Risk Perceptions and International Stock Market Liquidity

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Abstract

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JEL Classification Codes: G15, G18
Keywords: liquidity, international stock markets, risk perception, VIX

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Risk Perceptions and International Stock Market Liquidity

Abstract

We show, using data for 57 countries over the 1990–2015 period, that investors' risk perceptions are an important determinant of international stock market liquidity. Increased risk perception reduces liquidity around the world, and its impact is not subsumed by other well-documented market-level determinants of liquidity. The effect is pervasive, but is stronger in countries with higher GDP per capita, more trade openness, stronger governance, a more individualistic culture, and no short-selling constraints. It is not driven by periods of extreme changes in risk perception, expansionary or recessionary phases of the business cycle, or the way liquidity is measured.

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1. Introduction

We investigate the impact of investor risk perception on international equity market liquidity. Chung and Chuwonganant (2014) show uncertainty is an important determinant of stock liquidity in the US. However, little is known about a) its impact in international markets where liquidity is affected by many country-level factors,[1] or b) how country-level factors influence the liquidity–uncertainty relation. We consider both these issues.

Our results indicate the influence of investor risk perception on liquidity is both statistically significant and economically meaningful in global markets after controlling for other well-documented market-level determinants of liquidity. The risk perception–liquidity relation is more pronounced in countries with higher GDP per capita, more trade openness, stronger governance, and no short-selling constraints. This is consistent with papers that show that development (e.g., Claessens, Klingebiel, and Schmukler, 2006), trade (e.g., Lim and Kim, 2011; Rizova, 2013), governance (e.g., Marshall, Nguyen, Nguyen, and Visaltanachoti, 2016), and frictions such as short-selling constraints (e.g., Bris, Goetzmann, and Zhu, 2007) impact investor trading activity and the speed at which information is impounded in international markets. Consistent with Hsee and Weber (1999) and Statman (2008), who suggest people in countries with a more individualistic culture have a lower propensity to take risk than people in more collectivistic countries, we show heightened risk perception exerts a stronger impact on liquidity in more individualistic countries.

[1] These include level of market development (e.g., Claessens, Klingebiel, and Schmukler, 2006), degree of market integration with world markets (e.g., Bekaert, Harvey, and Lumsdaine, 2002), existence of market makers (e.g., Anand, Tanggaard, and Weaver, 2009) and short-selling constraints (e.g., Beber and Pagano, 2013), legal and governance environment (e.g., Lin, Massa, and Zhang, 2014), market size (e.g., Cumming, Johan, and Li, 2011), foreign investor ownership (e.g., Ng, Wu, Yu, and Zhang, 2016), and macroeconomic variables (e.g., Bernile, Korniotis, and Wang, 2015).

We follow Chung and Chuwonganant (2014) and use the Chicago Board Options Exchange Market Volatility Index (VIX), which measures the implied volatility of S&P 500 Index options and is commonly used as a measure of investors' perceived risk in the literature (e.g., Kaplanski and Levy, 2010). Nagel (2012) shows expected returns from providing liquidity increase with VIX, and Graham and Harvey (2010) find that the equity risk premium is correlated with VIX. There is also widespread evidence that VIX is a good measure of risk perception in global markets. The International Monetary Fund (2004), Ciarlone, Piselli, and Trebeschi (2009), and Longstaff, Pan, Pedersen, and Singleton (2010) find a strong relation between VIX and sovereign bond credit spreads in developed and emerging economies, while Sari, Soytas, and Hacihasanoglu (2011), for example, use VIX to measure global risk perception. While VIX-like measures have been developed for some international markets in more recent times, these are highly correlated with VIX. Therefore, we use VIX in our core analysis due to its longer time series and the fact it allows us to include a greater sample of countries. However, we find our results still hold when these international VIX series are used.[2]

Our results are consistent and robust. We find that a 1% increase in investor risk perception in a given month leads to, on average, a 0.68% (0.80%) increase in the value-weighted (equal-weighted) Amihud (2002) ratio and a 0.40% (0.30%) increase in the value-weighted (equal-weighted) closing percent quoted spread of Chung and Zhang (2014) for global stock markets. Moreover, there is no evidence of reverse causality. While stronger in the more recent period, these effects persist throughout the sample period, and are evident in both expansionary and recessionary phases of the business cycle. They are robust to alternative ways of measuring market liquidity,

[2] We also find US VIX is highly correlated with credit spreads in a range of international markets for the period of our study.

alternative data frequencies (monthly and daily liquidity), the choice of univariate or multivariate model specification, and are not driven by extreme changes in risk perception.

These results contribute to several strands of the literature. Prior studies on VIX and liquidity are largely US-centric (e.g., Bao, Pan, and Wang, 2011; Nagel, 2012). We contribute to this work by investigating the relation between VIX and market liquidity on a global level using 45,564 stocks in 57 countries over the 1990–2015 period. Our paper relates to the recent evidence of Chung and Chuwonganant (2014), who find the impact of VIX on stock liquidity is stronger than all other well-known determinants of stock liquidity using US data. Our study differs from their work in a number of important ways. First, while Chung and Chuwonganant (2014) focus on the liquidity of individual stocks, we examine the link between VIX and aggregate market liquidity. As Chordia, Roll, and Subrahmanyam (2001) note, aggregate market liquidity differs from individual stock liquidity, with Jun, Marathe, and Shawky (2003) pointing out market liquidity depends largely on factors that are systemic to a given economy, while stock liquidity is affected by many individual security characteristics. Second, we use an international setting and generate evidence on how the impact of VIX varies across various legal, economic, and political environments, which has implications for regulators and policy makers focusing on stabilizing market liquidity. Third, Chung and Chuwonganant (2014) use a 2007–2009 sample period for their core results. It is therefore interesting to explore whether and to what extent the impact of VIX exists during non-crisis periods. Using the longer sample period enables us to assess the impact of VIX through time and in different business cycle phases.

We add to the research on the factors affecting market liquidity level in international markets. For example, Jain (2003) investigates the impact of institutional features on stock liquidity in 51 stock exchanges. Jain (2005) shows, based on a sample of 120 countries, that

automation of trading systems reduces cost of capital due to improved market liquidity. Using data on emerging markets, Lesmond (2005) finds higher liquidity in countries with better legal and political environments. Cumming and Li (2011) show specific exchange trading rules provide more market liquidity than broadly framed rules. Beber and Pagano (2013) find short-selling bans around the 2007–09 crisis period are associated with lower liquidity in 30 countries. We examine the effects on market liquidity of various country-level factors, such as market development, market integration, foreign institutional ownership, governance environments, short-selling constraints, the existence of market makers, macroeconomic instability, and foreign exchange rates. To our knowledge, we are the first to include all these well-known determinants of market liquidity.

As well as investigating the impact of country-level factors on liquidity, we document how these factors influence the link between risk perception and liquidity. Chung and Chuwonganant (2014) exploit time-series regulatory changes in the US and show market structure is an important determinant of how VIX affects liquidity. We explore the cross-sectional determinants of the VIX–liquidity relation in a rich international setting, and show economic development, trade openness, the presence of short-selling constraints, and governance environments constitute key equity market and country variables affecting the VIX's influence on liquidity. Rieger, Wang, and Hens (2015) find cultural factors such as individualism and uncertainty avoidance play an important role in shaping risk preferences. We therefore investigate whether cultural factors influence the risk perception–liquidity relation. We find market liquidity in countries high in the Hofstede (2001) individualism dimension is more sensitive to changes in VIX, which is consistent with the Hsee and Weber (1999) and Statman (2008), who find that people in more individualistic countries tolerate less risk.

The remainder of this paper proceeds as follows. Section 2 motivates our hypotheses of how country-level market attributes influence the risk perception-liquidity relation. Section 3 describes the data, sample selection procedures, and the liquidity and risk perception metrics. The core results are set forth in Section 4, and robustness checks are presented in Section 5. Finally, Section 6 describes our conclusions.

2. Hypotheses

In Chung and Chuwonganant (2014), market uncertainty reflected in VIX is an important determinant of stock liquidity in the United States, after controlling for other common determinants of liquidity. As VIX has been widely used as a good indicator for global risk (e.g., Sari, Soytas, and Hacihasanoglu, 2011; Mayordomo, Rodriguez-Moreno, and Pena, 2014), we hypothesize that market liquidity in global markets is lower when investor risk perception, reflected in VIX, is higher. We test this hypothesis in Section 4.2.

While we use various country-level market attributes as controls for market-wide liquidity, our main focus is to test how these factors affect the risk perception-liquidity relation. We report these results in Section 4.4. Our hypotheses are motivated by the empirical evidence that institutional environments are important in determining how perceived information is impounded in financial markets (e.g., Bris, Goetzmann, and Zhu, 2007; Naghavi and Lau, 2014). We categorise our country-level factors as follows:

1. Market development. It has been established that stock market informational efficiency depends on the level of market development, as frictions in less developed markets result in insufficient (or the absence of) adjustment in response to a shock (e.g., Kim and Shamsuddin, 2008). We therefore expect a more pronounced risk perception-liquidity relation in more

developed markets. Our first development proxy is *DEV_MKT*, a dummy variable set to 1 for developed markets as per Griffin, Kelly, and Nardari (2010), and Griffin, Hirschey, and Kelly (2011). Our second proxy for country development is GDP per capita (*GDP_PER_CAP*).

2. Market integration. As Bali, Peng, Shen, and Tang (2013) point out, investor inattention and illiquidity are the two key factors that prevent information from being efficiently reflected in the market. Hooy and Lim (2013) provide evidence that stock markets which are more integrated with the world react to common information in a more timely manner. We therefore hypothesize that countries more integrated with, or less segmented from, world markets attract more investor attention and are more affected by international risk perceptions. Prior studies differentiate the effects of financial market openness and trade openness (e.g., Basu and Morey, 2005).[3] We therefore use both trade openness (*TRADE_OPENNESS*) and equity market segmentation (*SEGMENTATION*) as proxies for market integration. We compute *TRADE_OPENNESS* as the sum of exports and imports relative to GDP in a given year, and *SEGMENTATION* is calculated as per Bekaert, Harvey, Lundblad, and Siegel (2011).
3. Foreign ownership. Markets with a higher proportion of foreign institutional ownership are subject to greater exposure to global shocks (e.g., Amihud, Hameed, Kang, and Zhang, 2015). Moreover, foreign investors are skillful in processing market-wide information and facilitate the information diffusion in global markets (e.g., Bae, Ozoguz, Tan, and Wirjanto, 2012; He and Shen, 2014). As such, we expect that countries with a higher proportion of foreign institutional ownership are more sensitive to changes in risk perceptions, and have a stronger risk perception–liquidity relation. Our proxy for foreign institutional ownership (*INSTIT_OWNER*) is obtained from Ferreira and Matos (2008).

[3] For more discussion on the relation between trade openness and financial markets, see Basu and Morey (2005), Chinn and Ito (2006), Lim and Kim (2011), and Naghavi and Lau (2014).

4. Country governance. Naghavi and Lau (2014) find country governance plays an important role in determining informational efficiency of emerging financial markets. In Marshall, Nguyen, Nguyen, and Visaltanachoti (2016), countries with stronger governance respond more quickly to global innovations. Prior studies, such as Lee, Chung, and Yang (2016), show effective governance facilitates the disclosure of value-related information, increases arbitrage activities, and improves market efficiency accordingly. We therefore hypothesize that countries with stronger governance are more affected by changes in risk perceptions. We use *GOVERNANCE* as a proxy for country governance, which is measured as the average of the components of the Worldwide Governance Indicators (WGI) from Kaufmann, Kraay, and Mastruzzi (2010).
5. Short selling constraints and market makers. There is substantial evidence of short-selling constraints impeding the efficient processing of negative information (e.g., Bris, Goetzmann, and Zhu, 2007; Beber and Pagano, 2013). As noted in Chung and Chuwonganant (2014, p. 478), "a direct reflection of expected volatility in prices and quotes, without the filtering by market intermediaries, could increase the volatility of market liquidity." Thus, we expect investor risk perception to exert a greater negative impact on liquidity in markets without short-selling constraint and market makers. We use a time-varying proxy, *SHORT_SELLING*, set to 1 for the existence of short-selling constraints and zero otherwise, based on short-selling regulations in Charoenrook and Daouk (2005), and Jain, Jain, McInish, and McKenzie (2013). In addition, we use a dummy variable, *MKT_MAKER*, set to 1 for the presence of market makers and zero otherwise. We allow the market maker variables to vary over time, because a number of countries introduced market makers for stocks during the sample period.
6. Macroeconomic environments and market conditions. In Manconi, Massa, and Yasuda (2012), institutional investors prefer to liquidate their holdings of more liquid assets during crisis

periods, rather than sell illiquid assets at fire-sale prices. The finding of Manconi, Massa, and Yasuda (2012) is consistent with Scholes (2000), arguing that in response to an unfolding crisis, market participants liquidate the most liquid investments in their portfolios first, as transaction costs in these markets tend to be lower and trading volumes are larger. Thus, we posit that the risk perception-liquidity relation is stronger in countries with more favorable macroeconomic environments, larger market sizes, and higher stock trading volume.[4] Our first proxy for macroeconomic environments is GDP growth volatility (*GROWTH_VOLA*), as a proxy for macroeconomic instability. Moreover, we follow Karolyi, Lee, and van Dijk (2012) and include a proxy for foreign exchange rate changes (*EXCHANGE_RATE*), computed as percentage changes in the value of a country's local currency relative to special drawing rights (SDR).

7. Cultural factors. The literature also shows cultural factors are important in explaining differences in risk preferences or propensities for risk (e.g., Weber and Hsee, 1998; Statman, 2008). Using survey results from 53 countries, Rieger, Wang, and Hens (2015) find risk preferences depend not only on economic conditions, but also on cultural factors measured by two Hofstede (2001) dimensions: individualism and uncertainty avoidance. Societies with higher individualism are less tolerant to risk, while people from more collectivist countries are comfortable carrying more risk, as collectivistic societies provide greater downside protection than an individualistic society (e.g., Hsee and Weber, 1999; Statman, 2008). The uncertainty avoidance dimension captures the degree to which a society can tolerate uncertainty and ambiguity. Thus, we expect the risk perception–liquidity relation to be stronger in countries

[4] Chung and Chuwonganant (2014) also suggest that the spreads of high-priced stocks are more affected by market uncertainty because tick sizes are less binding for these stocks, which implies a positive coefficient on *MKT_PRICE* when the spread measure is used, but offer no clear prediction for the Amihud (2002) measure.

with higher scores on individualism (*INDIVIDUALISM*) and uncertainty avoidance (*UNCERT_AVOID*).

3. Data and measures of liquidity and risk perceptions

3.1 Sample construction

Our sample consists of 57 countries over the January 1990–April 2015 period. We include all countries from Griffin, Hirschey, and Kelly (2011) for which we can source data. We also include Luxembourg, South Korea, and Sri Lanka, because papers such as Griffin, Kelly, and Nardari (2010) and Lee (2011) include these countries.[5] Our sample includes 28 developed markets and 29 emerging markets, according to the classification by Griffin, Kelly, and Nardari (2010), and Griffin, Hirschey, and Kelly (2011). The start year is determined by the availability of VIX. While the VIX Index was introduced by the Chicago Board Options Exchange (CBOE) in 1993, it has been calculated back to January 1990. Daily VIX Index data are obtained from Thomson Reuters Datastream along with total return index (RI), stock prices (P and UP), shares outstanding (NOSH), trading volume (VO), closing bid price (PB) and ask price (PA) for all countries except for US stock bid and ask prices. US closing bid and ask prices are collected from the Centre for Research in Security Prices (CRSP) for the 1993–2014 period, as CRSP bid and ask prices are available only when a stock's closing price is missing for the 1990–1992 period.

Following Amihud, Hameed, Kang, and Zhang (2015), we obtain the above described data in US dollars to make our proxies and results comparable across countries, and apply the following

[5] Latvia and Slovakia are dropped from the initial 59 countries because they do not have valid monthly Amihud (2002) values to satisfy all the filters described in Section 3.2.

screens. We include only securities traded in local currency and identified as equity and primary quotes on the main exchange(s) in each country. We apply the Griffin, Kelly, and Nardari (2010) generic and country-specific name filters to eliminate non-common equity securities, such as preferred stocks, warrants, and real estate investment trusts (REITs), as their trading characteristics can differ from common shares. We use one major stock exchange in each country, except for China (Shanghai Stock Exchange and Shenzhen Stock Exchange), Japan (Osaka Securities Exchange and Tokyo Stock Exchange), and South Korea (Korea Stock Exchange and KOSDAQ).[6] For these three countries, we exclude stocks that are listed on both exchanges. We retain all dead stocks in the sample to avoid survivorship bias.

To handle data errors in Datastream, we follow Ince and Porter (2006), and set daily returns as missing if they are greater than 200%, or if $(1+r_{i,d})\times(1+r_{i,d-1})-1 \leq 50\%$, where $r_{i,d}$ is the return of stock i on day d and at least either $r_{i,d}$ or $r_{i,d-1}$ is greater than 100%. Monthly returns are also set as missing if they are above 500%, or they are above 300% and are reversed within the following month (i.e., if $(1+r_{i,t})\times(1+r_{i,t-1})-1 \leq 50\%$, where $r_{i,t}$ is the return of stock i in month t and at least either $r_{i,t}$ or $r_{i,t-1}$ is greater than 300%). Daily returns are calculated from the total RI of each stock, which controls for stock splits and dividends and is reported to the nearest hundredth. To avoid rounding errors, we set daily returns as missing if the total RI for either the previous day or the current day is less than 0.01. In addition, we set daily share trading volume as missing if it is larger than total shares outstanding. Daily dollar volume is set to missing if it is below 100 US dollars. Finally, we exclude non-trading days, defined as days on which more than 90% of stocks in a country have zero returns.

[6] For the US, we follow Karolyi, Lee, and van Dijk (2012) and only include stocks on NYSE, as the NASDAQ interdealer trading volume is double-counted and hence overstated (Atkins and Dyl, 1997).

3.2 Measuring liquidity

We follow Karolyi, Lee, and van Dijk (2012) and Amihud, Hameed, Kang, and Zhang (2015) in using the Amihud (2002) ratio as our first liquidity measure. Fong, Holden, and Trzcinka (2018) examine which low-frequency liquidity proxies are best for global research, and show that the Amihud (2002) measure is the best price impact proxy. The Amihud (2002) ratio for stock *i* in month *t* is estimated as follows:

$$Amihud_{i,t} = \frac{1}{N_{i,t}} \sum_{d=1}^{N_{i,t}} \frac{|r_{i,d,t}|}{vol_{i,d,t}} \quad (1)$$

where $N_{i,t}$ is the number of trading days with non-zero volume for stock *i* in month *t*, $|r_{i,d,t}|$ is the absolute value of return in US dollars for stock *i* on day *d* in month *t*, and $vol_{i,d,t}$ is trading volume in US dollars of stock *i* on day *d* in month *t*.

We require a minimum of 10 daily observations[7] to estimate the Amihud (2002) ratio of a stock in a given month. Similar to Amihud, Hameed, Kang, and Zhang (2015), we remove stock-month observations with a stock price at the end of the previous month in the top or bottom 1%, or a monthly Amihud (2002) ratio in the top 1% of the cross section within a country. A stock should also have data on the number of shares outstanding at the end of the previous month used

[7] This filter ensures that our monthly liquidity proxies are reliable and our results are not driven by extreme illiquid stocks and/or extreme illiquid periods. However, when we remove the filter requiring a minimum of 10 daily observations in a given month, our finding on the impact of VIX on liquidity becomes slightly stronger, as shown in Internet Appendix 1.

for value weighting. Finally, we drop any country-month with fewer than 10 stocks.[8] The final sample covers 45,564 unique stocks in 57 countries.

The closing percent quoted spread from Chung and Zhang (2014) is our second liquidity measure. According to Fong, Holden, and Trzcinka (2018), the closing percent quoted spread from Chung and Zhang (2014) is the best low-frequency spread proxy for global research that captures the percent-cost dimension of liquidity. The closing percent quoted spread (Spread) of stock *i* on day *d* is defined as per Equation (2):

$$Spread_{i,d} = \frac{Ask_{i,d} - Bid_{i,d}}{M_{i,d}} \tag{2}$$

where $Ask_{i,d}$ is the closing ask price of stock *i* on day *d*, $Bid_{i,d}$ is the closing bid price of stock *i* on day *d*, and $M_{i,d}$ is the mean of $Ask_{i,d}$ and $Bid_{i,d}$. We exclude negative spreads, and following Chung and Zhang (2014), we drop all closing percent quoted spreads that are greater than 50% of the quote midpoint. We construct monthly spreads by calculating monthly mean values for each stock for 56 countries, as we do not have valid spread data for Czech Republic.[9] We value weight and equal weight each stock's monthly liquidity on its market capitalization at the end of the previous month, and construct monthly aggregate market liquidity measures.

[8] For consistency, we apply the following filters to the spread measure: (1) we remove stock-month observations with a stock price at the end of the previous month in the top or bottom 1% of the cross section within a country; (2) a stock should have data on the number of shares outstanding at the end of the previous month, for value weighting; and (3) we exclude any country-month with fewer than 10 stocks.

[9] Recent studies using the same liquidity measures as ours include Chung and Chuwonganant (2018).

3.3 Measuring global risk perception

VIX measures implied volatility of S&P 500 Index options, and is known as the "fear index." We use VIX to proxy for international risk perceptions, which enables us to examine a longer time series and include a greater sample of countries. The use of VIX in an international setting is supported by the following reasons.

First, VIX is a leading investor risk perception indicator for international markets commonly used by financial institutions and academics (e.g., Coudert and Gex, 2008). Prior studies such as Bekaert, Hoerova, and Scheicher (2009) suggest that credit spreads "can serve as indicators of investors' risk attitude" (p. 21). The International Monetary Fund (2004), Ciarlone, Piselli, and Trebeschi (2009), and Longstaff, Pan, Pedersen, and Singleton (2010) find a strong relation between VIX and sovereign bond credit spreads in developed and emerging economies. Sari, Soytas, and Hacihasanoglu (2011) use VIX as a measure of global risk perception to assess its effect on oil prices. In Marshall, Nguyen, and Visaltannachoti (2015), the benefits of frontier market diversification are lower when VIX used as an international risk perception proxy is higher. Moreover, the European Central Bank (2007) includes VIX in their list of market-based risk appetite indicators. Pan and Singleton (2008) also suggest that "VIX is a key factor in investors' appetite for global 'event risk' in credit markets" (p. 2375).

Second, as shown in Panel A of Table 1, the VIX Index highly co-varies with international VIX indices. We calculate the monthly correlations between the US VIX and 17 international VIX indices; the average value of the correlations is as high as 0.91. While VIX measures have been developed for international markets in recent times, using the US VIX enables us to include more sample countries over a longer sample period.

Third, VIX is highly correlated with international credit spreads. Bond credit spreads are often used to proxy for perceived risk in international markets (e.g., Schuknecht, Hagen, and Wolswijk, 2009; Caceres and Unsal, 2013). In Panel B of Table 1, we show the correlations between US VIX and four series of corporate bond spreads (Asia emerging markets corporate bond spread; Latin America emerging markets corporate bond spread; Europe, Middle East, and Africa emerging markets corporate bond spread; and US Baa-Aaa corporate bond spread) are 0.72, 0.75, 0.69, and 0.72, respectively.

Before 2003, US VIX was measured based on S&P 100 Index option prices. We calculate the correlation between VIX and US credit spread (computed as the difference between the yields on Baa bonds and 10-year US treasuries) over two subperiods: 1990–2002 and 2003–2015. VIX co-varies with US credit spread in both periods, with correlations of 0.59 and 0.85, respectively. We conclude that VIX is an appropriate risk perception indicator before and after the change in the method for measuring VIX.

[Insert Table 1 Here]

4. Main results

4.1 Summary statistics and liquidity measure comparison

Table 2 presents summary statistics for 45,564 unique stocks, with 31,976 in 28 developed markets and 13,588 in 29 emerging markets over the period January 1990 to April 2015. Data start from 1990 for most developed countries, with the latest starting year of 2005 for Croatia.[10] The

[10] The first month from which the data reported in Table 2 are available is based on the Amihud (2002) measure. Spread data typically start later than the starting month indicated in Table 2.

number of unique stocks for each market is between 17 for Luxembourg and 4,067 for the US. Compared to emerging markets, developed markets on average have more stocks, higher GDP per capita, greater market capitalization, and lower market volatility and returns. The final two columns present the value-weighted Amihud (2002) and spread time-series means, and indicate that developed markets are generally more liquid.

[Insert Table 2 Here]

4.2 VIX and international market liquidity

This section investigates the influence of risk perception, reflected in VIX, on liquidity after controlling for other common determinants of market liquidity. We use an unbalanced data set of monthly data with standard errors clustered by country for our core results. We also run regressions with standard errors clustered both by country and month to check the presence of time effects, as suggested in Petersen (2009). The regression model is:

$$ILLIQUIDITY_{ct}=\alpha+\beta VIX_t+\gamma Controls+\varepsilon_{ct} \quad (3)$$

where *ILLIQUIDITY* is the log of one of four liquidity measures (the value- and equal-weighted Amihud (2002) and Spread) for country *c* in month *t*. VIX_t is the log of average VIX Index value in month *t*. We use monthly data for the most part, for two reasons. First, this represents the norm in recent international liquidity studies (e.g., Cumming, Johan, and Li, 2011; Karolyi, Lee, and van Dijk, 2012; Amihud, Hameed, Kang, and Zhang, 2015). Second, we use monthly data to avoid

problems with time zone and day-of-the-week effects. However, we also estimate Equation (3) using daily data as a check for robustness, as discussed in Section 5.4.[11]

Controls represents various explanatory variables, controlling for country and equity market characteristics. These include proxies for the level of country development, market integration, foreign investor ownership, presence of short-selling constraints and market makers, country governance environment, macroeconomic environments and market conditions. All our control variables are as defined in Table 3. The correlation matrix of the variables is presented in Panel A of Appendix 1.

[Insert Tables 3 and 4 Here]

Table 4 shows the estimation results of Equation (3). In each regression model, we include our key variable VIX and one control variable (as indicated in Column 1 of each row), given the relatively high correlations between some controls. However, we also run regressions on VIX and the combinations of the controls, which have pair-wise correlations lower than 0.50, as a check on robustness.[12] We find a strong link between VIX and all four measures of market liquidity after controlling for other well-documented determinants of market-level liquidity. Our finding is consistent with Brunnermeier and Pedersen (2009) and Nagel (2012), suggesting that liquidity decreases at times of high VIX when traders' funding liquidity is low and liquidity providers require higher returns. The average coefficient on VIX in Column 2 (Column 4) is 0.68 (0.80), suggesting that a 1% increase in international risk perception, as reflected in VIX, in month t on average leads to a 0.68% (0.80%) increase in the value- (equal-) weighted Amihud (2002)

[11] Our results hold when we include lag and lead VIX in Equation (3). However, leads and lags are more common to see in the liquidity commonality literature, in which daily data are used, to control for non-synchronous trading and to "capture any lagged adjustment in commonality" (Chordia, Roll, and Subrahmanyam, 2000, p. 10). Our regression results remain unchanged if we add a time trend to control the influence of the aggregate time trend.

[12] These results are shown in Internet Appendix 2. In addition, the impact of VIX is not subsumed when we include all control variables.

illiquidity ratio of a market during the same month. The average coefficient on VIX in Column 6 (Column 8) is 0.40 (0.30), showing a 1% increase in VIX is associated with a 0.40% (0.30%) increase in the value- (equal-) weighted spread of a given market in the same month.

To ensure the relation between global liquidity and risk perception is not driven by US market liquidity and VIX, we add two additional tests. First, we exclude the US market from our panel regressions, and regress non-US monthly market liquidity on US VIX. Second, we calculate a value-weighted average of 15 non-US implied volatility indices over the 2000–2015 period and regress the non-US monthly market liquidity on the value-weighted non-US global implied volatility. Our results, shown in Panel A of Table 5, indicate that the non-US results are slightly stronger than our main results (including the US market), and that the R^2 based on VIX alone is approximately 2%. Thus, we conclude that the relation between global volatility and global liquidity we document is not driven by the US market.

[Insert Table 5 Here]

It is possible that heightened world illiquidity leads to an increase in investors' perceived risk. To investigate the causal relation between VIX and world illiquidity, we measure world illiquidity as the global average of monthly value- and equal-weighted Amihud (2002) and spread values. In Figure 1, we depict the generalized impulse response functions for shocks in VIX and world illiquidity. A shock in VIX has a significantly positive and long lived impact on world illiquidity, while there is no VIX response to world illiquidity. Therefore, our results in Table 4 are not driven by reverse causality.

[Insert Figure 1 Here]

Moreover, it is reasonable to expect the influence of VIX to vary with the liquidity level of a market. We perform quantile regressions (with standard errors clustered by country) of the

market Amihud (2002) and spread values on VIX. Appendix 2 plots the quantile against the coefficient estimates of VIX and shows a consistent impact of VIX across quantiles of both liquidity measures except that the coefficient is relatively lower when the spread value is around its 0.9 quantile.

The coefficients on the controls in Columns 3, 5, 7, and 9 of Table 4 confirm the effects of various country-level factors on market (il)liquidity level, indicating that liquidity is, on average, higher in more developed and integrated markets, in markets that allow short selling and have market makers, and in markets with better investor protection, more favorable macroeconomic conditions, greater market capitalization, trading volume, and price level.

4.3 Impact of VIX on market liquidity by country

We document a strong link between VIX and global liquidity in Table 4. In this subsection, we assess whether and to what extent the impact of VIX on market liquidity varies across countries. We run the following time-series regression for each country:

$$ILLIQUIDITY_{c,t} = \alpha_c + \beta_{VIX,c} VIX_t + \varepsilon_{c,t} \quad (4)$$

where $ILLIQUIDITY_{c,t}$ is the log of one of four liquidity measures (the value- and equal-weighted Amihud (2002) and spread) for country c in month t. VIX_t is the log of average VIX Index value in month t. The estimated coefficient on VIX, $\beta_{VIX,c}$, from Equation (4) measures the percentage change in market liquidity in response to a 1% change in VIX (i.e., elasticity). Therefore, $\beta_{VIX,c}$ denotes the elasticity of market liquidity (with respect to VIX).

[Insert Table 6 Here]

Panel A of Table 6 reports elasticity of market liquidity ($\beta_{VIX,c}$) for developed markets. Of the 28 developed markets, 23 (82.14%) and 24 (85.71%) country $\beta_{VIX,c}$ are positive when the value- and equal-weighted Amihud (2002) are used, respectively, while 24 (85.71%) and 26 (92.86%) are positive for the value- and equal-weighted spread. Columns 2 and 4 show 21 (75.00%) developed markets have a significantly positive $\beta_{VIX,c}$ on the value-weighted Amihud (2002), and this number increases to 22 (78.57%) for the value-weighted spread. While a 1% increase in VIX in month t on average leads to a 0.58% (0.41%) increase in the value-weighted Amihud (2002) measure (Spread) in the same month, the percentage change in the value-weighted Amihud (2002) measure (Spread) in response to a 1% change in VIX ranges from -0.64% (-0.16%) to 1.73% (1.15%).

Turning to the equal-weighted results, we find VIX exerts a greater negative impact on the equal-weighted than on the value-weighted Amihud (2002), but a weaker impact on the equal-weighted spread measure compared to the value-weighted spread measure. This shows changes in risk perception have a greater effect on the price impact dimension of liquidity for small-cap firms. One potential explanation for the weaker influence on the equal-weighted spread is that small-cap firms have relatively low stock prices, and tick sizes are more likely to be binding constraints on spreads for small firms. Accordingly, spreads of small firms are less affected by changes in VIX than those of large firms. Another possible reason is that some exchanges have market makers / liquidity providers under obligation to maintain a pre-defined maximum price spread with a minimum order size, especially for smaller firms.[13] The emerging markets results in Panel B are

[13] For example, we are informed by the Istanbul Stock Exchange that their liquidity-providing program was developed with an aim to improve the liquidity of stocks with low traded values. See also http://www.nasdaqbaltic.com/en/products-services/trading-2/market-making-program/.

similar to the evidence for developed markets. We also replace US VIX with 16 international VIX indices and re-estimate the time-series regressions. The results are shown in Panel B of Table 5.

4.4 Market attributes and the impact of VIX

Using time-series regulatory changes in the US, Chung and Chuwonganant (2014) find market structure plays an important role in explaining how VIX affects stock liquidity. As discussed in Section 2, the main focus of our work is to investigate which cross-sectional country and equity market attributes influence the impact of VIX on market liquidity, by exploiting the variation in regulatory policies and institutional environments around the world. It is possible that some attributes influence liquidity differently through the investor risk perception channel than they do directly. For instance, countries that allow short selling might be more liquid on average. However, these countries may have a higher sensitivity of market liquidity to VIX due to short selling, resulting in concerns about risk being reflected in the market more readily. We use elasticity of market liquidity, $\beta_{VIX,c}$, from Equation (4) to measure the magnitude of the impact of VIX on liquidity and run cross-sectional regressions of $\beta_{VIX,c}$ on a number of market attributes, as per Equation (5):

$$\beta_{VIX,c}=\lambda_0+\lambda_1 Attributes_c+\varepsilon_c \quad (5)$$

where $Attributes_c$ represents the set of market attributes we examine, including all equity market and country variables examined in Equation (3) and two Hofstede (2001) cultural dimensions. For each country, we use the mean values of *GDP_PER_CAP*, *TRADE_OPENNESS*, *SEGMENTATION*, *GOVERNANCE*, *EXCHANGE_RATE*, *MKT_CAP*, *MKT_VOL*, and

MKT_PRICE during the entire sample period in the regressions. In addition, we set the short-selling dummy to 1 if a market has short-selling constraints for one month or more. We set the market maker dummy to 1 if a market has market makers for one month or more.[14] Panel B of Appendix 1 presents the correlation matrix of the country-level attribute variables.

[Insert Table 7 Here]

Table 7 presents the estimation results for Equation (5). In each regression model, we include one of our market attribute variables or cultural factors as the explanatory variable. Consistent with our hypothesis in Section 2 that market development strengthens the risk perception-liquidity relation, we show significantly positive coefficients on *GDP_PER_CAP* and *DEV_MKT* across the Amihud (2002) and spread measures. Our finding supports the notion that more developed markets impound information more efficiently (e.g., Kim and Shamsuddin, 2008).

Columns 3 and 4 show the effects of *TRADE_OPENNESS* on the value- and equal-weighted Amihud (2002) ratio, which reflects the price concession a trader must make to complete a transaction, is highly significant at the 1% level, indicating that the impact of VIX is significantly stronger in countries with greater trade openness. This finding is consistent with the significant negative coefficient on *SEGMENTATION*, which proxies for equity market segmentation, when the equal-weighted Amihud (2002) is used.[15] These results support the existing literature on the influence of trade openness on financial markets (e.g., Lim and Kim, 2011), and our hypothesis that countries more integrated with world markets attract more investor attention and are more affected by perceived risk reflected in VIX accordingly.

[14] We also compute the short selling variable as (Number of months with short-selling constraints)/(Total number of months) and the market maker variable as (Number of months with market makers)/(Total number of months). We then re-estimate our cross-sectional regressions using these alternative measures, and find similar results.

[15] As noted in Section 2, previous research differentiates the effects of financial market openness and trade openness, and suggests that trade openness is a prerequisite for a market to gain from financial market openness (e.g., Basu and Morey, 2005).

Whereas the coefficients on foreign institutional ownership (*INSTIT_OWNER*) are insignificant, we find significantly negative coefficients on country governance (*GOVERNANCE*), showing that the risk perception-liquidity relation is stronger in countries with better governance. The finding supports the idea in Lee, Chung, and Yang (2016), and Marshall, Nguyen, Nguyen, and Visaltanachoti (2016) that effective governance facilitates investor trading activities and increase informational efficiency in financial markets, and that countries with stronger governance react more quickly to global innovations.

Consistent with prior studies showing that short-selling constraints impede the process of negative information in financial markets (e.g., Bris, Goetzmann, and Zhu, 2013), we find significantly negative coefficients on our proxy for short-selling constraints (*SHORT_SELLING*) across the liquidity measures, indicating that the impact of risk perception is stronger in countries with no short-selling constraints. However, we find no significant influence of market makers and macroeconomic environments on the risk perception-liquidity relation.

The results in Columns 5 and 6 based on the spread measure show a significantly positive coefficient on *MKT_PRICE* (among our three proxies for market conditions), which is supportive of our expectation and the view in Chung and Chuwonganant (2014) that high-priced stocks are more sensitive to changes in VIX, since tick sizes are less likely to be binding constraints for these stocks. However, we find a negative sign on *MKT_PRICE* when the Amihud (2002) measure is used. Consistent with our hypotheses, we find that factors shown to improve market liquidity (e.g., GDP per capita and the practice of short selling) in Table 4 are associated with higher sensitivity of market liquidity to VIX, which implies greater liquidity volatility.

Turning to cultural factors, we find strong evidence across the Amihud (2002) and spread measures that the risk perception–liquidity relation is more pronounced in more individualistic

countries, consistent with the notion that a collectivistic society provides more downside protection than an individualistic society, and therefore can tolerate more risk (e.g., Hsee and Weber, 1999; Statman, 2008). However, we show no significant impact of uncertainty avoidance (*UNCERT_AVOID*) on the risk perception-liquidity relation.

5. Robustness checks

5.1 Impact of extreme VIX

In Cespa and Foucault (2014), illiquidity spillovers can be particularly strong when liquidity providers' risk tolerance approaches some critical value. We now investigate whether the impact of VIX we document is driven by extreme VIX values. We add interaction terms of VIX and extreme VIX dummies, and re-estimate the regression models contained in Table 4 as follows:

$$ILLIQUIDITY_{ct}=\alpha+\beta VIX_t+\beta_{HIGH}VIX_tD_{HIGH,t}+\beta_{LOW}VIX_tD_{LOW,t}+Controls+\varepsilon_{ct} \quad (6)$$

where $D_{HIGH,t}$ is a dummy variable set to 1 if VIX_t is more than 1.5 standard deviations above its mean, and $D_{LOW,t}$ is a dummy variable set to 1 if VIX_t is more than 1.5 standard deviations below its mean.[16] Other variables are as defined in Equation (3). Because our focus is to assess the effects of extreme VIX, we present only the coefficients on VIX and the interaction terms that show us the incremental effects of extreme high and low VIX on market liquidity. From this point on, for

[16] We follow Hameed, Kang, and Viswanathan (2010), and use 1.5 standard deviations to define extreme high and low VIX. If we use 2.0 standard deviations to define extreme VIX, we end with only 9 extreme high and 0 extreme low VIX values. We therefore use 1.5 standard deviations to define extreme VIX values, and the numbers of extreme high and low VIX are 24 and 8, respectively.

brevity, we report the results based on value-weighted liquidity measures in the tables. Our results hold when equal-weighted measures are used.

Table 8 presents a consistent and highly significant link between VIX and both liquidity measures. The significant coefficients on high and low VIX dummies in Columns 3 and 4 suggest the effect of a 1% increase in VIX on market liquidity rises significantly at times of high VIX and decreases significantly at times of low VIX, when the Amihud (2002) measure is used. We conclude the influence of VIX on the price impact dimension of liquidity is stronger when VIX is extremely high, and weaker when VIX is extremely low. However, Columns 6 and 7 show extreme VIX has insignificant incremental effects on the spread measure.

[Insert Table 8 Here]

5.2 Subperiod analysis on the impact of VIX

We initially split the sample into two subperiods (1990–2002 and 2003–2015), and investigate whether the link between VIX and international liquidity is unique to the second subperiod, which covers the Global Financial Crisis. Splitting on 2003 not only produces relatively similar subperiods of time, but it also reflects the period in which the VIX methodology was changed as discussed in Section 3.3. Figure 2 plots the VIX Index and the global average of the value-weighted Amihud (2002) values, and shows a strong co-movement between VIX and global liquidity measured by the Amihud (2002) values over the entire sample period. We re-estimate the regressions in Table 4 and report coefficients on VIX values for the two subperiods in Panel A of Table 9. The impact of VIX on the Amihud (2002) measure is present in both subperiods, with the impact being stronger in the more recent period, when the VIX Index is more volatile. However, while the effect of VIX on closing percent quoted spread is highly significant during the 2003–

2015 subperiod, the effect during the 1990–2002 subperiod is significant in only three models. This is likely due, at least in part, to the fewer country-month spread observations during the earlier subperiod. For example, spread data exist for only 37 countries in the earlier period. Another possible explanation is that, as VIX becomes more well-known, an increasing number of market participants adjust their positions according to uncertainty reflected in the readily available VIX. As such, both statistical significance and the economic magnitude of the effects of VIX are stronger in more recent times.

[Insert Figure 2 Here]

[Insert Table 9 Here]

We then conduct additional tests for the periods prior to the Global Financial Crisis (1990–2006), during the crisis (2007–2009), and after the crisis (2010–2015), separately. The results in Panel B of Table 9 show that the impact of VIX is highly statistically significant in all three subperiods, and is more economically significant during the crisis (2007–2009). This finding is consistent with Baele, Bekaert, Inghelbrecht and Wei (2015), which suggests that flight-to-safety episodes coincide with increases in VIX and decreases in liquidity.

5.3 Business cycle and the impact of VIX

We also investigate whether the impact of VIX on market liquidity is robust over different states of the business cycle. We add recession and expansion dummies to Equation (3) and estimate the following regression:

$$ILLIQUIDITY_{ct}=\alpha+\beta_{REC}VIX_tD_{REC,ct}+\beta_{EXP}VIX_tD_{EXP,ct}+Controls+\varepsilon_{ct} \quad (7)$$

where $D_{REC,ct}$ is a dummy variable set to 1 if the economy of country *c* is contracting in month *t*, and zero otherwise, and $D_{EXP,ct}$ is a dummy variable set to 1 if the economy is expanding, and zero otherwise. We obtain the business cycle peak and trough dates for 20 countries from the Economic Cycle Research Institute (ECRI).[17] The other variables are identical to those defined in Equation (3).

We re-estimate the regressions in Table 4. As shown in Panel C of Table 9, both β_{REC} and β_{EXP} are statistically significant in all models, and the magnitude of these estimated coefficients is comparable to the estimated coefficient on *VIX* in Table 4. Moreover, our results show a slightly higher influence of VIX on market liquidity in recessionary periods compared to expansionary periods.

5.4 Other robustness checks

Since both monthly and daily frequencies are of interest in the liquidity literature (e.g., Fong, Holden, and Trzcinka, 2018), we estimate Equation (3) using daily liquidity measures. Following Chung and Chuwonganant (2014), we regress daily liquidity measures on VIX values on days *t, t-1,* and *t+1,* and include the day-of-the-week dummies. We follow Lehkonen (2015) and address the issue of time zones by using one-day lagged data for Western Hemisphere countries. Our daily data results in Appendix 3 are consistent with the results based on monthly frequency. We also run our panel regressions with two-way clustered standard errors. Regression results with standard errors clustered by both country and time in Internet Appendix 3 are

[17] See https://www.businesscycle.com/. ECRI uses the same approach used to determine the NBER business cycle dates to determine international business cycles.

consistent with the main results in Table 4. Comparing the standard errors in Table 4 and Internet Appendix 3, we observe no time effect in the data.

Our results continue to hold when we replace US VIX with 16 international VIX indices (as reported in Internet Appendix 4).[18] The economic significance of the coefficients on VIX is higher when US VIX is replaced with the international VIX. This is likely driven by the fact that the 16 countries that have their local VIX are relatively more developed and open to world markets, given the evidence in Sections 4.3 and 4.4. Note also that there is a difference in the time periods of the US and local VIX results.

6. Conclusions

It is well established that uncertainty is an important determinant of liquidity in the US. However, the importance of uncertainty in international markets remains uninvestigated. We use VIX to proxy for risk perception internationally and examine its influence on market liquidity using 45,564 stocks in 57 countries.

We show the impact of VIX on international market liquidity is highly statistically significant and is not subsumed by other well-documented determinants of market liquidity. Further, it is economically meaningful. A 1% increase in VIX in a given month leads to a 0.68% (0.80%) increase in the value- (equal-) weighted Amihud (2002) illiquidity ratio and a 0.40% (0.30%) increase in the value- (equal-) weighted closing percent quoted spread of Chung and Zhang (2014) for a market in the same month. We find no evidence of reverse causality.

[18] The VSTOXX Volatility Index is based on the Euro Stoxx 50 Index and measures the implied volatility for European markets rather than an individual country.

We solve the question of which country-level factors exert a significant influence on the risk perception–liquidity relation. Our results indicate investor risk perception, as reflected in VIX, exerts a greater influence on market liquidity in more economically developed countries, and in countries with more trade openness, better governance environments, and no short-selling constraints. This is consistent with the view that more developed countries attract more international investors, incorporate information faster, and are, accordingly, likely to be more affected by changes in international risk perceptions. Moreover, we document a stronger risk perception–liquidity relation in more individualistic countries. Our findings are important in explaining why market liquidity in certain countries is more volatile than in others, and they have implications for policy makers focusing on stabilizing market liquidity.

We further show our core results are not driven by extreme VIX values, remain intact during the subperiods of our study, and in both expansionary and recessionary phases of the business cycle. Our results continue to hold when we replace monthly liquidity measures with daily liquidity measures. In addition, our results remain after replacing the US VIX with the international VIX indices for the 16 markets where this data is available.

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Table 1. Correlations with the US VIX

Panel A reports the start date of each international VIX index, and the monthly correlations between the US VIX index and the international indices. Panel B shows monthly correlations on international corporate bond spreads and the US VIX. We consider the US corporate bond spread and four regional corporate bond spreads based on the regional sub-indices of the BofA Merrill Lynch Emerging Markets Corporate Plus Index. We collect international VIX indices data from Datastream, and credit spread data from Bank of America Merrill Lynch via the Federal Reserve Bank of St. Louis.

Panel A: International VIX indices		
Index name	Start date	Correlation
FTSE 100 Volatility Index	2000-01-04	0.9612
Nikkei Stock Average Volatility Index	1998-01-05	0.8468
HSI Volatility Index	2010-07-16	0.9066
CAC 40 Volatility Index	2000-01-03	0.9222
VDAX-New Volatility Index	1992-01-02	0.8839
S&P/ASX Volatility Index	2008-01-02	0.9600
S&P/TSX 60 VIX Volatility Index	2010-10-18	0.9153
AEX Volatility Index	2000-01-03	0.9036
Vsmi Volatility Index	1999-01-04	0.9151
Vkospi Volatility Index	2009-04-13	0.9160
Sixvx Volatility Index	2004-05-07	0.9553
India Volatility Index	2008-03-03	0.8424
Mexico Volatility Index	2004-03-26	0.8548
RTS Volatility Index	2006-01-10	0.8163
South Africa Volatility Index	2007-02-01	0.9465
Belgium 20 Volatility Index 'Dead'	2000-01-03	0.9233
VSTOXX Volatility Index	1999-01-04	0.9210
Average		0.9053

Panel B: Regional corporate bond spreads		
Region	Start date	Correlation
Asia	1998-12-31	0.7167
Latin America	1998-12-31	0.7471
Europe, the Middle East, and Africa	1998-12-31	0.6922
US	1998-12-31	0.7156
Average		0.7179

Table 2. Summary statistics

This table presents summary statistics for 57 markets for the January 1990 to April 2015 period. The markets are divided into 28 developed markets and 29 emerging markets, following the classification of Griffin, Kelly, and Nardari (2010) and Griffin, Hirschey, and Kelly (2011). The first four columns present the first month from which the data are available, the number of months with valid observations, the number of unique stocks, and average GDP per capita for each market. The next three columns present average monthly market capitalization, market return, and market volatility (monthly standard deviation of market returns). The final two columns present the time-series means of monthly market liquidity measures. The market liquidity in a given month, measured by the Amihud (2002) ratio and the closing percent quoted spread from Chung and Zhang (2014), is value-weighted on market capitalization across individual stocks within a market.

Market	Starting month	No. of months	No. of unique stocks	GDP per capita (US$)	Market cap (000 US$)	Market return (%)	Market volatility (%)	Amihud VW	Spread VW
Panel A: Developed markets									
Australia	1990:01	304	2,799	32,548	549,119,145	0.9817	6.2380	0.0351	0.0079
Austria	1990:01	304	197	34,348	69,365,505	0.6046	6.6357	0.0143	0.0095
Belgium	1990:01	304	256	32,434	170,221,589	0.8020	5.4952	0.0052	0.0044
Canada	1990:01	304	2,435	31,704	742,453,062	0.9212	5.3221	0.0330	0.0048
Cyprus	1994:05	212	146	19,972	7,975,248	0.4500	13.4072	0.4688	0.0193
Denmark	1990:01	302	385	42,057	131,261,069	0.9863	5.3738	0.0199	0.0086
Finland	1990:05	293	223	34,062	148,505,717	1.1394	8.3087	0.0562	0.0119
France	1990:01	298	1,621	30,896	1,248,160,619	0.7481	5.6084	0.0093	0.0057
Germany	1990:01	304	1,306	32,611	1,001,833,904	0.7353	5.8520	0.0137	0.0063
Greece	1990:01	304	412	17,726	71,164,359	0.4953	10.7732	0.0885	0.0093
Hong Kong	1990:01	304	1,664	26,294	880,394,587	1.2482	7.4007	0.0139	0.0053
Ireland	2000:06	179	67	34,747	70,572,443	0.9910	11.1368	0.0317	0.0111
Israel	1993:02	267	786	21,446	65,247,686	0.6113	7.8138	0.2907	0.0083
Italy	1990:01	304	584	27,359	471,192,307	0.5776	6.9012	0.0035	0.0065
Japan	1990:01	304	3,584	35,644	3,414,457,606	0.2011	6.0181	0.0060	0.0042
Luxembourg	1999:03	15	17	67,389	13,364,021	0.0269	5.4732	0.0304	0.0383
Netherlands	1990:01	304	281	35,570	446,958,809	0.8840	5.5157	0.0055	0.0046
New Zealand	1990:01	304	263	22,161	27,604,062	0.9927	5.9212	0.0694	0.0100
Norway	1990:01	304	583	56,509	139,552,813	0.9567	7.2374	0.0296	0.0093
Portugal	1990:01	303	177	15,483	50,388,992	0.5014	6.1570	0.0758	0.0080
Singapore	1990:01	304	735	30,042	180,735,680	0.8681	6.9156	0.0458	0.0092
South Korea	1990:01	304	2,594	15,240	478,504,928	0.8706	10.5742	0.0189	0.0036
Spain	1990:02	303	273	21,587	439,953,511	0.8145	6.6199	0.0047	0.0046
Sweden	1990:01	304	1,087	39,232	325,527,385	1.0730	7.1960	0.0187	0.0047
Switzerland	1990:05	300	480	52,406	812,029,319	1.0266	4.9539	0.0018	0.0035
Taiwan	1991:05	288	1,030	14,991	428,958,167	0.6390	8.3684	0.0030	0.0028
United Kingdom	1990:01	304	3,924	31,034	1,976,968,462	0.7929	4.9299	0.0033	0.0064
United States	1990:01	304	4,067	38,228	7,841,682,544	0.9114	3.9927	0.0009	0.0050
Average		283	1,142	31,919	793,005,484	0.7804	7.0050	0.0499	0.0083

Panel B: Emerging markets									
Argentina	1993:08	261	121	7,872	34,760,483	0.9858	9.2765	0.0966	0.0173
Brazil	1994:08	249	311	5,834	417,460,986	1.0846	10.5591	0.1529	0.0567
Bulgaria	2004:11	125	108	3,584	6,052,386	0.1335	10.5100	1.0995	0.1149
Chile	1990:01	304	222	7,370	128,646,625	1.1663	8.1733	0.0835	0.0170
China	1992:04	276	2,704	2,175	1,470,222,227	1.5296	12.8964	0.0026	0.0020
Colombia	1992:02	185	65	3,577	88,240,356	2.5614	8.3937	0.0304	0.0113
Croatia	2005:11	114	122	9,650	23,247,737	0.5619	8.4872	0.1354	0.0558
Czech Republic	1994:03	80	175	11,250	14,473,071	-0.8985	7.8911	0.1037	-
Egypt	1996:11	219	169	1,547	42,468,707	0.6535	8.3700	0.1265	0.0292
Estonia	1997:08	142	27	10,396	2,798,781	0.2439	11.1485	0.1719	0.0117
Hungary	1994:01	252	87	8,542	18,679,290	1.4019	10.7735	0.0332	0.0183
India	1995:01	244	2,955	723	19,011,378	0.3437	8.9245	1.4991	0.0301
Indonesia	1997:08	46	485	1,543	335,274,295	-2.3846	10.4797	0.0408	0.0097
Kenya	1993:11	251	61	612	7,405,950	1.7841	8.3566	0.7129	0.0436
Lithuania	2002:04	146	31	12,337	2,744,609	1.2963	7.8846	0.3690	0.0140
Malaysia	1990:01	304	1,087	5,572	203,798,670	0.8908	8.5130	0.0770	0.0105
Mexico	1990:01	304	242	6,703	119,613,614	0.6643	9.3149	0.0472	0.0148
Morocco	1994:09	248	101	1,854	33,959,718	0.8346	4.9785	0.0405	0.0078
Pakistan	1991:04	271	374	708	25,397,290	1.1457	9.0305	0.3869	0.0051
Peru	1992:03	278	178	3,008	28,751,487	0.1228	9.1448	0.1322	0.0382
Philippines	1990:01	304	321	1,385	68,710,043	0.8007	8.2773	0.2173	0.0151
Poland	1994:02	254	951	7,213	82,909,293	0.6559	10.1227	0.0620	0.0129
Romania	1997:03	217	176	4,234	10,895,687	1.3317	13.1135	0.8575	0.0067
Slovenia	1998:02	205	96	17,561	8,012,637	0.6678	6.2719	0.0805	0.0227
South Africa	1990:01	304	878	4,663	226,680,548	1.0059	7.2210	0.0623	0.0100
Sri Lanka	1990:02	297	313	1,355	6,223,781	1.0919	7.8351	1.0659	0.0352
Thailand	1990:01	304	785	2,996	135,121,517	0.8394	9.7657	0.0923	0.0076
Turkey	1990:02	303	422	5,794	110,082,222	1.7445	14.8801	0.0758	0.0066
Venezuela	2000:06	32	21	6,285	5,010,771	3.2344	14.1827	0.4992	0.1378
Average		225	469	5,391	126,781,178	0.8791	9.4751	0.2881	0.0272

Table 3. Variable definitions
This table defines the explanatory variables.

Variable	Description
VIX	Log of average VIX value in a given month. Source: Datastream.
DEV_MKT	A dummy variable set to 1 if a country is classified as a developed economy by the World Bank, and zero otherwise. Sources: Griffin, Kelly, and Nardari (2010), and Griffin, Hirschey, and Kelly (2011).
GDP_PER_CAP	Log of gross domestic product (GDP) per capita (in US$) in the previous year. Sources: World Bank, and IMF World Economic Outlook.
TRADE_OPENNESS	Proxy for market openness, computed as (Export + Import)/GDP in the same year. Source: World Bank.
SEGMENTATION	Monthly proxy for equity market segmentation based on valuation, developed by Bekaert, Harvey, Lundblad, and Siegel (2011), constructed for each market. Source: Datastream.
INSTIT_OWNER	Foreign institutional ownership measured as a percentage of a country's stock market capitalization. Source: Ferreira and Matos (2008).
GOVERNANCE	Average of the six components of the Worldwide Governance Indicators (WGI) in a given year. WGI consists of six composite indicators measuring six dimensions of governance: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. Source: World Bank.
SHORT_SELLING	A time-varying dummy variable set to 1 if short selling is prohibited, and zero otherwise. Source: Jain, Jain, McInish, and McKenzie (2013), and Charoenrook and Daouk (2005).
MKT_MAKER	Time-varying dummy variable set to 1 for markets with presence of market makers, and zero otherwise. To ensure our market maker dummy reflects the presence of market makers in a given market and over time, we survey the main stock exchange(s) when we are unsure of the trading mechanism in that exchange. Sources: Survey answers from main exchanges, and exchange webpages.
GROWTH_VOLA	Standard deviation of the growth in each country's GDP. Sources: World Bank and IMF World Economic Outlook.
EXCHANGE_RATE	Monthly percentage changes in the value of a country's local currency relative to special drawing rights (SDR). Source: IMF International Financial Statistics.
MKT_CAP	Log of market capitalization of listed firms in a country at the end of each month. Source: Datastream.
MKT_VOL	Log of value-weighted average of stock dollar volume within a market in a given month. Source: Datastream.
MKT_PRICE	Log of value-weighted average of stock prices within a market in a given month. Source: Datastream.
INDIVIDUALISM	Individualism versus collectivism (IDV) index of the Hofstede (2001) dimensions. Source: Hofstede (2001) dimensions.
UNCERT_AVOID	Uncertainty avoidance index of the Hofstede (2001) dimensions. Source: Hofstede (2001) dimensions.

Table 4. Risk perceptions and global liquidity

This table presents the results of panel regressions. In each regression model, we include our key variable VIX and one control variable. The first column indicates which control (with its expected sign in brackets) is included. However, we also run regressions on VIX and the combinations of the controls as a check on robustness. The dependent variable is the monthly aggregate market liquidity measured by the Amihud (2002) value and closing percent quoted spread from Chung and Zhang (2014). Independent variables are as defined in Table 3. The monthly Amihud (2002) and spread measures are value- and equal-weighted on market capitalization across individual stocks within a market. The liquidity measures, VIX, GDP per capita (GDP_PER_CAP), market capitalization (MKT_CAP), market volume (MKT_VOL), and market price level (MKT_PRICE) are natural log scaled. We have more than or equal to 54 markets with valid data in 11 out of the 13 regression models. The two regressions with MKT_MAKER and INSTIT_OWNER are based on data available for 43 and 26 markets, respectively. Standard errors are clustered by country. VW (EW) refers to the monthly market liquidity being value- (equal-) weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

	Amihud				Spread			
	VW		EW		VW		EW	
	VIX	Control	VIX	Control	VIX	Control	VIX	Control
DEV_MKT (-)	0.6835***	-1.9780***	0.8031***	-0.8226**	0.3996***	-0.7785***	0.2950***	-0.0365
	(8.64)	(-4.93)	(10.29)	(-2.06)	(7.39)	(-3.80)	(5.29)	(-0.13)
GDP_PER_CAP (-)	0.7324***	-0.8350***	0.8268***	-0.3526**	0.3910***	-0.2312**	0.3201***	0.1278
	(9.50)	(-5.58)	(10.46)	(-2.13)	(7.39)	(-2.38)	(6.19)	(1.11)
TRADE_OPENNESS (-)	0.6958***	0.0266	0.8035***	0.2122	0.4222***	-0.0295	0.2974***	0.1273
	(7.39)	(0.12)	(9.13)	(1.16)	(7.98)	(-0.28)	(5.60)	(0.84)
SEGMENTATION (+)	0.4162***	15.3420**	0.6351***	8.7327*	0.2727***	11.0361***	0.1796***	8.9113**
	(4.01)	(2.47)	(6.19)	(1.82)	(4.16)	(3.43)	(3.08)	(2.28)
INSTIT_OWNER (+/-)	0.7104***	-1.0000	0.9206***	-0.2623	0.4412***	-1.3386	0.4129***	1.5529
	(5.98)	(-0.24)	(7.64)	(-0.08)	(6.26)	(-0.94)	(6.31)	(0.72)
GOVERNANCE (-)	0.8732***	-1.0977***	0.7421***	-0.2887	0.4472***	-0.3863***	0.3163***	0.1916
	(13.83)	(-3.83)	(12.25)	(-0.96)	(8.43)	(-2.78)	(5.45)	(1.21)
SHORT_SELLING (+)	0.7450***	1.8131***	0.8247***	0.5211	0.4241***	0.6806*	0.2956***	0.0088
	(8.57)	(3.85)	(9.76)	(1.06)	(7.76)	(1.93)	(5.14)	(0.02)
MKT_MAKER (-)	0.6446***	-1.1140**	0.8272***	-0.2283	0.4001***	-0.4488*	0.3370***	0.1838
	(6.50)	(-2.32)	(8.77)	(-0.49)	(7.09)	(-1.95)	(5.37)	(0.58)
GROWTH_VOLA (+)	0.6928***	0.5674***	0.8075***	0.2211	0.4236***	0.1766**	0.2948***	-0.0070
	(8.26)	(3.76)	(10.13)	(1.64)	(7.88)	(2.32)	(5.11)	(-0.07)
EXCHANGE_RATE (+)	0.6883***	4.6002***	0.8155***	2.8958***	0.3833***	0.7741**	0.2732***	0.0598
	(6.28)	(5.08)	(7.95)	(3.84)	(5.94)	(2.09)	(4.06)	(0.13)
MKT_CAP (-)	0.5506***	-0.7790***	0.7214***	-0.4495***	0.3802***	-0.2550***	0.2841***	-0.2082**
	(9.32)	(-11.70)	(9.49)	(-5.57)	(6.91)	(-4.06)	(5.03)	(-2.45)
MKT_VOL (-)	0.8605***	-0.6403***	0.8903***	-0.3261***	0.4492***	-0.2384***	0.3151***	-0.1157**
	(13.13)	(-13.21)	(11.65)	(-5.62)	(9.01)	(-6.33)	(5.19)	(-2.08)
MKT_PRICE (-)	0.5623***	-0.4960***	0.7403***	-0.2465*	0.3753***	-0.1171*	0.3218***	0.1090
	(6.99)	(-3.52)	(9.15)	(-1.79)	(7.07)	(-1.67)	(6.19)	(1.24)

Table 5. Non-US evidence and local VIX evidence

In Models (1), (3), (5), and (7) of Panel A, we regress non-US monthly liquidity on the US VIX. In Models (2), (4), (6), and (8), we calculate a value-weighted average of the non-US implied volatility indices over the 2000-2015 period and regress non-US monthly liquidity on non-US global implied volatility. In Panel B, we replace US VIX with 16 international VIX indices and re-estimate our time-series regressions as per Equation (4). Liquidity measures are value- and equal-weighted on market capitalization across individual stocks within each market. We report coefficients on VIX (i.e., β_{VIX}) for 16 countries that have a local VIX Index. VW (EW) refers to the monthly market liquidity being value- (equal-) weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

Panel A: Non-US risk perceptions and non-US liquidity

	Non-US Amihud				Non-US spread			
	VW		EW		VW		EW	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-5.7208***	-6.7976***	-3.8784***	-3.9280***	-6.0241***	-6.3019***	-4.4257***	-4.6365***
	(-18.08)	(-17.15)	(-12.93)	(-12.33)	(-31.35)	(-25.95)	(-21.20)	(-19.67)
US VIX	0.7232***		0.8278***		0.4028***		0.2725***	
	(8.19)		(10.03)		(7.14)		(5.11)	
Non-US global VIX		1.0273***		0.8656***		0.4762***		0.3445***
		(14.10)		(13.40)		(7.50)		(5.35)
Number of countries	56	56	56	56	55	55	55	55
R-squared	0.0166	0.027	0.0271	0.0261	0.0198	0.0229	0.0095	0.0126

Panel B: Risk perceptions and liquidity by country: international VIX indices

	Amihud		US spread	
	VW	EW	VW	EW
Australia	0.1125	0.3249**	0.4607***	0.5975***
Belgium	1.4486***	1.0965***	0.6657***	0.7084***
Canada	0.5644***	-0.0520	0.4599***	0.4017***
France	1.3606***	0.9863***	0.6000***	0.3570***
Germany	1.2990***	1.7985***	0.6433***	0.3160***
Hong Kong	0.8858***	1.1374***	0.2338***	0.3444***
Japan	1.6790***	1.9870***	0.5958***	0.9825***
Netherlands	1.5635***	1.0247***	0.9624***	0.6898***
South Korea	1.0596***	1.2246***	0.2129***	0.5530***
Sweden	1.3492***	1.1376***	0.6319***	0.5631***
Switzerland	1.1563***	1.1302***	0.7632***	0.7981***
United Kingdom	0.9148***	0.8842***	0.4415***	0.3334***
United States	0.0488	0.0580	0.6664***	0.7238***
India	0.3943***	0.3410***	0.3474**	0.2389**
Mexico	0.7400***	0.5385***	0.4012***	0.3280***
South Africa	1.4645***	0.9384***	1.0107***	0.4457***
Average	1.0026	0.9097	0.5686	0.5238
% Positive	100.00%	93.75%	100.00%	100.00%
% Positive significant	87.50%	0.88%	100.00%	100.00%

Table 6. Risk perceptions and liquidity by country

This table presents the results of time-series regressions of monthly market liquidity, measured by the Amihud (2002) and spread values, on VIX for each country. Liquidity measures are value- or equal-weighted on market capitalization across individual stocks within each market. We report the coefficients on VIX (β_{VIX}) for developed markets in Panel A, and emerging markets in Panel B. VW (EW) refers to the monthly market liquidity being value- (equal-) weighted. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

Panel A: Developed markets

	Amihud		Spread	
	VW	EW	VW	EW
Australia	0.2792***	0.7693***	0.4239***	0.4696***
Austria	0.6521***	0.5054***	0.6994***	0.1001
Belgium	1.2140***	1.6306***	0.9150***	0.3377***
Canada	0.5156***	0.8090***	0.4943***	0.5455***
Cyprus	-0.3017	-0.1975	-0.0401	0.1794***
Denmark	0.7824***	0.8873***	0.3910***	0.4408***
Finland	-0.0020	0.7061***	-0.0286	0.3409***
France	0.5244***	0.7534***	0.3504***	0.4034***
Germany	0.9149***	1.1951***	0.5535***	0.2565***
Greece	-0.4365**	-0.6919***	0.0447	-0.2363**
Hong Kong	0.7567***	1.0743***	0.1954***	0.2680***
Ireland	1.1849***	1.4399***	0.4921***	0.4522***
Israel	-0.3532*	-0.0043	0.6748***	0.5341***
Italy	0.6478***	1.0559***	0.9173***	0.7648***
Japan	1.3669***	1.8531***	0.4716***	0.8742***
Luxembourg	1.7269**	2.4340***	0.2539*	0.1736**
Netherlands	0.5499***	0.6646***	1.1471***	0.6754***
New Zealand	0.7369***	0.5503***	0.3188***	0.0960**
Norway	0.8816***	1.0938***	0.9774***	0.8604***
Portugal	-0.6383***	-0.0749	-0.1640*	-0.1894**
Singapore	1.2182***	1.2736***	0.2665***	0.3490***
South Korea	0.7811***	0.9667***	0.2980***	0.4377***
Spain	0.2142	0.2313*	-0.1074	0.1788**
Sweden	1.0284***	1.2696***	0.6695***	0.7235***
Switzerland	0.6137***	0.9472***	0.4241***	0.5117***
Taiwan	0.7496***	0.9544***	0.1134***	0.3204***
United Kingdom	0.6939***	1.1131***	0.0846	0.2582***
United States	0.0488	0.0580	0.6664***	0.7238***
Average	0.5839	0.8310	0.4108	0.3875
% Positive	82.14%	85.71%	85.71%	92.86%
% Positive significant	75.00%	82.14%	78.57%	89.29%

Panel B: Emerging markets

	Amihud		Spread	
	VW	EW	VW	EW
Argentina	0.4539***	0.0899	0.5853***	0.2302***
Brazil	1.0341***	0.7257***	0.6257***	-0.1740
Bulgaria	0.6789***	0.9956***	1.1944***	0.8831***
Chile	0.7581***	0.5445***	0.5074***	0.3834***
China	-0.7803***	-0.7099***	-0.1830***	-0.1022
Colombia	-0.8841***	-0.7870***	0.2307	0.2054
Croatia	0.0451	0.6132***	0.0483	-0.7475***
Czech Republic	0.2313	2.7856***	-	-
Egypt	0.8872***	0.3743**	0.2208*	0.2283**
Estonia	1.0556***	1.2916***	0.6550***	0.6114***
Hungary	-0.0547	0.3080**	0.6394***	0.3516***
India	0.8210***	0.7771***	0.0742	0.0014
Indonesia	1.0219***	1.0106***	0.4936***	0.2599***
Kenya	0.8640***	0.5654***	0.0594	0.1236
Lithuania	0.7280***	1.0128***	0.4253***	0.2888***
Malaysia	1.6503***	1.6390***	0.5337***	0.3990***

Mexico	0.7893***	0.8939***	0.6109***	0.4739***
Morocco	0.2159*	0.1732*	0.7627*	0.7694*
Pakistan	0.9576***	0.7429***	-0.2749***	-0.2307***
Peru	0.1889**	-0.0374	0.3001***	-0.0456
Philippines	0.9759***	0.7943***	0.4319***	0.1161*
Poland	1.2444***	1.6830***	0.7410***	0.5533***
Romania	1.8382***	1.1288***	0.8494***	0.3214***
Slovenia	0.8061***	0.7390***	0.2042***	-0.5774***
South Africa	1.1704***	1.1442***	0.6144***	0.2806***
Sri Lanka	1.5048***	1.5567***	-0.1802*	-0.3752***
Thailand	1.1596***	1.1543***	0.2070***	0.2652***
Turkey	0.0861	0.1621	0.3510***	0.2994***
Venezuela	-2.2882***	-1.9474***	0.6439	0.6195
Average	0.5917	0.6698	0.4061	0.1933
% Positive	86.21%	86.21%	89.29%	75.00%
% Positive significant	75.86%	79.31%	71.43%	60.71%

Table 7. Market attributes and the risk perception-liquidity relation

This table contains results for the effects of market attributes on the risk perception-liquidity relation. In each regression model, we include one equity market/country attribute as the explanatory variable given the relatively high correlations between the equity market/country attribute variables as reported in Panel B of Appendix 2. The dependent variable is $\beta_{VIX,c}$ obtained from Equation (4) based on the value- and equal-weighted Amihud (2002) and spread measures. Explanatory variables are as defined in Table 2. VW (EW) refers to the monthly market liquidity being value- (equal-) weighted. Numbers in parentheses are t-statistics. *=significance at the 10% level; **=significance at the 5% level; ***=significance at the 1% level.

		Amihud		Spread	
	Exp sign	VW	EW	VW	EW
DEV_MKT	+	-0.0078	0.1612	0.0047	0.1942**
		(-0.04)	(0.79)	(0.05)	(2.20)
GDP_PER_CAP	+	0.0027	0.1307*	0.0638*	0.0903***
		(0.04)	(1.93)	(1.80)	(3.09)
TRADE_OPENNESS	+	0.3199***	0.4453***	0.0049	0.0201
		(2.79)	(2.89)	(0.10)	(0.52)
SEGMENTATION	-	-8.7755	-10.0089**	1.5742	0.2865
		(-1.65)	(-2.30)	(1.10)	(0.18)
INSTIT_OWNER	+	0.6749	1.4695	0.5451	0.6151
		(0.39)	(0.85)	(0.43)	(0.96)
GOVERNANCE	+	0.1670	0.3430**	0.0708	0.1186**
		(1.14)	(2.66)	(1.31)	(2.56)
SHORT_SELLING	-	-0.1552	-0.4094**	-0.1663*	-0.0962
		(-0.87)	(-2.07)	(-1.92)	(-1.03)
MKT_MAKER	-	0.0059	-0.0459	0.1574	0.0948
		(0.03)	(-0.19)	(1.48)	(0.83)
GROWTH_VOLA	-	-0.0933	-0.0949	0.0306	0.0097
		(-0.86)	(-0.93)	(1.00)	(0.33)
EXCHANGE_RATE	-	-3.3748	-13.7228	6.5113	-4.5836
		(-0.38)	(-1.51)	(1.67)	(-0.83)
MKT_CAP	+	0.0218	0.0278	0.0095	0.0545*
		(0.36)	(0.42)	(0.37)	(1.99)
MKT_VOL	+	-0.0035	0.0416	0.0085	0.0526**
		(-0.07)	(0.83)	(0.35)	(2.15)
MKT_PRICE	+	-0.1286**	-0.0470	0.0592**	0.0353
		(-2.03)	(-0.71)	(2.47)	(1.27)
INDIVIDUALISM	+	0.0044	0.0094*	0.0054***	0.0058***
		(0.88)	(1.92)	(3.16)	(3.58)
UNCERT_AVOID	+	-0.0067	-0.0063	0.0004	-0.0029
		(-1.59)	(-1.40)	(0.22)	(-1.45)

Table 8. Extreme risk perception and liquidity

This table presents the panel regression results of Equation (6). D_{HIGH} is a dummy variable set to 1 if VIX_t is more than 1.5 standard deviations above its mean, and D_{LOW} is a dummy variable set to 1 if VIX_t is more than 1.5 standard deviations below its mean. Other variables are as defined in Equation (3). Because our focus is on the effects of extreme VIX, we report only the coefficients on VIX and the interaction terms. VW refers to monthly market liquidity being value-weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

	Amihud VW			Spread VW		
	VIX	VIX×D_{HIGH}	VIX×D_{LOW}	VIX	VIX×D_{HIGH}	VIX×D_{LOW}
DEV_MKT	0.5606***	0.0472**	-0.1109***	0.3883***	0.0045	-0.0059
	(5.07)	(2.29)	(-3.51)	(5.05)	(0.31)	(-0.23)
GDP_PER_CAP	0.5205***	0.0954***	-0.1040***	0.3403***	0.0222	-0.0111
	(4.96)	(4.32)	(-3.40)	(4.48)	(1.56)	(-0.40)
TRADE_OPENNESS	0.5516***	0.0603**	-0.0966***	0.4037***	0.0092	0.0034
	(4.28)	(2.67)	(-2.68)	(5.22)	(0.61)	(0.13)
SEGMENTATION	0.2775**	0.0562**	-0.1085***	0.3058***	-0.0161	-0.0013
	(2.37)	(2.02)	(-3.55)	(3.69)	(-1.31)	(-0.05)
INSTIT_OWNER	0.5276***	0.0660**	-0.2085***	0.4578***	-0.0107	-0.0173
	(3.44)	(2.66)	(-5.59)	(4.74)	(-0.73)	(-0.63)
GOVERNANCE	0.7943***	0.0278	-0.0474*	0.4422***	0.0039	0.0120
	(8.47)	(1.67)	(-1.88)	(5.45)	(0.27)	(0.49)
SHORT_SELLING	0.6154***	0.0547**	-0.0863***	0.4187***	0.0038	0.0085
	(5.24)	(2.47)	(-2.84)	(5.23)	(0.24)	(0.39)
MKT_MAKER	0.4267***	0.0900***	-0.1571***	0.3616***	0.0173	-0.0060
	(3.28)	(3.54)	(-4.56)	(4.57)	(1.04)	(-0.22)
GROWTH_VOLA	0.5623***	0.0507**	-0.1141***	0.4168***	0.0023	-0.0059
	(4.91)	(2.51)	(-3.62)	(5.37)	(0.16)	(-0.23)
EXCHANGE_RATE	0.6024***	0.0428*	-0.0243	0.3864***	0.0027	0.0275
	(4.21)	(1.78)	(-0.66)	(4.02)	(0.14)	(0.89)
MKT_CAP	0.4099***	0.0647***	-0.0607***	0.4030***	-0.0083	0.0167
	(5.43)	(4.36)	(-2.81)	(5.87)	(-0.71)	(0.74)
MKT_VOL	0.7807***	0.0527***	0.0646**	0.4923***	-0.0117	0.0592***
	(9.49)	(3.22)	(2.44)	(8.08)	(-1.04)	(3.16)
MKT_PRICE	0.4552***	0.0447**	-0.0747**	0.3608***	0.0065	-0.0019
	(4.23)	(2.03)	(-2.38)	(4.60)	(0.39)	(-0.07)

Table 9. Subperiod results

This table reports the impact of VIX by subperiod. In Panel A, we split the sample into two subperiods and investigate whether the link between VIX and international liquidity is unique to the more recent subperiod. Splitting on 2003 not only produces relatively similar subperiods, but also reflects the period when the VIX methodology was changed as discussed in Section 3.3. In Panel B, we test the influence of VIX for the periods prior to the Global Financial Crisis (1990-2006), during the crisis (2007-2009), and after the crisis (2010-2015). We investigate whether the impact of VIX on market liquidity is robust over expansionary and recessionary phases of the business cycle in Panel C. VW refers to monthly market liquidity being value-weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

Panel A: The pre- and post-2003 subperiods

	Amihud VW		Spread VW	
	VIX 1990-2002	VIX 2003-2015	VIX 1990-2002	VIX 2003-2015
DEV_MKT	0.3732*	0.7702***	0.1899	0.4030***
	(1.78)	(12.02)	(0.77)	(7.99)
GDP_PER_CAP	0.5470**	0.8754***	0.2460	0.4396***
	(2.53)	(11.98)	(1.10)	(8.16)
TRADE_OPENNESS	0.5053**	0.7553***	0.3136	0.4302***
	(2.12)	(11.24)	(1.61)	(8.30)
SEGMENTATION	0.2207	0.4964***	0.2322	0.3036***
	(1.01)	(4.72)	(1.42)	(4.14)
INSTIT_OWNER	0.1133	1.0279***	-0.0258	0.4440***
	(0.39)	(14.64)	(-0.17)	(7.10)
GOVERNANCE	0.8323***	0.7579***	0.6451**	0.3979***
	(4.89)	(12.23)	(2.39)	(7.69)
SHORT_SELLING	0.6803***	0.7410***	0.2645	0.4065***
	(2.88)	(11.30)	(1.43)	(7.40)
MKT_MAKER	0.2862	0.8101***	0.1539	0.4173***
	(1.10)	(10.18)	(0.75)	(7.79)
GROWTH_VOLA	0.4376*	0.7626***	0.2973	0.4081***
	(1.90)	(12.07)	(1.34)	(7.95)
EXCHANGE_RATE	0.7624***	0.6102***	0.3705*	0.3758***
	(2.95)	(6.78)	(1.82)	(5.98)
MKT_CAP	0.5599***	0.5920***	0.2802	0.3514***
	(3.31)	(11.43)	(1.44)	(6.62)
MKT_VOL	1.1154***	0.7773***	0.3766**	0.4030***
	(7.25)	(12.07)	(2.12)	(7.71)
MKT_PRICE	0.3162	0.6702***	0.2197	0.3796***
	(1.52)	(11.08)	(1.20)	(6.73)

Panel B: The 2007-09 crisis and non-crisis periods

	Amihud VW			Spread VW		
	Crisis period	Non-crisis period		Crisis period	Non-crisis period	
	VIX 2007-2009	VIX 1990-2006	VIX 2010-2015	VIX 2007-2009	VIX 1990-2006	VIX 2010-2015
DEV_MKT	1.2351***	0.7199***	0.6841***	0.4955***	0.4705***	0.3264***
	(16.91)	(5.82)	(6.54)	(10.31)	(5.38)	(3.15)
GDP_PER_CAP	1.3527***	0.6300***	0.5507***	0.5415***	0.4338***	0.2824***
	(15.65)	(5.12)	(4.60)	(9.99)	(4.17)	(3.04)
TRADE_OPENNESS	1.2195***	0.7368***	0.6204***	0.5179***	0.4652***	0.3079***
	(15.41)	(5.19)	(5.18)	(9.97)	(5.16)	(2.97)
SEGMENTATION	0.7681***	0.4323***	0.4594**	0.4040***	0.3652***	0.2171
	(4.88)	(3.23)	(2.25)	(6.99)	(4.45)	(1.49)
INSTIT_OWNER	1.5041***	0.6535***	0.8656***	0.5537***	0.5142***	0.4078***
	(21.36)	(3.73)	(7.77)	(8.72)	(5.39)	(3.00)
GOVERNANCE	1.2338***	1.1288***	0.6655***	0.4984***	0.6019***	0.3124***
	(17.80)	(8.55)	(6.98)	(10.16)	(5.94)	(3.12)
SHORT_SELLING	1.1657***	0.8183***	0.6526***	0.4690***	0.4776***	0.3522***
	(16.68)	(6.09)	(7.17)	(9.32)	(5.44)	(3.51)
MKT_MAKER	1.3317***	0.6044***	0.5930***	0.5356***	0.4359***	0.3100***
	(17.22)	(3.94)	(4.54)	(9.18)	(4.30)	(3.65)
GROWTH_VOLA	1.2403***	0.7371***	0.6619***	0.5159***	0.4674***	0.3075***

	(18.84)	(5.63)	(6.97)	(10.08)	(5.60)	(3.03)
EXCHANGE_RATE	1.0499***	0.7533***	0.5145***	0.4478***	0.3988***	0.2912**
	(9.95)	(4.73)	(4.54)	(7.92)	(3.71)	(2.33)
MKT_CAP	0.8158***	0.4961***	0.3627***	0.3360***	0.4510***	0.2653**
	(11.49)	(5.26)	(4.35)	(6.75)	(5.46)	(2.64)
MKT_VOL	1.0114***	0.7866***	0.7390***	0.3903***	0.4807***	0.3766***
	(13.56)	(8.39)	(7.44)	(8.08)	(6.29)	(3.78)
MKT_PRICE	1.0077***	0.5216***	0.5394***	0.4879***	0.4246***	0.2572**
	(10.27)	(4.06)	(5.45)	(8.46)	(5.26)	(2.29)

Panel C: Expansionary and recessionary phases of the business cycle

	Amihud VW		Spread VW	
	$VIX \times D_{REC,C}$	$VIX \times D_{EXP,C}$	$VIX \times D_{REC,C}$	$VIX \times D_{EXP,C}$
DEV_MKT	0.7082***	0.6104***	0.4340***	0.4110***
	(7.72)	(3.82)	(6.90)	(5.02)
GDP_PER_CAP	0.7451***	0.5839***	0.4314***	0.3907***
	(9.28)	(4.77)	(6.53)	(5.01)
TRADE_OPENNESS	0.7125***	0.6891**	0.4512***	0.4621***
	(4.55)	(2.61)	(5.95)	(4.22)
SEGMENTATION	0.4839***	0.5202**	0.3844***	0.4131***
	(3.11)	(2.73)	(4.53)	(4.37)
INSTIT_OWNER	0.7694***	0.8378***	0.4957***	0.5369***
	(5.86)	(3.65)	(6.28)	(5.09)
GOVERNANCE	0.9968***	1.0364***	0.5236***	0.5670***
	(8.55)	(4.55)	(5.71)	(4.16)
SHORT_SELLING	0.7395***	0.6646***	0.4872***	0.4972***
	(6.39)	(4.01)	(6.43)	(6.02)
MKT_MAKER	0.7840***	0.7011**	0.4484***	0.4504***
	(5.35)	(2.84)	(5.90)	(4.33)
GROWTH_VOLA	0.7415***	0.6810***	0.4905***	0.4965***
	(6.18)	(3.29)	(6.95)	(5.26)
EXCHANGE_RATE	0.6828***	0.6116**	0.4435***	0.4169***
	(4.04)	(2.19)	(5.12)	(3.41)
MKT_CAP	0.6882***	0.6465***	0.3932***	0.3921***
	(9.66)	(6.75)	(4.46)	(3.51)
MKT_VOL	1.0335***	0.9961***	0.4815***	0.4727***
	(8.06)	(5.14)	(6.33)	(4.41)
MKT_PRICE	0.6878***	0.5953***	0.4407***	0.4307***
	(6.54)	(3.52)	(6.41)	(5.20)

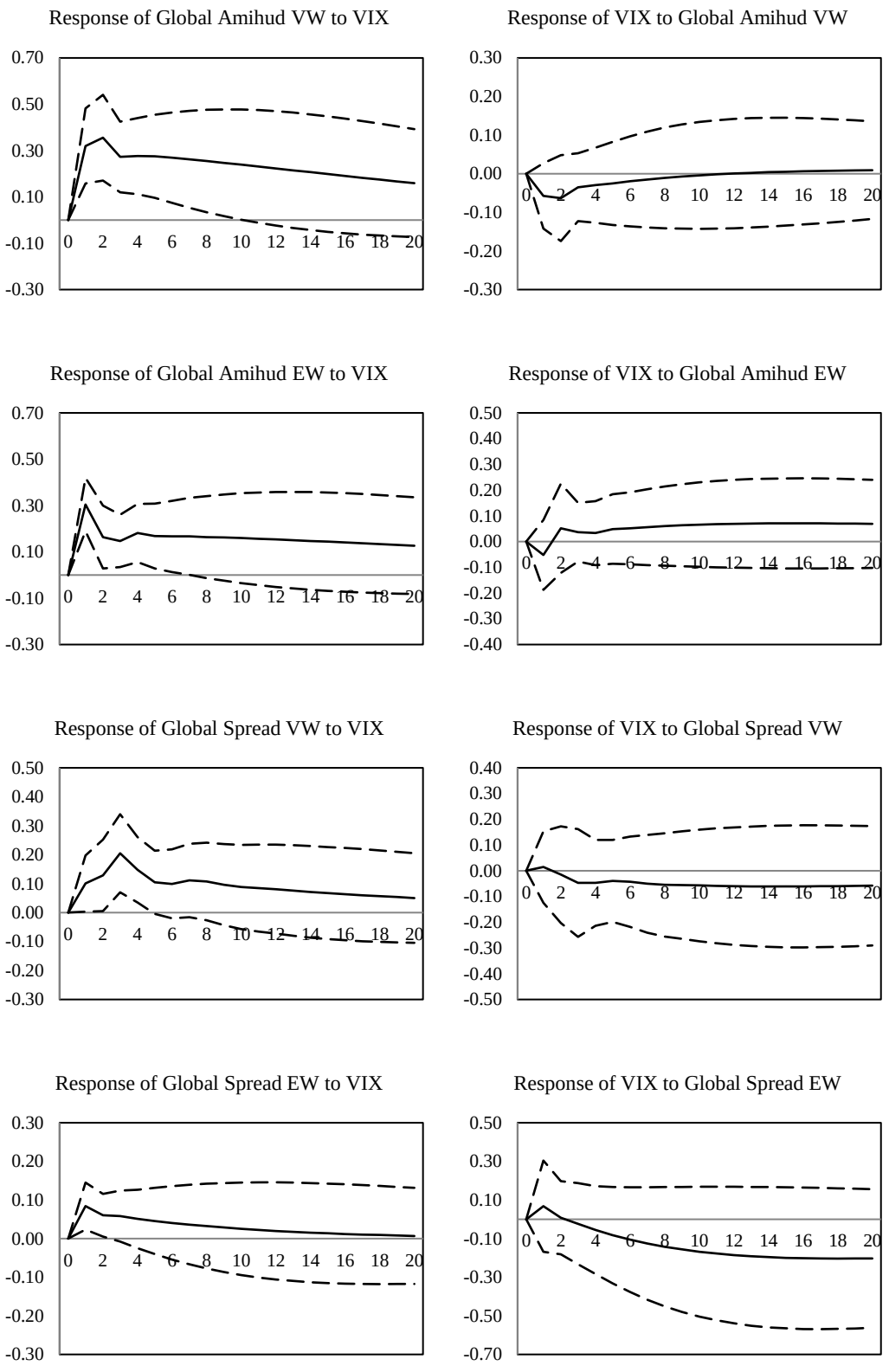


Figure 1. Generalized impulse responses. The solid line represents the generalized responses, and the dashed lines are the 95% confidence bands.

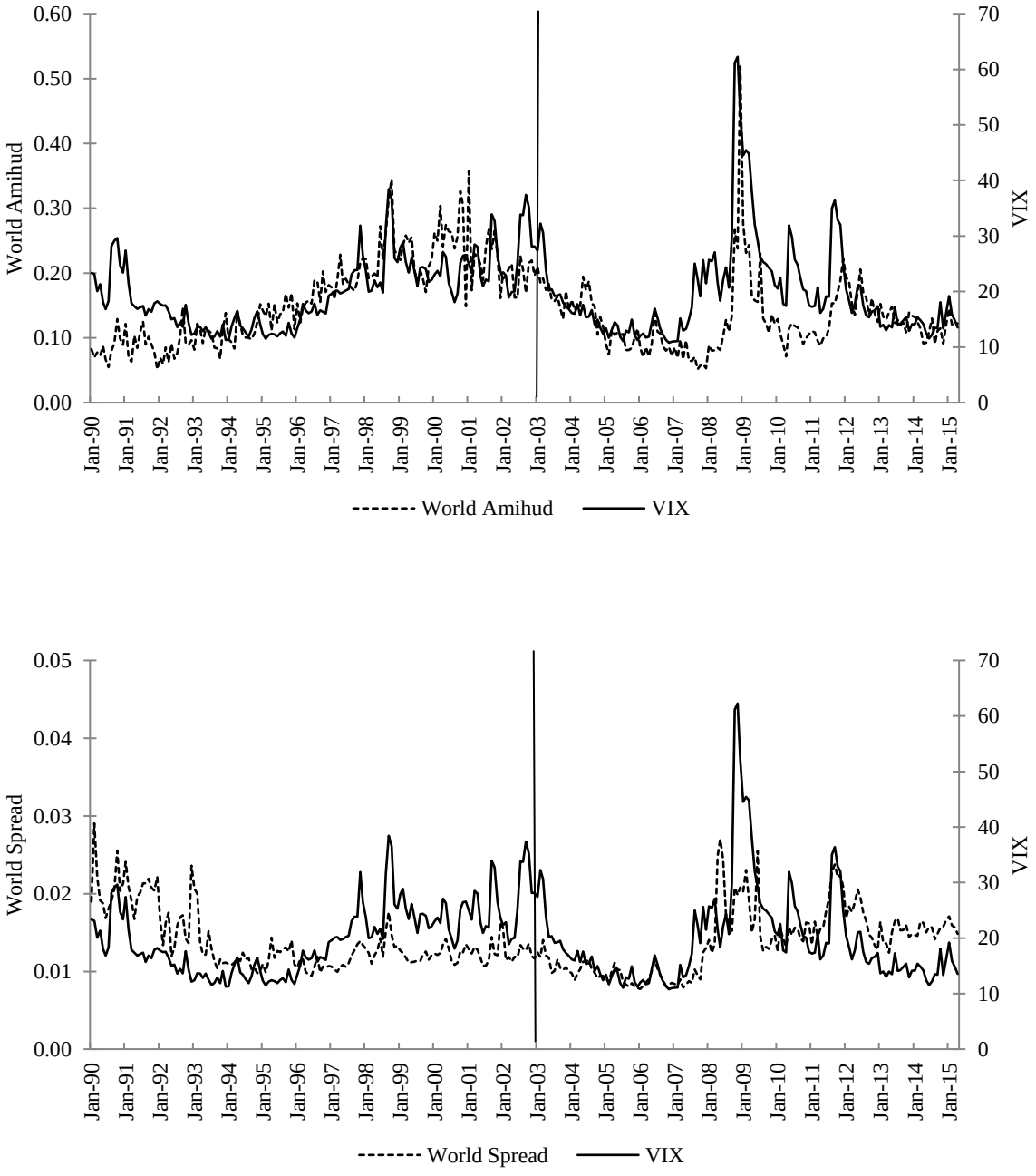


Figure 2. Risk perceptions and world liquidity. This figure presents the time series of monthly VIX, defined as average VIX value within a month, and the global average of the value-weighted Amihud (2002) and spread values across all sample countries.

Appendix 1. Correlation matrices

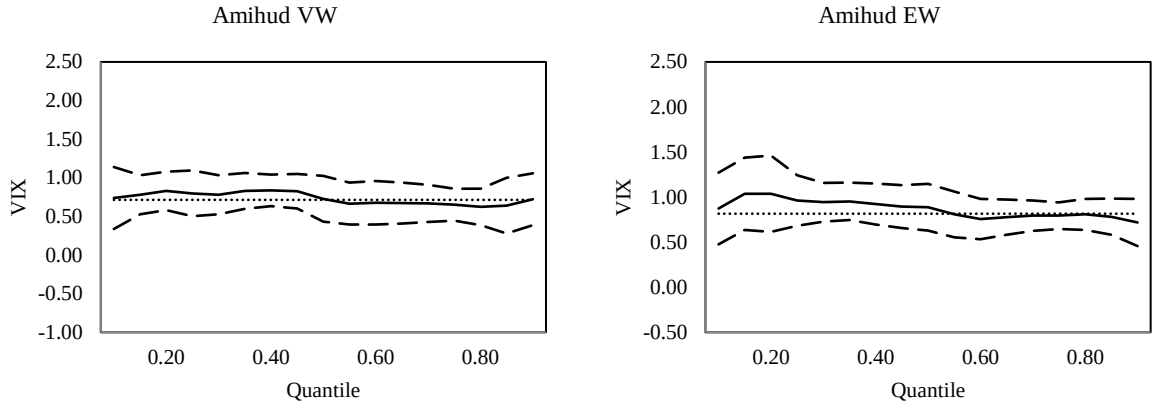
This table contains the correlation matrices of independent variables for Equation (3) and Equation (5), respectively.

Panel A: VIX and international market liquidity

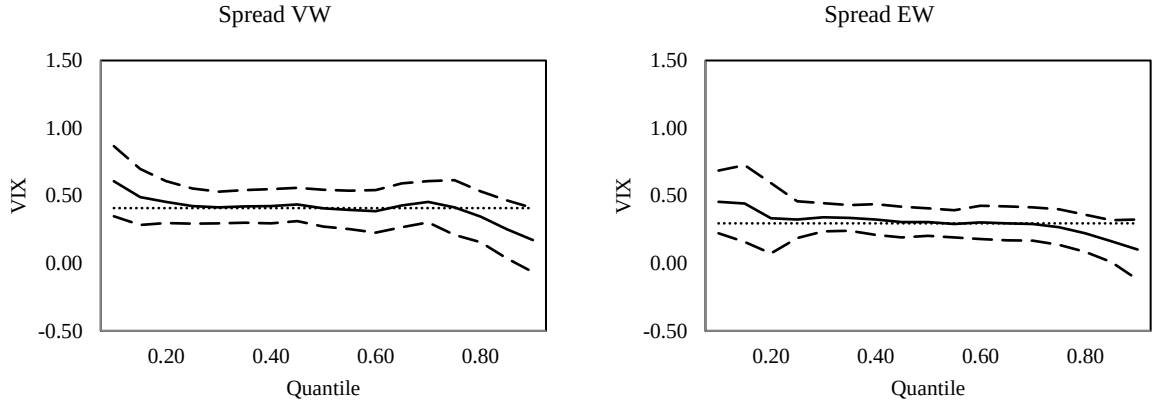
	VIX	*DEV_ MKT*	*GDP_ PER_ CAP*	*TRADE _OPEN NESS*	*SEG MENT ATION*	*INST IT_OWNER*	*GOVER NANCE*	*SHORT _SELL ING*	*MKT_ MAKER*	*GROWTH _VOLA*	*EXCH ANGE_ RATE*	*MKT _CAP*	*MKT _VOL*
DEV_MKT	0.0000												
GDP_PER_CAP	0.0152	0.7905											
TRADE_OPENNESS	0.0043	0.1979	0.3038										
SEGMENTATION	0.0856	-0.1056	-0.0881	-0.0420									
INSTIT_OWNER	0.0000	0.1358	0.2050	0.1144	0.1323								
GOVERNANCE	-0.0036	0.7784	0.8551	0.3500	-0.1514	0.3801							
SHORT_SELLING	-0.0182	-0.4943	-0.5658	-0.1375	0.1584	0.0928	-0.5063						
MKT_MAKER	-0.0009	0.3691	0.4311	-0.0704	-0.1438	0.3515	0.3832	-0.2348					
GROWTH_VOLA	0.0000	-0.4368	-0.2140	0.1756	0.1999	0.3202	-0.3235	0.3368	-0.2495				
EXCHANGE_RATE	0.0139	-0.0581	-0.0613	-0.0362	0.0275	-0.0047	-0.0744	0.0435	-0.0316	0.0542			
MKT_CAP	-0.0365	0.5043	0.5627	0.0083	-0.3490	-0.1146	0.4095	-0.5066	0.2903	-0.4216	-0.0726		
MKT_VOL	0.0245	0.5372	0.5753	0.0263	-0.2029	0.0687	0.5030	-0.5781	0.3224	-0.4452	-0.0728	0.8185	
MKT_PRICE	-0.0760	0.4205	0.5596	0.0092	-0.1117	0.0432	0.5014	-0.3298	0.4127	-0.1707	-0.0181	0.3857	0.3589

Panel B: Market attributes and impact of VIX

	DEV_ MKT	*GDP_ PER_ CAP*	*TRADE _OPEN NESS*	*SEG MENT ATION*	*INST IT_OW NER*	*GOVER NANCE*	*SHORT _SELL ING*	*MKT_ MAKER*	*INDI VIDUA LISM*	*UNCER T_AVO ID*	*GROW TH_VO LA*	*EXCH ANGE _RATE*	*MKT _CAP*	*MKT _VOL*
GDP_PER_CAP	0.8334													
TRADE_OPENNESS	0.2153	0.2989												
SEGMENTATION	-0.3382	-0.2932	-0.0965											
INSTIT_OWNER	0.1358	0.2348	0.1208	0.3373										
GOVERNANCE	0.7980	0.9061	0.3521	-0.4554	0.3866									
SHORT_SELLING	-0.3363	-0.4848	-0.1022	0.2705	0.1580	-0.4059								
MKT_MAKER	0.2975	0.4000	-0.0293	-0.2127	0.3133	0.2935	-0.3875							
INDIVIDUALISM	0.5123	0.6211	-0.0645	-0.3872	0.2435	0.6843	-0.3465	0.2695						
UNCERT_AVOID	-0.1870	-0.0922	-0.4270	0.2957	-0.1494	-0.2510	-0.0658	0.1088	-0.1828					
GROWTH_VOLA	-0.4224	-0.2091	0.1910	0.6438	0.3202	-0.3381	0.2515	-0.0487	-0.4337	0.1750				
EXCHANGE_RATE	-0.4676	-0.3507	-0.2385	0.6195	-0.0607	-0.4560	0.1470	-0.0629	-0.3697	0.3468	0.4119			
MKT_CAP	0.5233	0.4233	-0.1025	-0.5597	-0.2183	0.3670	-0.3108	0.1505	0.2115	-0.2512	-0.5450	-0.2754		
MKT_VOL	0.6470	0.5670	-0.0654	-0.5819	0.0485	0.5418	-0.3637	0.2279	0.4386	-0.2096	-0.5710	-0.3951	0.8531	
MKT_PRICE	0.3456	0.5186	-0.0246	0.1294	0.0433	0.3445	-0.3839	0.4001	0.3109	0.2771	-0.0325	-0.0396	0.1646	0.2280



(A) Amihud results



(B) Spread results

Appendix 2. Quantile regressions. The graph plots the quantile against the coefficient estimate on VIX. The solid lines represent the coefficient estimate, and the dashed lines are the 95% confidence bands. The dotted horizontal line denotes the OLS estimates that do not vary with the quantile.

Appendix 3. Daily risk perceptions and global liquidity

This table presents our panel regression results using daily liquidity measures. Following Chung and Chuwonganant (2014), we include lag and lead VIX. We address the issue of time zones and the day-of-the-week effects by including one-day lagged data for Western Hemisphere countries and day-of-the-week dummies. VW refers to the monthly market liquidity being value-weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

	Amihud VW			Spread VW		
	VIX_t	VIX_{t-1}	VIX_{t+1}	VIX_t	VIX_{t-1}	VIX_{t+1}
DEV_MKT	0.2471***	0.1214***	0.1620***	0.1681***	0.0373	0.1799***
	(6.51)	(2.83)	(4.19)	(8.73)	(1.37)	(6.69)
GDP_PER_CAP	0.2470***	0.1491***	0.1749***	0.1673***	0.0335	0.1665***
	(6.32)	(3.49)	(4.63)	(8.71)	(1.28)	(6.40)
TRADE_OPENNESS	0.2189***	0.1274***	0.1920***	0.1633***	0.0443	0.1912***
	(5.49)	(2.67)	(4.29)	(8.65)	(1.62)	(7.03)
SEGMENTATION	0.2334***	-0.0007	0.1154***	0.1405***	-0.0208	0.1696***
	(5.47)	(-0.02)	(2.69)	(7.18)	(-0.74)	(6.81)
INSTIT_OWNER	0.2344***	0.1984***	0.2241***	0.1734***	0.0295	0.2358***
	(4.98)	(3.48)	(3.44)	(9.22)	(0.83)	(6.57)
GOVERNANCE	0.2541***	0.2409***	0.2432***	0.1633***	0.0724***	0.1975***
	(6.27)	(4.88)	(6.04)	(8.39)	(2.75)	(7.27)
SHORT_SELLING	0.2515***	0.1422***	0.1806***	0.1653***	0.0527*	0.1910***
	(6.48)	(3.18)	(4.31)	(9.58)	(1.87)	(7.00)
MKT_MAKER	0.2365***	0.1299**	0.1754***	0.1590***	0.0333	0.1812***
	(5.05)	(2.44)	(3.59)	(7.95)	(1.13)	(5.69)
GROWTH_VOLA	0.2390***	0.1301***	0.1719***	0.1641***	0.0513*	0.1944***
	(5.96)	(3.04)	(4.07)	(8.87)	(1.83)	(7.15)
EXCHANGE_RATE	0.2146***	0.1231**	0.1590***	0.1554***	0.0395	0.1679***
	(4.86)	(2.24)	(3.16)	(6.67)	(1.24)	(4.80)
MKT_CAP	0.2278***	0.0834**	0.1359***	0.1551***	0.0258	0.1704***
	(6.38)	(2.12)	(4.21)	(7.81)	(1.00)	(7.65)
MKT_VOL	0.2493***	0.1339***	0.3012***	0.1631***	0.0326	0.2476***
	(6.88)	(3.57)	(7.50)	(8.77)	(1.34)	(9.64)
MKT_PRICE	0.2269***	0.0733*	0.1518***	0.1548***	0.0277	0.1849***
	(5.53)	(1.69)	(3.77)	(8.06)	(1.04)	(7.05)

Internet Appendix 1. Risk perceptions and global liquidity

We delete the filter that requires a minimum of 10 daily observations and re-estimate the results in Table 4. The dependent variable is the monthly aggregate market liquidity measured by the Amihud (2002) value and closing percent quoted spread from Chung and Zhang (2014). Independent variables are as defined in Table 3. The liquidity measures, VIX, GDP per capita (GDP_PER_CAP), market capitalization (MKT_CAP), market volume (MKT_VOL), and market price level (MKT_PRICE) are natural log scaled. Standard errors are clustered by country. VW refers to the monthly market liquidity being value-weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

	Amihud VW		Spread VW	
	VIX	Control	VIX	Control
DEV_MKT (-)	0.7514***	-2.2095***	0.4581***	-0.9187***
	(8.50)	(-5.17)	(6.36)	(-4.09)
GDP_PER_CAP (-)	0.8230***	-0.8699***	0.4446***	-0.2690***
	(9.60)	(-5.56)	(5.97)	(-2.74)
TRADE_OPENNESS (-)	0.7945***	-0.0246	0.4788***	-0.0014
	(7.68)	(-0.11)	(6.91)	(-0.01)
SEGMENTATION (+)	0.6951***	3.5266	0.3128***	10.4897***
	(6.91)	(1.46)	(4.89)	(5.28)
INSTIT_OWNER (-)	0.7798***	-0.9253	0.4347***	-0.0050
	(6.22)	(-0.21)	(5.67)	(0.00)
GOVERNANCE (-)	0.9416***	-1.1668***	0.4797***	-0.4672***
	(12.74)	(-4.22)	(8.00)	(-3.26)
SHORT_SELLING (+)	0.8333***	1.8952***	0.4847***	0.7656**
	(8.45)	(3.90)	(6.79)	(2.10)
MKT_MAKER (-)	0.7500***	-1.1989**	0.4310***	-0.5813**
	(6.75)	(-2.39)	(6.00)	(-2.38)
GROWTH_VOLA (+)	0.7609***	0.5605***	0.4878***	0.2114**
	(7.80)	(3.63)	(6.99)	(2.45)
EXCHANGE_RATE (+)	0.8088***	4.7354***	0.4650***	1.1625***
	(6.62)	(4.90)	(5.49)	(2.69)
MKT_CAP (-)	0.6581***	-0.8329***	0.4226***	-0.3143***
	(9.86)	(-11.17)	(6.15)	(-6.81)
MKT_VOL (-)	0.9025***	-0.6307***	0.5157***	-0.2561***
	(10.82)	(-12.23)	(7.18)	(-6.61)
MKT_PRICE (-)	0.6223***	-0.5375***	0.4204***	-0.1637**
	(6.28)	(-3.78)	(6.17)	(-2.25)

Internet Appendix 2. Risk perceptions and global liquidity: multivariate analysis

This table presents the results for multivariate analysis. The dependent variable is the monthly aggregate market liquidity measured by the Amihud (2002) value in Panel A and the closing percent quoted spread from Chung and Zhang (2014) in Panel B. Independent variables are as defined in Table 3. The monthly Amihud (2002) and spread measures are value-weighted on market capitalization across individual stocks within a market. The liquidity measures, VIX, GDP per capita (GDP_PER_CAP), market capitalization (MKT_CAP), market volume (MKT_VOL), and market price level (MKT_PRICE) are natural log scaled. Standard errors are clustered by country. VW refers to the monthly market liquidity being value-weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

Panel A: Amihud VW

	Exp sign	(1)	(2)	(3)	(4)	(5)	(6)
Constant		-4.7136***	-3.9120***	0.6447	-5.8824***	1.2554	13.3671***
		(-6.20)	(-9.06)	(0.37)	(-6.02)	(1.48)	(3.36)
VIX	+	0.5049***	0.3438***	0.4598***	0.6034***	0.7107***	0.6328***
		(5.03)	(2.69)	(3.63)	(5.08)	(5.69)	(5.80)
DEV_MKT	-	-0.8927**	-1.0285***				
		(-2.21)	(-3.02)				
GDP_PER_CAP	-			-0.7144***			
				(-3.87)			
TRADE_OPENNESS	-	0.0679					
		(0.35)					
SEGMENTATION	+		8.2274	6.8719	10.0100	7.9623**	
			(1.44)	(1.40)	(1.61)	(2.63)	
INSTIT_OWNER	-						-4.0928
							(-0.72)
GOVERNANCE	-				-0.8083**		-0.7456**
					(-2.10)		(-2.09)
SHORT_SELLING	+	0.6607	0.5356				
		(1.58)	(1.19)				
MKT_MAKER	-					-0.2275	
						(-0.75)	
GROWTH_VOLA	+	0.1972		0.2434	0.2149		
		(1.17)		(1.61)	(0.98)		
EXCHANGE_RATE	+	2.7545***	2.8570***	2.2436***	1.6327**	1.3519*	0.4792
		(3.63)	(3.33)	(2.83)	(2.09)	(1.99)	(1.12)
MKT_CAP	-						-0.9231***
							(-4.43)
MKT_VOL	-					-0.6017***	
						(-7.64)	
MKT_PRICE	-	-0.2842**	-0.2480*			-0.1019	
		(-2.41)	(-1.92)			(-0.66)	
Number of countries		54	51	51	51	38	24
R-squared		0.3002	0.2862	0.3371	0.2335	0.5740	0.7058

Panel B: Spread VW	Exp sign	(1)	(2)	(3)	(4)	(5)	(6)
Constant		-5.5649***	-5.5903***	-4.4927***	-5.8874***	-3.6344***	-1.0413
		(-10.56)	(-22.47)	(-3.75)	(-13.95)	(-3.47)	(-0.83)
VIX	+	0.3745***	0.2490***	0.2415***	0.2930***	0.3479***	0.4680***
		(6.79)	(3.36)	(4.13)	(3.83)	(4.13)	(5.29)
DEV_MKT	-	-0.5972***	-0.5855***				
		(-2.73)	(-3.02)				
GDP_PER_CAP	-			-0.1469			
				(-1.36)			
TRADE_OPENNESS	-	-0.0357					
		(-0.40)					
SEGMENTATION	+		11.6420**	12.6137***	11.4730**	6.6631	
			(2.22)	(2.90)	(2.30)	(1.09)	
INSTIT_OWNER	-						-5.3687***
							(-3.18)
GOVERNANCE	-				-0.2619		-0.2926**
					(-1.49)		(-2.26)
SHORT_SELLING	+	0.1938	0.1288				
		(0.50)	(0.33)				
MKT_MAKER	-					-0.218	
						(-1.01)	
GROWTH_VOLA	+	0.0025		0.0195	0.0423		
		(0.02)		(0.20)	(0.38)		
EXCHANGE_RATE	+	0.3431	0.2217	0.3617	0.0833	0.2863	-0.3707
		(0.83)	(0.54)	(0.91)	(0.21)	(0.70)	(-1.21)
MKT_CAP	-						-0.2221***
							(-3.74)
MKT_VOL	-					-0.2041**	
						(-2.27)	
MKT_PRICE	-	0.0061	0.0274			0.076	
		(0.06)	(0.31)			(0.78)	
Number of countries		52	49	49	49	36	23
R-squared		0.1297	0.1637	0.1233	0.1392	0.2610	0.5135

Internet Appendix 3. Risk perceptions and global liquidity: two-way clustered standard errors

This table presents the results of panel regressions using two-way clustered standard errors. The dependent variable is the monthly aggregate market liquidity measured by the Amihud (2002) value and the closing percent quoted spread from Chung and Zhang (2014). Independent variables are as defined in Table 3. VW refers to the monthly market liquidity being value-weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

	Amihud VW		Spread VW	
	VIX	Control	VIX	Control
DEV_MKT (-)	0.6835***	-1.9780***	0.3996***	-0.7785***
	(7.79)	(-4.93)	(7.47)	(-3.79)
GDP_PER_CAP (-)	0.7324***	-0.8350***	0.3910***	-0.2312**
	(9.12)	(-5.59)	(7.74)	(-2.38)
TRADE_OPENNESS (-)	0.6958***	0.0266	0.4222***	-0.0295
	(7.34)	(0.12)	(8.66)	(-0.28)
SEGMENTATION (+)	0.4162***	15.3420**	0.2727***	11.0361***
	(4.02)	(2.48)	(4.34)	(3.37)
INSTIT_OWNER (-)	0.7104***	-1.0000003	0.4412***	-1.3386
	(5.70)	(-0.24)	(5.47)	(-0.94)
GOVERNANCE (-)	0.8732***	-1.0977***	0.4472***	-0.3863***
	(14.26)	(-3.84)	(9.15)	(-2.78)
SHORT_SELLING (+)	0.7450***	1.8131***	0.4241***	0.6806*
	(8.57)	(3.85)	(8.27)	(1.93)
MKT_MAKER (-)	0.6446***	-1.1140**	0.4001***	-0.4488*
	(6.57)	(-2.33)	(7.58)	(-1.95)
GROWTH_VOLA (+)	0.6928***	0.5674***	0.4236***	0.1766**
	(7.75)	(3.77)	(8.28)	(2.31)
EXCHANGE_RATE (+)	0.6883***	4.6002***	0.3833***	0.7741**
	(6.52)	(4.95)	(6.52)	(2.12)
MKT_CAP (-)	0.5506***	-0.7790***	0.3802***	-0.2550***
	(8.77)	(-11.71)	(7.23)	(-4.05)
MKT_VOL (-)	0.8605***	-0.6403***	0.4492***	-0.2384***
	(11.82)	(-13.21)	(9.12)	(-6.29)
MKT_PRICE (-)	0.5623***	-0.4960***	0.3753***	-0.1171*
	(7.39)	(-3.52)	(7.68)	(-1.68)

Internet Appendix 4. Risk perceptions and global liquidity: international VIX indices

We replace US VIX with 16 international VIX indices and re-estimate our panel regressions in Table 4. The dependent variable is the monthly aggregate market liquidity measured by the Amihud (2002) value and the closing percent quoted spread from Chung and Zhang (2014). Independent variables (except for VIX) are as defined in Table 3. VW refers to the monthly market liquidity being value-weighted. Numbers in parentheses are t-statistics. * = significance at the 10% level; ** = significance at the 5% level; *** = significance at the 1% level.

	Amihud VW		Spread VW	
	VIX	Control	VIX	Control
DEV_MKT (-)	1.2450***	-3.4111***	0.5755***	-0.8770**
	(8.38)	(-3.45)	(5.72)	(-2.73)
GDP_PER_CAP (-)	1.0249***	-1.5421***	0.4756***	-0.4841***
	(6.06)	(-5.72)	(5.77)	(-5.06)
TRADE_OPENNESS (-)	1.4788***	0.2545	0.5874***	-0.2773
	(6.41)	(0.60)	(4.57)	(-1.19)
SEGMENTATION (+)	0.9310**	42.2020	0.7542***	-8.4208
	(2.43)	(1.23)	(6.60)	(-1.01)
INSTIT_OWNER (-)	1.5175***	0.1274	0.6531***	-4.2366**
	(5.79)	(0.02)	(5.10)	(-2.25)
GOVERNANCE (-)	1.2957***	-1.7921***	0.6266***	-0.5710***
	(5.30)	(-3.16)	(7.27)	(-3.92)
SHORT_SELLING (+)	1.4935***	0.3596	0.6400***	0.0663
	(5.90)	(0.38)	(5.16)	(0.15)
MKT_MAKER (-)	1.2366***	-1.7647	0.6068***	-0.3313
	(5.45)	(-1.30)	(5.87)	(-0.81)
GROWTH_VOLA (+)	1.4415***	1.1079	0.6393***	0.0303
	(5.83)	(1.47)	(5.43)	(0.11)
EXCHANGE_RATE (+)	1.4376***	4.5522**	0.6406***	0.5870
	(3.75)	(2.63)	(3.75)	(1.20)
MKT_CAP (-)	1.0358***	-1.1062***	0.5949***	-0.0912
	(3.83)	(-4.92)	(5.96)	(-0.55)
MKT_VOL (-)	1.0878***	-0.8404***	0.5632***	-0.1680**
	(5.40)	(-4.64)	(6.42)	(-2.47)
MKT_PRICE (-)	1.1629***	-0.8654***	0.5331***	-0.2902***
	(5.48)	(-3.17)	(5.11)	(-3.58)