on the share of countries experiencing a liquidity exceedance the same week (*# Markets with LIQ.COEX.*) either in the same region, in one of the remaining regions, or in the category Global. The category Global consists of Australia, Japan, the U.K. and the U.S. When we compute the share of countries experiencing a liquidity exceedance within a region we exclude the country of reference (dependent variable) when it belongs in the same region. Estimation is performed in following two different estimation techniques, one that assumes a logistic distribution of the error term (*Logit*), and a second that assumes a complementary logarithmic cumulative distribution function, $F(x) = 1 - exp(-exp(x))$. Market exceedances are defined as drops of the filtered liquidity series 1SD below the sample mean. In every regression we include market and year fixed effects. Robust standard errors are reported in the parentheses. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

	Developed Europe		**Emerging Europe**		**Asia**		**Latin America**		**Global**	
	Logit	*Log-Log*	*Logit*	*Log-Log*	*Logit*	*Log-Log*	*Logit*	*Log-Log*	*Logit*	*Log-Log*
Panel A: Developed Europe										
Constant	-4.3099***	-4.2728***	-4.3026***	-4.2696***	-4.3142***	-4.2825***	-4.2521***	-4.2228***	-4.4088***	-4.3687***
	(0.3363)	(0.3270)	(0.3386)	(0.3295)	(0.3363)	(0.3273)	(0.3345)	(0.3259)	(0.3403)	(0.3306)
# Markets with LIQ.COEX.	0.0146***	0.0126***	0.0047	0.0043	0.0189***	0.0179***	-0.0041	-0.0040	0.0105***	0.0098***
	(0.0048)	(0.0043)	(0.0049)	(0.0045)	(0.0063)	(0.0058)	(0.0053)	(0.0048)	(0.0030)	(0.0028)
Chi-square test	464.4***	521.0***	459.9***	509.3***	460.6***	513.2***	460.3***	509.5***	477.4***	529.6***
#Observations	8,468	8,468	8,468	8,468	8,468	8,468	8,468	8,468	8,468	8,468
|Log-Likelihood|	1736	1738	1740	1741	1735	1737	1740	1742	1734	1736
Panel B: Emerging Europe										
Constant	-1.5940***	-1.7016***	-1.4411***	-1.5577***	-1.5847***	-1.6938***	-1.5761***	-1.6844***	-1.7512***	-1.8536***
	(0.2133)	(0.1961)	(0.2213)	(0.2036)	(0.2142)	(0.1969)	(0.2128)	(0.1956)	(0.2201)	(0.2028)
# Markets with LIQ.COEX.	0.0054	0.0052	-0.0148**	-0.0139**	0.0030	0.0033	-0.0003	-0.0002	0.0120***	0.0115***
	(0.0070)	(0.0066)	(0.0058)	(0.0055)	(0.0084)	(0.0081)	(0.0069)	(0.0065)	(0.0036)	(0.0033)
Chi-square test	164.5***	167.4***	169.9***	174.4***	164.9***	167.9***	164.7***	167.7***	175.4***	179.6***
#Observations	5,041	5,041	5,047	5,047	5,049	5,049	5,047	5,047	5,049	5,049
|Log-Likelihood|	1130	1130	1128	1128	1131	1131	1131	1131	1126	1126

Table 5.4: continued

Panel C: Asia										
Constant	-3.3692***	-3.3946***	-3.3465***	-3.3728***	-3.3271***	-3.3538***	-3.3204***	-3.3478***	-3.4418***	-3.4624***
	(0.2962)	(0.2879)	(0.3004)	(0.2921)	(0.2966)	(0.2885)	(0.2944)	(0.2864)	(0.2991)	(0.2904)
# Markets with LIQ.COEX	0.0182***	0.0174***	0.0022	0.0022	0.0017	0.0015	-0.0028	-0.0026	0.0083**	0.0079**
	(0.0063)	(0.0060)	(0.0056)	(0.0054)	(0.0062)	(0.0059)	(0.0068)	(0.0066)	(0.0033)	(0.0031)
Chi-square test	174.3***	177.8***	167.9***	170.5***	167.8***	170.4***	168.2***	170.8***	174.8***	178.2***
#Observations	7,886	7,886	7,902	7,902	7,900	7,900	7,900	7,900	7,902	7,902
|Log-Likelihood|	1607	1607	1625	1625	1623	1623	1623	1623	1622	1622
Panel D: Latin America										
Constant	-4.5768***	-4.5955***	-4.6049***	-4.6203***	-4.5764***	-4.5941***	-4.5991***	-4.6187***	-4.4747***	-4.4935***
	(1.0043)	(0.9998)	(1.0166)	(1.0104)	(1.0005)	(0.9961)	(1.0027)	(0.9981)	(0.9972)	(0.9928)
# Markets with LIQ.COEX	-0.0078	-0.0078	-0.0007	-0.0011	-0.0127	-0.0131	0.0120*	0.0113*	-0.0113	-0.0114
	(0.0125)	(0.0120)	(0.0108)	(0.0101)	(0.0147)	(0.0138)	(0.0068)	(0.0062)	(0.0087)	(0.0084)
Chi-square test	118.7***	124.9***	118.2***	123.9***	119.7***	125.6***	117.3***	124.3***	117.9***	123.9***
#Observations	3,147	3,147	3,149	3,149	3,149	3,149	3,146	3,146	3,149	3,149
|Log-Likelihood|	405.0	404.9	408.1	408.0	407.8	407.6	403.9	403.8	406.9	406.7

Table 5.5: Factor Decomposition of Liquidity Contagion

This table reports results of logistic regressions of liquidity exceedances on *market return*, *market volatility*, *market turnover*, *bank index return*, *short term (interest) rate*, and the *Market/Book* ratio. In the column "Total Region" regressors are computed as the equally weighted average of respective variables for all the markets within the same region, excluding the country of reference (dependent variable). In the column "Global", regressors are computed as the equally-weighted average of respective variables for Australia, Japan, U.K., and the U.S. In the column "Local Region/Global", the regressors corresponding to the same region are first orthogonalized on their "Global" counterparts. All regressions include market and year fixed effects. Standard errors are clustered at the market level. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

	All Markets			Developed Markets			Emerging Markets		
	Total Region	Global	Local Region / Global	Total Region	Global	Local Region / Global	Total Region	Global	Local Region / Global
Market Return (Own Region)	-0.0141		-0.0912	-0.1971		-0.0004	0.1722		0.0137
	(0.1685)		(0.2119)	(0.1872)		(0.2680)	(0.2735)		(0.3001)
Market Volatility (Own Region)	0.0413**		0.0277	0.0415		0.0317	-0.0079		-0.0141
	(0.0202)		(0.0266)	(0.0295)		(0.0383)	(0.0244)		(0.0321)
Market Turnover (Own Region)	-0.1318		-0.0662	0.0541		0.0923	-0.3220		-0.2834
	(0.3287)		(0.3080)	(0.6231)		(0.6255)	(0.4112)		(0.3687)
Bank Index Return (Own Region)	-0.1408		-0.1541	0.0049		-0.0976	-0.3307		-0.3219
	(0.1372)		(0.1524)	(0.1632)		(0.1971)	(0.2107)		(0.2231)
Short Rate (Own Region)	0.0952		0.1199	-0.1686		-0.1932	0.0473		0.0786
	(0.0843)		(0.0892)	(0.1403)		(0.1297)	(0.0981)		(0.1113)
Market/Book (Own Region)	-0.8159***		-0.6534*	-1.1759**		-1.2084**	-1.2360***		-1.1062**
	(0.2886)		(0.3336)	(0.4593)		(0.5582)	(0.3605)		(0.4296)
Market Return (Global)		-0.2920*	-0.1760		-0.3245**	-0.2948		-0.0148	0.0074
		(0.1657)	(0.1937)		(0.1446)	(0.1887)		(0.3007)	(0.3151)
Market Volatility (Global)		0.0475**	0.0047		0.0622	0.0164		0.0209	0.0116
		(0.0196)	(0.0343)		(0.0382)	(0.0594)		(0.0248)	(0.0333)
Market Turnover (Global)		0.0188	0.2331		0.0586	-0.4045		1.2494	1.0208
		(0.8252)	(0.7034)		(0.9509)	(0.9255)		(1.1035)	(1.0896)
Bank Index Return (Global)		0.0490	0.0447		0.1095	0.1411		-0.0716	-0.0548
		(0.0880)	(0.1135)		(0.1087)	(0.1317)		(0.1559)	(0.1680)
Short Rate (Global)		-0.0900	-0.2397		-0.0105	0.2020		-0.2941	-0.3154
		(0.1360)	(0.1978)		(0.2268)	(0.2428)		(0.2347)	(0.2788)
Market/Book (Global)		-1.1213***	-0.3714		-1.1770**	-0.1180		-0.8043**	-0.0199
		(0.2896)	(0.3194)		(0.5953)	(0.4569)		(0.3417)	(0.4026)

Table 5.5: continued

Constant	-3.1921***	-1.1809	-2.2969**	-1.7980***	-2.5126**	-5.3771***	-0.2045	1.0118	-0.6702
	(0.7515)	(0.7302)	(1.1242)	(0.6477)	(1.2203)	(1.4373)	(1.3454)	(1.1320)	(1.4939)
Market FEs	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***
Year FEs	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***
Chi2-test (Region)	31.93		15.25	105.9		24.55	25.53		24.57
p-value	0.0000		0.0184	0.0000		0.000414	0.000273		0.0004
Chi2-test (Global)		58.26	6.574		52.66	14.45		71.08	4.714
p-value		0.0000	0.3620		0.0000	0.0250		0.0000	0.5810
Observations	24,825	27,743	24,825	10,657	10,657	10,657	14,168	14,172	14,168
|Log-Likelihood|	4971	5737	4964	2226	2240	2224	2673	2710	2669

Table 5.6: Liquidity Contagion in the Cross-Section of Stocks

This table presents results of logistic regressions of liquidity exceedances constructed for each of the following categories of stocks, big-capitalization (***Big-Cap***), small-capitalization (***Small-Cap***), high-idiosyncratic volatility (***High-iVol***), low-idiosyncratic volatility (***Low-iVol***), high-information (***High-Info***), low-information (***Low-Info***), high-sentiment (***High-Sentiment***), low-sentiment (***Low-Sentiment***). The liquidity index of big(small)-capitalization stocks is constructed as the equally-weighted average liquidity of stocks that rank above (below) the median in terms of their market capitalization the previous year. The liquidity index of high(low)-idiosyncratic volatility stocks is constructed as the equally-weighted average liquidity of stocks that rank above (below) the median in terms of their idiosyncratic volatility (standard deviation of daily market-adjusted stock returns) the previous year. The liquidity index of high(low)-information stocks is constructed as the equally-weighted average liquidity of stocks that rank above (below) the median in terms of their information driven order flow the previous year. We follow Llorente at al. (2002) and construct a measure of information based trading by estimating the following time-series relation for each stock in our sample: $R_{i,d+1} = c_{0,i} + c_{1,i} \cdot R_{i,d} + c_{2,i} \cdot R_{i,d} \cdot TV_{i,d} + \varepsilon_{i,d+1}$, where $R_{i,d}$ is the daily stock return, and $TV_{i,d}$ is the (detrended) log turnover during day d, whereas the estimated coefficient $c_{2,i}$ is our measure for information-driven trading. The liquidity index of high(low)-sentiment stocks is constructed as the equally-weighted average liquidity of stocks that rank above (below) the median in terms of the predictability of sentiment over monthly returns the previous year. Sentiment is measured as the *GDP*-weighted closed-end fund discount for all the markets in our sample with available data. All regressions include market and year fixed effects. Robust standard errors are reported in the parentheses. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

	Big-Cap	***Small-Cap***	***High-iVol***	***Low-iVol***	***High-Info***	***Low-Info***	***High-Sentiment***	***Low-Sentiment***
Panel A: Own Region								
Constant	-3.5427***	-3.1056***	-3.1125***	-2.8409***	-3.4557***	-4.0248***	-3.6275***	-3.5245***
	(0.2012)	(0.1914)	(0.1908)	(0.1772)	(0.1955)	(0.2417)	(0.2187)	(0.2103)
# Markets with LIQ.COEX.	0.0222***	0.0194***	0.0203***	0.0297***	0.0203***	0.0157***	0.0138***	0.0161***
	(0.0023)	(0.0027)	(0.0026)	(0.0023)	(0.0023)	(0.0028)	(0.0027)	(0.0025)
Chi-square test	1717***	774.5***	771.7***	1286***	2025***	575.4***	774.9***	791.4***
#Observations	23,576	23,431	23,063	22,548	23,385	23,186	25,077	25,079
|Log-Likelihood|	6486	5154	5142	5697	6218	4915	5395	5869
Panel B: Global								
Constant	-3.1544***	-2.9732***	-3.0016***	-2.6590***	-3.3213***	-3.9208***	-3.6293***	-3.5529***
	(0.1891)	(0.1894)	(0.1889)	(0.1756)	(0.1946)	(0.2399)	(0.2193)	(0.2096)
# Markets with LIQ.COEX.	0.0134***	0.0090***	0.0141***	0.0160***	0.0126***	0.0086***	0.0063***	0.0091***
	(0.0013)	(0.0017)	(0.0016)	(0.0013)	(0.0013)	(0.0018)	(0.0017)	(0.0016)
Chi-square test	1922***	766.7***	820.5***	1317***	2045***	573.4***	755.2***	805.7***
#Observations	26,346	23,439	23,071	22,583	23,421	23,194	25,085	25,087
|Log-Likelihood|	7402	5166	5139	5720	6223	4919	5407	5880

Table 5.6: continued

Panel C: All Markets								
Constant	-3.5593***	-3.1204***	-3.1404***	-2.8744***	-3.4765***	-4.0371***	-3.6981***	-3.6359***
	(0.2013)	(0.1913)	(0.1902)	(0.1769)	(0.1965)	(0.2409)	(0.2202)	(0.2119)
# Markets with LIQ.COEX.(Own Region)	0.0205***	0.0181***	0.0182***	0.0273***	0.0179***	0.0143***	0.0128***	0.0148***
	(0.0023)	(0.0027)	(0.0026)	(0.0024)	(0.0023)	(0.0028)	(0.0027)	(0.0025)
# Markets with LIQ.COEX.(Global)	0.0095***	0.0078***	0.0128***	0.0146***	0.0116***	0.0076***	0.0055***	0.0083***
	(0.0015)	(0.0017)	(0.0016)	(0.0014)	(0.0014)	(0.0018)	(0.0018)	(0.0017)
Chi-square test	1741***	813.4***	850.6***	1372***	2058***	598.3***	791.3***	844.1***
#Observations	23,576	23,431	23,063	22,548	23,385	23,186	25,077	25,079
|Log-Likelihood|	6466	5144	5113	5646	6185	4907	5390	5857

Table 5.7: Determinants of Contagion

This table reports the results from logistic regressions of within-region liquidity exceedances on a number of factors, namely the *TED spread*, *Expected Volatility*, *Variance Premium*, *Prime Broker Returns*, *Prime Broker Volatility*, *World Rate*, and *Credit Spread*. The *TED spread* is computed as the difference between the daily 3-month LIBOR rate and the rate on the U.S. Treasury bill with the same maturity, averaged over a week. The *Volatility Forecast* is computed as the square root of the forecasted variance of the daily S&P 500 index return using GARCH(1,1) over a horizon of 21 days. The *Variance Premium* is computed as the weekly difference of the *Volatility Forecast* from the weekly value of the *VIX* index. *Prime Broker Returns* are computed as the equally-weighted average of 26 leading prime brokers that operate internationally, as described in section 2.1. *Prime Broker Volatility* is computed by estimating a GARCH(1,1) process on the daily *Prime Broker Return* series, and then averaged over a week. The w *World Rate* is computed as the *GDP-weighted* average of the short term interest rate for all the countries in our sample. The *Credit Spread* is computed as the difference between the yield of the US High-Yield Bond Index (BB-B) and that on U.S. Treasury bonds of comparable maturity. All regressions include market and year fixed effects. Robust standard errors are reported in the parentheses. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

	Developed Europe	***Emerging Europe***	***Asia***	***Latin America***	***Global***	***Joint-test [p-values]***
TED spread	-1.3583***	0.2601	-0.6556	4.6570**	1.4848*	24.4190
	(0.4647)	(0.6828)	(0.5381)	(2.2925)	(0.7703)	[0.0002]
Expected Volatility	0.0207	0.0238	0.0621*	-0.3107	0.0576	10.0083
	(0.0264)	(0.0353)	(0.0352)	(0.1991)	(0.0381)	[0.0750]
Variance Premium	0.1348***	0.0919	0.1004**	0.2446**	0.2055***	23.9680
	(0.0489)	(0.0665)	(0.0497)	(0.1034)	(0.0700)	[0.0002]
Prime Broker Returns	0.0340	0.1199	-0.1180	0.6036	0.0051	2.4595
	(0.1846)	(0.2069)	(0.1622)	(0.4800)	(0.1914)	[0.7826]
Prime Broker Volatility	0.4966***	0.1448	0.1054	2.0239**	0.0666	24.7711
	(0.1185)	(0.1854)	(0.2248)	(0.9014)	(0.2068)	[0.0002]
World Rate	-0.1811	-0.2523	0.3569	-0.0492	-0.1604	3.7410
	(0.2828)	(0.3105)	(0.2681)	(0.2658)	(0.2585)	[0.5873]
Credit Spread	0.3299	0.4211	0.1861	3.2597**	-0.2324	10.1122
	(0.2412)	(0.3879)	(0.2709)	(1.3228)	(0.3706)	[0.0721]
Year Fixed Effects	***yes***	***yes***	***yes***	***yes***	***yes***	
Market Fixed Effects	***yes***	***yes***	***yes***	***yes***	***yes***	
#Observations	738	738	738	738	738	
Pseudo-R^2	0.219	0.140	0.109	0.354	0.241	
Joint test stat.	31.83***	18.23**	22.57***	25.96***	31.98***	

Table 5.8: Determinants of Contagion in the Cross-Section of Stocks

This table reports the results from tobit regressions of liquidity exceedances across each of the following categories of stocks, big-capitalization (***Big-Cap***), small-capitalization (***Small-Cap***), high-idiosyncratic volatility (***High-iVol***), low-idiosyncratic volatility (***Low-iVol***), high-information (***High-Info***), low-information (***Low-Info***), high-sentiment (***High-Sentiment***), low-sentiment (***Low-Sentiment***) on a number of factors, namely the *TED spread*, *Expected Volatility*, *Variance Premium*, *Prime Broker Returns*, *Prime Broker Volatility*, *World Rate*, and *Credit Spread*. The liquidity index of big(small)-capitalization stocks is constructed as the equally-weighted average liquidity of stocks that rank above (below) the median in terms of their market capitalization the previous year. The liquidity index of high(low)-idiosyncratic volatility stocks is constructed as the equally-weighted average liquidity of stocks that rank above (below) the median in terms of their idiosyncratic volatility (standard deviation of daily market-adjusted stock returns) the previous year. The liquidity index of high(low)-information stocks is constructed as the equally-weighted average liquidity of stocks that rank above (below) the median in terms of their information driven order flow the previous year. We follow Llorente at al. (2002) and construct a measure of information based trading by estimating the following time-series relation for each stock in our sample: $R_{i,d+1} = c_{0,i} + c_{1,i} \cdot R_{i,d} + c_{2,i} \cdot R_{i,d} \cdot TV_{i,d} + \varepsilon_{i,d+1}$, where $R_{i,d}$ is the daily stock return, and $TV_{i,d}$ is the (detrended) log turnover during day d, whereas the estimated coefficient $c_{2,i}$ is our measure for information-driven trading. The liquidity index of high(low)-sentiment stocks is constructed as the equally-weighted average liquidity of stocks that rank above (below) the median in terms of the predictability of sentiment over monthly returns the previous year. Sentiment is measured as the *GDP*-weighted closed-end fund discount for all the markets in our sample with available data. The *TED spread* is computed as the difference between the daily 3-month LIBOR rate and the rate on the U.S. Treasury bill with the same maturity, averaged over a week. The *Volatility Forecast* is computed as the square root of the forecasted variance of the daily S&P 500 index return using GARCH(1,1) over a horizon of 21 days. The *Variance Premium* is computed computed as the weekly difference of the *Volatility Forecast* from the weekly value of the *VIX* index. *Prime Broker Returns* are computed as the equally-weighted average of 26 leading prime brokers that operate internationally, as described in section 2.1. *Prime Broker Volatility* is computed by estimating a GARCH(1,1) process on the daily *Prime Broker Return* series, and then averaged over a week. The w *World Rate* is computed as the *GDP-weighted* average of the short term interest rate for all the countries in our sample. The *Credit Spread* is computed as the difference between the yield of the US High-Yield Bond Index (BB-B) and that on U.S. Treasury bonds of comparable maturity. All regressions include market and year fixed effects. Robust standard errors are reported in the parentheses. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

	Big-Cap	***Small-Cap***	***High-iVol***	***Low-iVol***	***High-Info***	***Low-Info***	***High-Sentiment***	***Low-Sentiment***	***Joint-test [p-values]***
TED spread	-4.9270***	-3.7312***	-7.3622***	-4.4560***	-2.6127***	-3.4242***	-2.3848***	-1.1427	81.422
	(0.6703)	(0.9245)	(1.0155)	(1.2253)	(0.9662)	(0.9909)	(0.8757)	(0.8828)	0.0000
Expected Volatility	0.3052***	0.1865***	0.4745***	0.8290***	0.1900***	0.2145***	0.1816***	0.2758***	165.218
	(0.0499)	(0.0589)	(0.0662)	(0.0718)	(0.0571)	(0.0516)	(0.0584)	(0.0512)	0.0000
Variance Premium	0.3049***	0.2053**	0.4995***	0.7107***	0.3089***	0.2275**	0.2373***	0.4111***	65.416
	(0.0731)	(0.0842)	(0.0946)	(0.1120)	(0.0947)	(0.0886)	(0.0761)	(0.0965)	0.0000
Prime Broker Returns	-0.8667**	-0.0073	0.5781*	0.3153	-0.2518	-0.4807*	-0.0055	0.1994	20.967
	(0.3601)	(0.2852)	(0.3209)	(0.3687)	(0.3074)	(0.2869)	(0.2710)	(0.3052)	0.0210
Prime Broker Volatility	0.9992***	0.6536*	1.0445***	0.6861	1.0735***	0.5303*	0.7106**	0.0860	37.707
	(0.3095)	(0.3543)	(0.3471)	(0.4357)	(0.3262)	(0.2948)	(0.3169)	(0.3221)	0.0000

Table 5.8: continued

World Rate	0.7663***	1.1121	3.3740***	0.8860	0.2507	1.4089*	0.4439	-1.0231**	45.785
	(0.2169)	(0.9134)	(0.9033)	(1.0321)	(0.8392)	(0.8544)	(0.5127)	(0.4658)	0.0000
Credit Spread	1.1197***	0.9200	1.9903***	3.7334***	1.2458**	1.4565***	0.1900	-0.3059	49.152
	(0.1980)	(0.5735)	(0.5514)	(0.6804)	(0.5526)	(0.5167)	(0.4342)	(0.4195)	0.0000
Constant	-7.4824***	-8.3834	-25.9345***	-20.3664***	-5.8621	-13.4217**	-3.2889	9.7021**	
	(1.2770)	(6.8776)	(6.6527)	(7.7415)	(6.1485)	(6.4329)	(5.1174)	(4.3521)	
Year Fixed Effects	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	
Market Fixed Effects	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	***yes***	
#Observations	685	685	686	686	685	685	733	733	
McFadden-R^2	0.0899	0.0642	0.131	0.197	0.0812	0.0806	0.0603	0.0639	
Joint test stat.	56.10***	8.536***	40.64***	104.7***	18.32***	11.85***	8.172***	8.040***	

Table 5.9: Potential Contagion Mechanisms

This table reports the results from tobit regressions of liquidity exceedances across each of the following categories of markets, namely markets that receive above (below) median net equity flows the corresponding quarter, ***Above Median Net Flows*** (***Below Median Net Flows***), and markets that receive above (below) bank flows the corresponding quarter, ***Above Median Bank Flows*** (***Below Median Bank Flows***). Net equity flows are computed as the quarterly sum of monthly net purchases – purchases minus sales – of foreign equity by U.S. investors during each quarter, scaled by the *GDP* of the recipient country the respective year. Bank flows are computed as the quarterly change of aggregate holdings of U.S. banks in respective countries, scaled by the *GDP* of the recipient country the respective year. The list of regressors includes the *TED spread*, *Expected Volatility*, *Variance Premium*, *Prime Broker Returns*, *Prime Broker Volatility*, *World Rate*, and *Credit Spread*. The *TED spread* is computed as the difference between the daily 3-month LIBOR rate and the rate on the U.S. Treasury bill with the same maturity, averaged over a week. The *Volatility Forecast* is computed as the square root of the forecasted variance of the daily S&P 500 index return using GARCH(1,1) over a horizon of 21 days. The *Variance Premium* is computed computed as the weekly difference of the *Volatility Forecast* from the weekly value of the *VIX* index. *Prime Broker Returns* are computed as the equally-weighted average of 26 leading prime brokers that operate internationally, as described in section 2.1. *Prime Broker Volatility* is computed by estimating a GARCH(1,1) process on the daily *Prime Broker Return* series, and then averaged over a week. The w *World Rate* is computed as the *GDP-weighted* average of the short term interest rate for all the countries in our sample. The *Credit Spread* is computed as the difference between the yield of the US High-Yield Bond Index (BB-B) and that on U.S. Treasury bonds of comparable maturity. All regressions include market and year fixed effects. Robust standard errors are reported in the parentheses. Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

	Above Median Net Flows	***Below Median Net Flows***	***Above Median Bank Flows***	***Below Median Bank Flows***
TED spread	-0.0037	-0.0198*	-0.0269*	-0.0473***
	(0.0102)	(0.0101)	(0.0142)	(0.0136)
Volatility Forecast	0.0021***	0.0019**	0.0004	0.0021**
	(0.0007)	(0.0009)	(0.0009)	(0.0009)
Variance Premium	0.0057***	0.0009	0.0047***	0.0027**
	(0.0010)	(0.0011)	(0.0012)	(0.0013)
Prime Broker Returns	0.0059	-0.0033	0.0021	0.0009
	(0.0040)	(0.0049)	(0.0047)	(0.0052)
Prime Broker Volatility	0.0032	0.0054	0.0146***	0.0048
	(0.0036)	(0.0045)	(0.0047)	(0.0038)
World Rate	-0.0178***	0.0101	0.0174	0.0357**
	(0.0065)	(0.0065)	(0.0187)	(0.0158)
Credit Spread	-0.0014	0.0109**	0.0138	0.0235***
	(0.0053)	(0.0053)	(0.0091)	(0.0083)
Constant	0.1553**	-0.0846	-0.1105	-0.2264**
	(0.0610)	(0.0622)	(0.1026)	(0.0896)
Year Fixed Effects	***yes***	***yes***	***yes***	***yes***
Market Fixed Effects	***yes***	***yes***	***yes***	***yes***
# Observations	733	733	522	522
McFadden-R^2	0.124	0.234	0.168	0.264
Joint test stat.	8.072***	4.633***	5.146***	7.379***

Figure 5.1: Ratio of (Raw) Liquidity Co-Exceedances Across Markets

This figure displays the share (%) of markets experiencing a liquidity exceedance every week for each of the following categories, namely "*All Markets*", "*Developed Markets*", and "*Emerging Markets*". A liquidity exceedance occurs when the respective *AR(1)*-adjusted liquidity index of a market drops 1SD below its corresponding sample mean. For demonstration purposes, the time-series of coexceedances are smoothed using the Hodrick-Prescott filter ($\lambda = 100$).

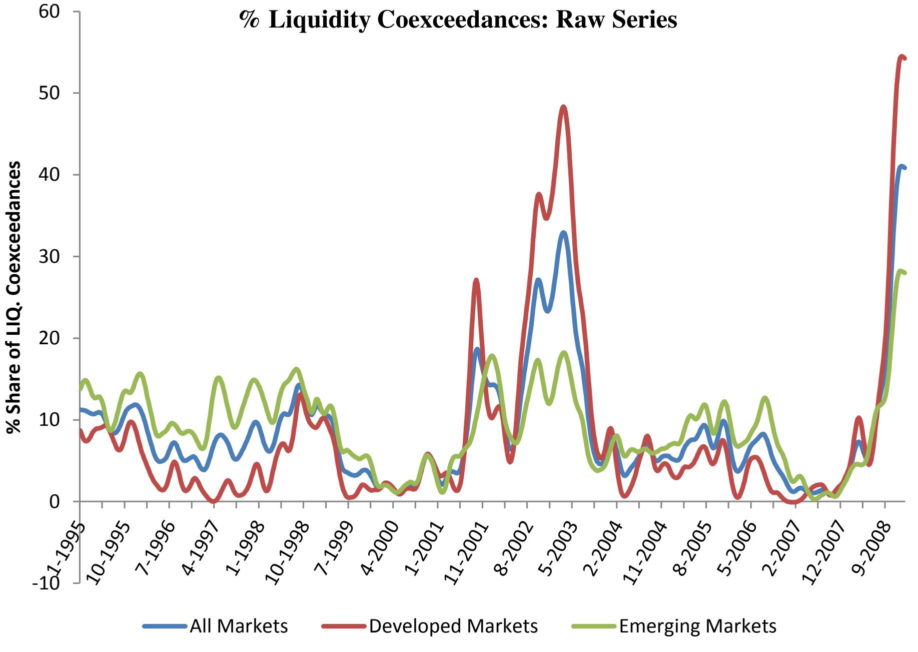
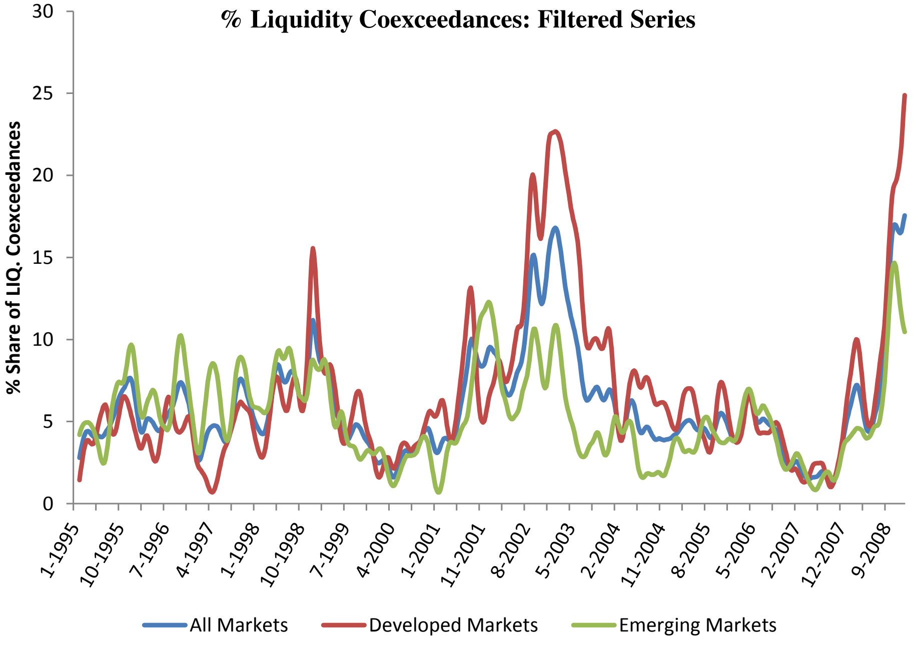


Figure 5.2: Ratio of (Filtered) Liquidity Co-Exceedances Across Markets

This figure displays the share (%) of markets experiencing a liquidity exceedance every week for each of the following categories, namely "*All Markets*", "*Developed Markets*", and "*Emerging Markets*". A liquidity exceedance occurs when the respective (filtered) liquidity index of a market drops 1SD below its corresponding sample mean. Filtering is performed at the market level by running the regression described in Equation (6). For demonstration purposes, the time-series of coexceedances are smoothed using the Hodrick-Prescott filter ($\lambda = 100$).



Chapter 6
Summary and Concluding Remarks

This dissertation consists of four empirical studies that seek to furnish a better understanding of liquidity's role in international capital markets going beyond the dimensions traditionally considered in the asset pricing literature. In Chapter 2 we investigate the impact of foreign equity flows on local liquidity conditions. Our baseline approach involves the estimation of unrestricted VAR models at different levels of aggregation. We also explore both the time-series properties as well as the differences in the cross-section of stocks over the interaction between their liquidity and foreign trading and try to identify periods of distinguishing importance in that respect. Our results confirm the belief that foreign investors engage in destabilizing strategies. Capital inflows strongly respond to past local market returns both for developed and emerging markets, for all six regions, and for many individual countries. We also confirm prior evidence that capital inflows are associated with higher future local market returns. Both of these effects are economically and statistically significant for many regions and countries. In addition, market liquidity seems to be an important determinant of cross-border portfolio flows, although this effect is more pronounced in our set of Developed countries. Our findings are robust across a large number of alternative specifications.

Finally, we try to explain the cross-sectional heterogeneity in the responsiveness of liquidity over foreign flows by running cross-sectional regressions on proxies for a country's economic and financial development, regulatory and information environment, openness, and market risk. We find that the response of liquidity to flows is significantly more positive in countries with greater transparency and in countries with less developed financial markets. The first effect suggests that in transparent countries it is less likely that foreign investors aggravate adverse selection problems on local financial markets. The second effect is consistent with the view that more developed financial markets are more resilient to the trading behavior of foreign investors.

In the third chapter we advance the view that security issuance is inversely related to illiquidity. Our analysis suggests that market liquidity plays an important role in the decision to perform an equity offering. After conducting an extensive battery of tests we conclude that our findings cannot be attributed to liquidity serving as a proxy for future economic growth or market sentiment. In further support of such an interpretation we show that the relation between equity issuance and liquidity is more pronounced during periods of low rather than high liquidity. We next take a step forward and investigate the potential relation between liquidity and the particular type of equity offering decided. Consistent with intuition we show that the fraction of private to public equity offerings increases as liquidity worsens. Our interpretation is that market liquidity is less relevant in the case of private equity offerings since they typically do not increase the supply of traded shares due to selling restrictions. We believe our findings lend further support to the view that in imperfectly liquid markets, the demand for shares is downward-sloping and that corporations take into account the slope of the demand curve for their shares in their financing decisions. Finally, we show that postponements and cancellations of equity offerings are also negatively related to liquidity innovations, which further supports our hypothesis that firms tend to postpone or cancel equity issues during times of deteriorating liquidity and decreasing valuations.

In Chapter 4, we document a positive relation between bank stock liquidity and market valuations. Our interpretation is that banks subject to more intense monitoring by equity markets are able to generate more value from their investments. Next, we decompose Tobin's Q into three components, namely a factor accounting for investor sentiment, another for leverage, and a proxy for operating profitability. We find that differences in liquidity do not generate variation in investor sentiment, but consistent with the market discipline interpretation, are significantly associated with profitability (positive) and leverage (negative). In further support of our hypothesis, we document that banks with higher stock liquidity operate closer to the efficient frontier, demonstrate lower credit risk, and have lower probability of default.

Finally, we try to shed more light on the particular mechanism through which the liquidity channel operates. An information-based interpretation would suggest that improved liquidity encourages the participation of informed investors in the price discovery process, thus rendering market monitoring more efficient. We investigate this explanation by creating portfolios of bank stocks differing over the extent of information-driven trading, but find no evidence of a positive relation with liquidity. Our empirical analysis is, however, more supportive of an agency-based interpretation. For example, when we distinguish banks' on the basis of their susceptibility to principal-agent type of conflicts we find that the liquidity effects is significantly more pronounced in the group that ranks higher in that respect. We also present evidence that the monitoring exerted by debt holders and depositors is significantly more effective in the case of banks with more liquid stock. This is reflected in the increasing responsiveness of deposit growth and debt costs to the risk-taking of banks that belong to the top-end of the liquidity spectrum.

In the last chapter I investigate the extent of clustering of adverse liquidity shocks within and across particular geographic regions. In addition, I try to assess the relative importance of different channels in explaining liquidity contagion both for the aggregate market as well as across subsets of the cross-section. My analysis produces a number of interesting results in that respect. First, I show that the likelihood of an adverse liquidity shock increases when other markets within the same region experience similar shocks. Moreover, I show that deteriorating liquidity conditions in systemically important markets exert, in certain cases, a disproportionate impact over foreign markets even after controlling for own region developments. When I try to identify the liquidity factors with the greatest explanatory power over the likelihood of a liquidity exceedance, investor sentiment combined with aggregate volatility stand out as the ones with the most pronounced effect. Interestingly, even though global aggregates are important in their own right, regional aggregates demonstrate a leading role when it comes to explain the extent of contagion in the same region.

Next, I investigate the extent of cross-sectional heterogeneity in the clustering of adverse liquidity shocks across markets based on a number of different stock characteristics. For this purpose I sort stocks on the basis of their market capitalization, idiosyncratic volatility, the extent of information-motivated order flow, and their sentiment induced overreaction. Contrary to initial expectations I show that liquidity contagion is actually more pronounced in "high" rather than "low quality" stocks. In other words, during periods of market distress liquidity drops are more correlated across stocks of "high quality". Consistent with previous studies (e.g. Brunnermeier, and Pedersen, 2009) my analysis demonstrates that commonality in liquidity becomes particularly pronounced in periods of deteriorating global funding conditions as well as downbeat investor sentiment. Finally, I also show that cross-border portfolio investment by international investors can aggravate the clustering of negative liquidity shocks across markets that benefit disproportionately from such flows.

Nederlandse samenvatting (Summary in Dutch)

Deze dissertatie bestaat uit vier empirische studies welke erop gericht zijn een diepgaander begrip van de rol die liquiditeit speelt in internationale kapitaalmarkten te bewerkstelligen dan dat tot op heden het geval is op basis van de traditionele dimensies in de asset pricing literatuur. In hoofdstuk 2 bestuderen wij de invloed van buitenlandse aandelenkapitaal stromen op de lokale liquiditeit condities. Onze basis benadering betreft het schatten van unrestricted VAR modellen op verschillende niveaus van aggregatie. We exploreren verder zowel tijdreeks eigenschappen als verschillen in de cross sectie van aandelen over de interactie tussen hun liquiditeit en buitenlandse handel en proberen met oog op dit kenmerk saillante periodes te identificeren. Onze resultaten bevestigen de gedachte dat buitenlandse investeerders destabiliserende strategieën toepassen. Kapitaal instromen reageren sterk op de in het verleden behaalde rendementen op de lokale markten voor zowel ontwikkelde en ontwikkelingslanden, voor alle zes regionen, en voor vele individuele landen. Wij bevestigen tevens het in het verleden gevonden bewijs dat kapitaal instromen met hogere toekomstige rendementen op lokale markten geassocieerd zijn. Beide deze effecten zijn zowel economisch als statistisch significant voor vele regionen en landen. Verder lijkt markt liquiditeit een belangrijke determinant van portfolio stromen over landsgrenzen te zijn, hoewel dit effect meer aanwezig is in de set van ontwikkelde landen. Onze bevindingen zijn robuust voor vele alternatieve specificaties.

Tot slot beogen wij de cross-sectionele heterogeniteit in de responsiviteit van liquiditeit over buitenlandse kapitaalstromen te verklaren door cross-sectionele regressies uit te voeren op proxies voor de economische en financiële ontwikkelingen van een land, de juridische en informatie omgeving, openheid, en markt risico. We vinden dat de reactie van liquiditeit op kapitaalstromen significant meer positief is in landen met een hogere mate van transparantie en in landen met minder ontwikkelde financiële markten. Het eerstgenoemde effect suggereert dat in landen met hoge mate van transparantie het minder waarschijnlijk is dat buitenlandse investeerders adverse selection problemen op de lokale financiële markten verergeren. Het tweede effect is consistent met het beeld dat meer ontwikkelde financiële markten weerbaarder zijn tegen het handel gedrag van buitenlandse investeerders.

In het derde hoofdstuk verdedigen wij het idee dat het uitgeven van waardepapieren omgekeerd evenredig is met illiquiditeit. Onze analyse suggereert dat markt liquiditeit een belangrijke rol spelt in de beslissing om aandelenkapitaal uit te geven. Na het uitvoeren van een scala aan testen concluderen wij dat onze bevindingen niet toe te wijzen zijn aan het fungeren van liquiditeit als een proxy voor toekomstige economische groei of markt sentiment. In verdere ondersteuning van een dergelijke interpretatie tonen wij dat de relatie tussen het uitgeven van aandelenkapitaal en liquiditeit sterker aanwezig is in periodes van lage liquiditeit. Vervolgens onderzoeken wij de mogelijke relatie tussen liquiditeit en het specifieke type aandelenkapitaal uitgave. In lijn met onze beredenering laten wij zien de fractie van het uitgeven van privaat tot publiek aandelenkapitaal toeneemt naarmate liquiditeit afneemt. Onze interpretatie hiervan is dat markt liquiditeit minder relevant is in het geval van het uitgeven van privaat aandelenkapitaal daar private investeerders doorgaans het aanbod van verhandelde aandelen niet doen toenemen gezien verkoop restricties. We zijn van mening dat onze bevindingen verder ondersteuning bieden aan het idee dat in imperfect liquide markten de vraag naar aandelen een neerwaartse richtingscoëfficiënt heeft en dat bedrijven de richtingscoëfficiënt van de vraag curve van hun aandelen in beschouwing nemen bij hun beslissingen. Tot slot laten wij zien dat zowel het uitstellen als het afstellen van het uitgeven van aandelen negatief gerelateerd zijn met liquiditeit innovaties, wat verdere ondersteuning biedt voor onze hypothese dat bedrijven geneigd zijn het uitgeven van aandelen uit- of af te stellen gedurende periodes van afnemende liquiditeit en waarderingen.

In hoofdstuk 4 tonen wij een positieve relatie tussen de liquiditeit van bank aandelen en markt waarderingen. Onze interpretatie hiervan is dat banken die aan meer intense monitoring door aandelenmarkten onderhevig zijn, in staat zijn meer waarde uit hun investeringen te genereren. Vervolgens splitsen wij Tobin’s Q in drie componenten, te weten een factor dat investeerder sentiment ondervangt, een tweede voor leverage, en een proxy voor operationele winstgevendheid. We vinden dat verschillen in liquiditeit geen variatie in investeerder sentiment genereren, maar, in lijn met de markt discipline interpretatie, wel significant geassocieerd zijn winstgevendheid (positief) en leverage (negatief). In verdere ondersteuning van onze hypothese laten wij zien dat banken met hogere aandelen liquiditeit dichter bij de efficient frontier opereren, lagere krediet risico's laten zien, en aan lagere faillissementskans onderhevig zijn.

Tot slot trachten wij verdere inzichten te genereren in het specifieke mechanisme waarlangs de liquiditeit haar invloed uitoefent. Een informatie-gebaseerde interpretatie zou suggereren dat verbeterde liquiditeit het deelnemen van geïnformeerde investeerders in het prijsontwikkeling proces bevordert, en zodoende markt monitoring tot meer efficiënt bekroont. We onderzoeken deze verklaring door portfolio's van bank aandelen te creëren welke verschillen in de mate van informatie gedreven handel, maar vinden geen bewijs voor een positieve relatie met liquiditeit. Onze empirische analyse ondersteunt echter meer een agency-gebaseerde interpretatie. Bijvoorbeeld, wanner wij banken onderscheiden op basis van hun ontvankelijkheid voor principal-agent conflicten, vinden wij dat de liquiditeit effecten significant meer aanwezig zijn in de groep dat hoger scoort op dat gebied. Ook tonen wij bewijs dat de monitoring uitgevoerd door vreemd vermogen verschaffers en spaarders significant meer effectief is in het geval van banken met meer liquide aandelen. Dit wordt tevens gereflecteerd in de toenemende responsiviteit van deposito groei en vreemd vermogen kosten tot het risico nemend gedrag van banken die tot de top van het liquiditeit spectrum behoren.

In het laatste hoofdstuk onderzoek ik de mate van het clusteren van ongunstige liquiditeit schokken binnen en over specifieke geografische regio's. Verder probeer ik het relatieve belang van verschillende kanalen ter verklaring van liquiditeit contagion voor zowel de gehele markt als over delen van de cross sectie te beoordelen. Mijn analyse genereert enkele interessante bevindingen. Allereerst laat ik ziek dat het kans voor een ongunstige liquiditeit schok toeneemt wanneer andere markten binnen dezelfde regio een soortgelijke schok ondervinden. Verder toon ik dat verslechterende liquiditeit condities in systematisch belangrijke markten, in sommige gevallen, een buitenproportioneel grote invloed op buitenlandse markten uitoefenen, zelfs wanneer gecontroleerd wordt voor ontwikkelingen binnen de eigen regio. Bij de pogingen tot het identificeren van de liquiditeit factoren die de grootste verklarende kracht hebben aangaande de waarschijnlijkheid van een liquiditeit overschrijding blijken investeerder sentiment gecombineerd met totale volatiliteit het meest sterke effect te tonen. Een andere interessante bevinding is dat ondanks dat wereldwijde sommen op zich staand belangrijk zijn, regionale sommen een leidende rol op zich nemen daar waar het op het verklaren van de mate van contagion in de regio aankomt.

Vervolgens onderzoek ik de mate van cross-sectionele heterogeniteit in het clusteren van ongunstige liquiditeit schokken over markten gebaseerd op een aantal verschillende aandelen karakteristieken. Hiertoe sorteer ik aandelen op basis van hun markt kapitalisatie, idiosyncratische volatiliteit, de mate van informatie gemotiveerder order flow, en hun sentiment geïnduceerde overreactie. In tegenstelling tot de initiele verwachtingen laat ik zien dast liquiditeit contagion meer aanwezig is in ‘hoge’ kwaliteit aandelen. In andere bewoordingen, gedurende periodes van markt distress zijn liquiditeit dalingen meer gecorreleerd over aandelen van ‘hoge’ kwaliteit. In lijn met eerdere studies (e.g. Brunnermeier en Pedersen, 2009) tonen mij analyses dat commonality in liquiditeit buitengewoon sterk wordt in periodes van verslechterende wereldwijde financiering condities, alsook in tijden van sobere investeerder sentiment. Tot slot toon ik dat portfolio investeringen door internationale investeerders over landsgrenzen het clusteren van negatieve liquiditeit schokken over verschillende market kunnen verergeren, wie tevens buitenproportioneel hun voordeel doen met dergelijke stromen.

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Biography

Dimitris Vagias obtained his first degree in Electrical and Computer Engineering from the National Technical University of Athens (NTUA). Following the completion of his undergraduate studies (2005), he went to the U.S. to puruse graduate training and in 2008 he was awarded a Master of Science in Electrical Engineering from Columbia University (NY). In September 2008 he joined the Department of Finance of the Rotterdam School of Managmenent (RSM, Erasmus University) as a PhD candidate. His main research interests are in the areas of international finance and empirical asset pricing, but also extend to banking and financial intermediation, financial decisions and capital structure, macroeconomics, and fixed income asset pricing. During his PhD studies, Dimitris has followed courses in several leading academic institutions including the University of Chicago, the Gerzensee study center, the Barcelona Graduate School of Economics (GSE), and the CEMFI institute. In addition, he was able to present his work at several international conferences such as the EFA, the FMA Applied Finance Conference, the Infiniti Conference, the Multinational Finance Society meetings, the Global Finance Conference, the Erasmus Liquidity Conference, and the 10th Corporate Finance Day at Ghent. Dimitris has also presented his work in the internal seminars of the International Policy Analysis Division of the ECB, and of the Research Division in the BoSpain. While pursuing his PhD, Dimitris has been involved in thesis supervision at both graduate and undergraduate level as well as in the teaching of several Finance related courses. Starting from September 2013 Dimitris will be working at the ECB.

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LIQUIDITY, INVESTORS AND INTERNATIONAL CAPITAL MARKETS

This dissertation consists of four empirical studies that seek to furnish a better understanding over liquidity's broader implications in the decision-making process of investors, managers and regulators in international capital markets. Chapter 2 investigates the time-series as well as cross-sectional properties of the interaction between foreign equity flows and local liquidity conditions. My findings suggest that foreign investors are less likely to aggravate adverse selection problems in financial markets that are more developed and demonstrate higher levels of transparency. Chapter 3 shows that liquidity conditions play an important role in the decision to perform an equity offering. Moreover, my findings suggest that in imperfectly liquid markets, companies take into consideration the slope of the demand curve for their stock when deciding upon the type of an equity offering. Chapter 4 shows that banks subject to more intense monitoring by equity markets operate closer to the efficient frontier and are thus able to generate more value from their investments. It also shows that the liquidity effects is significantly more pronounced in the case of banks that are more susceptible to principal-agent type of conflicts. Chapter 5 investigates the extent of clustering of adverse liquidity shocks within and across particular geographic regions. I document that liquidity contagion is more pronounced in "high" rather than "low quality" stocks. Finally, I show that cross-border portfolio investment can aggravate the clustering of negative liquidity shocks across markets that benefit disproportionately from such flows.

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