Market Volatility, Liquidity Shocks, and Stock Returns: Worldwide Evidence

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Abstract

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JEL Classification Codes: G12; G15; G18
Keywords: Market volatility, liquidity, returns, international stock markets

First Version: September 20, 2017
This Version: November 9, 2017

Acknowledgments: We thank Sean Foley, and the participants in the Massey University School of Economics and Finance Seminar Series for valuable comments. All errors are our own.

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Abstract

We examine the interaction between market volatility, liquidity shocks, and stock returns in 41 countries over the period 1990–2015. We find liquidity is an important channel through which market volatility affects stock returns in international markets and we show this is distinct from the direct volatility–return relation. The influence of the liquidity channel on the link between market volatility and returns is stronger in markets exhibiting higher levels of market volatility and lower trading volume. It is also stronger in countries with better governance, no short-selling constraints, and more high-frequency trading and during crisis periods.

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1. Introduction

We investigate how volatility, liquidity, and stock returns interact in international markets with diverse institutional environments. Chung and Chuwonganant (2017) find that market volatility affects returns directly, as well as indirectly, through stock liquidity, suggesting that liquidity providers play an important role in the market volatility–return relation in the United States. While an out-of-sample test in international markets is important (e.g., Amihud, Hameed, Kang, and Zhang, 2015; Brockman, Chung, and Perignon, 2009), our main motivation is to provide insights on which market attributes are associated with the impact of the liquidity channel linking volatility and returns, by exploiting the rich variation in institutional environments around the world. This issue is important, since many institutional factors, such as a country's governance (e.g., Chung, Kim, Park, and Sung, 2012), the degree of market segmentation (e.g., Bekaert, Harvey, and Lumsdaine, 2002), and the existence of market makers (e.g., Clark-Joseph, Ye, and Zi, 2017) and short-selling constraints (e.g., Beber and Pagano, 2013), influence the role of liquidity providers in global markets.

We contribute to several strands of literature. Earlier research on the role of liquidity in determining asset returns is typically focused on the United States (e.g., Acharya and Pedersen, 2005; Amihud and Mendelson, 1986); more recently, researchers have turned their attention to international markets. For example, Lee (2011) shows liquidity risks, as measured by the covariances of individual stock liquidity with market liquidity and returns, are priced factors around the world. Amihud, Hameed, Kang, and Zhang (2015) provide evidence of the pricing of stock liquidity level (as opposed to liquidity risks) in an international setting. We contribute to this literature on liquidity and asset pricing by documenting that liquidity is an important channel through which market volatility influences returns in a sample of 41 countries. Using the

methodology of Chung and Chuwonganant (2017) to measure market volatility and stock liquidity shocks, we begin our empirical tests with a portfolio-level analysis. Our double-sorted portfolio results verify that returns are more negative for stocks with greater liquidity sensitivity to market volatility when market volatility shocks are controlled. We group countries based on geographical regions[1] and show the average return differential between quintile portfolios of stocks with the highest (positive) liquidity shocks and stocks with the lowest (negative) liquidity shocks within a given region ranges from 0.80% to 6.02% per month, depending on the proxy to measure liquidity.

Using stock-level regressions for each market, we find the effects of market volatility shocks and stock liquidity shocks on stock returns remain intact, after controlling for various stock and market characteristics, such as stock idiosyncratic volatility, size, and market returns. We show the effects of liquidity shocks on returns are stronger than market volatility shocks. Moreover, our five-year sub-period regression results indicate the influence of the liquidity channel that links market volatility and stock returns is time varying.

We also add to the literature on how market-specific characteristics influence the role of liquidity on the volatility–return relation. As noted in Cespa and Foucault (2014) and Nagel (2012), liquidity is more likely to evaporate in times of market turmoil. Beber and Pagano (2013) show the impact of short-selling bans on liquidity is more pronounced in markets that are overrepresented by small stocks. In Ma, Anderson, and Marshall (2016), liquidity reacts more to market uncertainty in more developed markets with more trade openness, better governance, and no short-selling constraints. This strand of literature suggests that the sensitivity of liquidity and, accordingly, the influence of the liquidity channel on returns could vary, depending on various market characteristics across countries and over time. Following Chung and Chuwonganant

[1] Brockman, Chung, and Perignon (2009) use a similar approach.

(2017), we measure the indirect effect of volatility on returns through liquidity by computing the difference in monthly stock returns between stocks with liquidity shock values in the 75th and 25th percentiles, respectively, associated with a median market volatility shock. Overall, our results show country governance, a proxy for investor protection, is a key factor that determines the impact of the liquidity channel through which volatility affects returns. A one standard deviation increase in our country governance measure, on average, increases the impact of volatility on monthly stock returns though the liquidity channel by 0.66% when we measure liquidity based on the Amihud (2002) ratio and by 1.03% when liquidity is measured as the closing percent quoted spread of Chung and Zhang (2014). Given the evidence that better country governance leads to higher liquidity (e.g., Chung Kim, Park, and Sung, 2012) and a positive relation between governance and institutional ownership (e.g., Chung and Zhang, 2011), our finding is consistent with previous research (e.g., Manconi, Massa, and Yasuda, 2012) showing institutional investors liquidate liquid securities first when it is too costly to sell illiquid assets. We also provide evidence that the influence of the liquidity channel is greater in markets with a higher level of market volatility, lower trading volume, and no short-selling constraints. Moreover, we exploit changes in the institutional environment over time in subsets of countries and show that market volatility exerts a stronger impact on stock returns through liquidity during crisis periods, when high-frequency trading (HFT) is more active, and in the absence of market maker services. Our results are consistent with papers examining liquidity dry-ups during market turmoil and studies suggesting that the governance environment (e.g., Marshall, Nguyen, Nguyen, and Visaltanacoti, 2016) and market fictions, such as short-sales constraints, influence price and market efficiency (e.g., Bris, Goetzmann, and Zhu, 2007).

The remainder of the paper is organized as follows. Section 2 describes the data and our sample selection criteria. In Section 3, we discuss the liquidity and shocks measures and provide summary statistics. Section 4 presents our empirical results. We conclude the paper in Section 5.

2. Data

Our sample consists of all common stocks listed in 41 markets over the period from January 1990 to April 2015.[2] The markets are divided into 25 developed markets and 16 emerging markets, following the classification of Griffin, Kelly, and Nardari (2010). We further classify the developed and emerging markets based on their geographical regions. The developed markets group contains two American markets (N-America), seven Asia-Pacific markets (Asia-Pacific), and 16 European and Middle Eastern markets (European-ME). The emerging markets contain four Latin American markets (L-America), seven Asia-Pacific markets (Asia-Pacific), and five European, Middle Eastern, and African markets (Europe-MEA).

We obtain the daily total return index (RI), stock prices (P and UP), shares outstanding (NOSH), trading volume (VO), closing bid price (PB) and ask price (PA), historic stock beta (897E), and price-to-book values (PTBV) for all countries, except for the United States, from Thomson Reuters Datastream, with US data sourced from the Center for Research in Security Prices (CRSP). We collect stock data in US dollars to make our proxies and results comparable across countries (e.g., Fong, Holden, and Trzcinka, 2017). Following Amihud, Hameed, Kang, and Zhang (2015), we include only stocks traded in local currency and identified as equity and primary quotes on the main exchange(s) in each country. We use the generic and country-specific security name filters in Appendix B of Griffin, Kelly, and Nardari (2010) to eliminate

[2] The initial sample includes all countries from Griffin, Kelly, and Nardari (2010) for which we can source data. In addition, we require the stock data of a country to satisfy the data screens discussed in Sections 2 and 3.

non-common equity securities, such as preferred stocks and real estate investment trusts, for non-US markets. We use the leading stock exchange in each country, except for Japan, South Korea, and China, for which we use, respectively, the Osaka Securities Exchange and Tokyo Stock Exchange, the Korea Stock Exchange and KOSDAQ, and the Shanghai Stock Exchange and Shenzhen Stock Exchange. For the United States, we follow Karolyi, Lee, and van Dijk (2012) and include common stocks on the New York Stock Exchange only, because trading volume reported on NASDAQ is double counted and therefore overstated (Atkins and Dyl, 1997). We retain data on dead stocks to avoid survivorship bias.

We follow Ince and Porter (2006) to handle data errors in Datastream. In addition, we set the number of shares traded to missing if it is greater than total shares outstanding and we set the daily dollar volume to missing if it is below US$100. We further exclude non-trading days, defined as days on which more than 90% of stocks in a market have zero returns.

3. Measures and summary statistics

3.1 Measuring liquidity

We use the Amihud (2002) ratio as our main liquidity measure, which captures price changes per dollar volume, as in the following equation, where, following Karolyi, Lee, and van Dijk (2012), we use logarithms to make the distribution of *ILLIQ* close to normal and reduce the influence of outliers for international markets:

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

where $N_{i,t}$ is the number of trading days with a non-zero volume for stock i in month t; $|r_{i,d,t}|$ is the absolute value of the return in US dollars for stock i on day d in month t; and $vol_{i,d,t}$ is the trading volume in US dollars of stock i on day d in month t. We require each month to have at least 25 stocks with valid Amihud values for a given market.[3]

Fong, Holden, and Trzcinka (2017) show that the closing percent quoted spread of Chung and Zhang (2014) is the best low-frequency liquidity proxy to capture changes in effective and quoted spreads. Our second liquidity measure is therefore the closing percent quoted spread, calculated as follows:

$$SPREAD_{i,t} = \frac{1}{N_{i,t}} \sum_{d=1}^{N_{i,t}} \frac{Ask_{i,d,t} - Bid_{i,d,t}}{M_{i,d,t}} \quad (2)$$

where, for stock i, $N_{i,t}$ is the number of trading days with valid closing spreads in month t, $Ask_{i,d}$ is the closing ask price on day d, $Bid_{i,d}$ is the closing bid price on day d, and $M_{i,d}$ is the mean of $Ask_{i,d}$ and $Bid_{i,d}$. When constructing monthly spread values, we exclude negative daily closing spreads and closing spreads that are greater than 50% of the quote midpoint.

3.2 Measuring shocks

We follow Chung and Chuwonganant (2017) and measure market volatility and individual stock liquidity shocks as unexpected changes in market volatility and stock liquidity, respectively, as follows:

$$VOLASHOCK_t = (MKTVOLA_t - AVGVOLA_{t-12,\,t-1})/AVGVOLA_{t-12,\,t-1} \quad (3)$$

[3] We need sufficient numbers of stocks to construct portfolios, as described in Section 4.1. Similarly, we require a minimum of 25 stocks in a given month when computing the spread measure.

$$AMISHOCK_{i,t} = -(ILLIQ_{i,t} - AVGILLIQ_{i|t-12,t-1})/AVGILLIQ_{i|t-12,t-1} \quad (4)$$

$$SPRSHOCK_{i,t} = -(SPREAD_{i,t} - AVGSPR_{i|t-12,t-1})/AVGSPR_{i|t-12,t-1} \quad (5)$$

where $MKTVOLA_t$ is the standard deviation of daily value-weighted market returns in month t;[4] $AVGVOLA_{t-12,\ t-1}$ is the average of $MKTVOLA_t$ from months t - 12 to t - 1; $ILLIQ_{i,t}$ is the log-transformed Amihud ratio, *ILLIQ*, for stock i in month t; $AVGILLIQ_{i|t-12,t-1}$ is the average of *ILLIQ* for stock i from months t - 12 to t - 1; $SPREAD_{i,t}$ is the closing percent quoted spread for stock i in month t; and $AVGSPR_{i|t-12,t-1}$ is the average monthly spread value for stock i from months t - 12 to t - 1.

We require at least six months' data over the past 12 months to measure shocks in market volatility and stock liquidity (*VOLASHOCK*, *AMISHOCK*, and *SPRSHOCK*) and we drop the stock–month observations with the top and bottom 1% of *AMISHOCK* and *SPRSHOCK* values for each market. A positive *VOLASHOCK* value indicates an increase in market volatility (*MKTVOLA*) relative to its mean in the past 12 months. Positive *AMISHOCK* and *SPRSHOCK* values indicate an increase in stock liquidity (a decrease in *ILLIQ* and *SPREAD*), since multiplication by -1 of *AMISHOCK* and *SPRSHOCK* converts the interpretation of illiquidity to liquidity.

Table 1 presents summary statistics for 37,677 unique stocks, 27,601 in developed markets and 10,076 in emerging markets, over the period 1990–2015. The number of stocks for each market is between 94 for Peru and 5,055 for the United States.[5] The mean (median)

[4] Our monthly market volatility measure is realized market volatility, while Chung and Chuwonganant (2017) use the Chicago Board Options Exchange Volatility Index (VIX) for the US market. While VIX-like measures have been recently calculated for international markets, using realized market volatility allows us to capture more sample countries over a longer time span. The correlation between VIX and the US realized market volatility is as high as 0.8855 for our full sample period. We plot the monthly VIX and the US realized market volatility in Figure 1.

[5] We initially follow Lee (2011) in excluding any country with fewer than 100 stocks. To ensure that our core results can represent the full sample period, we also require each country to have at least 100 months with valid data. We

VOLASHOCK, *AMISHOCK*, and *SPRSHOCK* values for developed markets are 0.0184 (0.0208), -0.0018 (0.0021), and 0.0041 (0.0041), respectively, while the corresponding values for emerging markets are 0.0109 (0.0091), -0.0083 (-0.0126), and -0.0028 (-0.0044), suggesting stocks in developed markets, on average, experience increasing liquidity over our sample period. Developed market stocks also exhibit lower returns and idiosyncratic volatility and higher prices and trading value.

[Insert Table 1 Here]

4. Results

4.1 Univariate and bivariate portfolio analysis

We first show the effects of market volatility shocks on individual stock returns and liquidity using univariate portfolio sorts. For each market, we sort stocks on market volatility shocks (*VOLASHOCK*) in each month into five portfolios. We then calculate the average return (*RETURN*) and liquidity shocks (*AMISHOCK* and *SPRSHOCK*) for each portfolio. In Table 2, we present the cross-market means of portfolio returns and liquidity shocks within each region. We show, across the six geographical regions, the average monthly portfolio returns decrease with the increase in market volatility. For example, in the Europe-ME region, the average monthly return declines from 2.60% for the lowest volatility shock portfolio to -2.29% for the highest volatility shock portfolio, the difference of 4.88% indicating an economically meaningful return difference. The return differences between the highest and lowest volatility shock portfolios are statistically significant in all 25 (25) developed markets and 11 (10) out of 16 emerging markets in our sample at the 0.10 (0.05) level. Both measures of liquidity shock show

include Peru to include as many countries as possible, whereas, for other countries dropped from our sample, the number of stocks is well under 100. The inclusion or exclusion of Peru, however, does not change the overall results.

that the liquidity of higher volatility shock portfolios is significantly lower. Overall, developed market returns and liquidity react more to market volatility shocks.

[Insert Table 2 Here]

In Figure 2, we depict the average monthly portfolio returns, *AMISHOCK*, and *SPRSHOCK* across *VOLASHOCK* quintiles for all sample countries and for developed and emerging markets. Both stock returns and liquidity decrease more in the highest *VOLASHOCK* quintile compared to the other four quintiles, suggesting the effects of volatility on returns is likely to be stronger during periods of extreme uncertainty.

[Insert Figure 2 Here]

We next examine whether the impact of market volatility on stock returns is stronger for stocks with greater liquidity sensitivity to market volatility shocks. We perform conditional bivariate sorts on market volatility shock and stock liquidity shock by sorting the stocks in each *VOLASHOCK* quintile into five portfolios based on the liquidity shocks of individual stocks in each month. We then calculate the mean returns of the 25 portfolios double sorted on volatility and liquidity shocks. Table 3 reports the cross-market means within each region for the 25 portfolio returns, with liquidity shock measured by *AMISHOCK*. Consistent with the US evidence in Chung and Chuwonganant (2017), our international results indicate that returns are lower for stocks with more negative liquidity shocks, when controlling for market volatility shocks. We also report the percentage of markets within a region for which the return differential between portfolios of stocks with the highest liquidity shocks (Quintile 5) and stocks with the lowest liquidity shocks (Quintile 1) is positive and significant at the 0.10 and 0.05 levels, respectively. For instance, according to the Europe-ME results in Panel A2, within each *VOLASHOCK* quintile, the raw return difference between the highest and lowest *AMISHOCK*

quintiles, ranging from 5.23% to 6.01%, is consistently significant at the 0.05 level for all European and Middle Eastern markets. Table 4 presents similar results when we measure liquidity by the closing spread. Consistent with our univariate portfolio analysis in Table 2, we find more significant results for developed markets.

[Insert Tables 3 and 4 Here]

4.2 Multivariate regression models and results

In addition to the portfolio-level analysis, we examine the effects of volatility and liquidity shocks on stock-level returns to determine whether the impact of market volatility and liquidity shocks on stock returns remains intact after controlling for other stock and market characteristics. Following the model specification of Chung and Chuwonganant (2017), we run the following regression to examine the effects of volatility and liquidity shocks on stock returns for each market:

$$\begin{aligned} RETURN_{i,t} &= \beta_0 + \beta_1 VOLASHOCK_t + \beta_2 (AMISHOCK_{i,t} \text{ or } SPRSHOCK_{i,t}) \\ &+ \beta_3 VOLASHOCK_t \times (AMISHOCK_{i,t} \text{ or } SPRSHOCK_{i,t}) \\ &+ \beta_4 IVOSHOCK_{i,t} + \beta_5 DVOLSHOCK_{i,t} + \beta_6 MKTRET_t \\ &+ \beta_7 (MKTAMISHOCK_t \text{ or } MKTSPRSHOCK_t) + \beta_8 BETA_{i,t} \\ &+ \beta_9 \log(SMKTCAP_{i,t}) + \beta_{10} MAXRET_{i,t} + \beta_{11} REVISE_{i,t} + \beta_{12} MOMENT_{i,t} \\ &+ \beta_{13} STDTO_{i,t} + \beta_{14} BVTOPRI_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (6)$$

where $RETURN_{i,t}$ is the raw monthly return of stock i in month t; $IVOSHOCK_{i,t}$ and $DVOLSHOCK_{i,t}$ are, respectively, shocks in idiosyncratic volatility, estimated from the market model as in Bali and Cakici (2008), and the dollar trading volume of stock i in month t; $MKTRET_t$ is the value-weighted market return in month t; $MKTAMISHOCK_t$ and

$MKTSPRSHOCK_t$ are market liquidity shocks in month t; $BETA_{i,t}$ is the stock beta of stock i in month t; $SMKTCAP_{i,t}$ is the market capitalization, in million dollars, of stock i in month t; $MAXRET_{i,t}$ is the maximum daily return for stock i in month t - 1; $REVISE_{i,t}$ is the return for stock i in month t - 1; $MOMENT_{i,t}$ is the cumulative return of stock i over months t - 12 to t-2; $STDTO_{i,t}$ is the standard deviation of the monthly turnover over the past 12 months for stock i in month t; and $BVTOPRI_{i,t}$ is the ratio of the book value to price for stock i in month t.[6] Standard errors are clustered by both stock and month, as suggested in Petersen (2009). More detailed descriptions of the variables and data sources are given in Panel A of Appendix 1.

[Insert Tables 5 and 6 Here]

Tables 5 and 6 report regression results based on *AMISHOCK* and *SPRSHOCK*, respectively. We show that, when other stock and market characteristics are controlled for, stock liquidity shocks exert a stronger impact on stock returns than market volatility shocks do across international markets. We find positively significant coefficients for the interaction term between volatility and liquidity shocks for a number of countries, such as South Korea, Denmark, and France, suggesting the effects of market volatility are greater for stocks with a larger negative contemporaneous liquidity shock in these countries. However, the interaction term is not consistently significant across markets. Overall, we find market volatility exerts a stronger impact on stocks with larger liquidity shocks in the great majority of global markets. Our results are unlikely to be driven by reverse causality from returns to volatility, because our volatility measure measures shocks in aggregate market volatility. The causal direction is more likely from aggregate market volatility to stock returns rather than from stock returns to aggregate volatility (e.g., Ang, Hodrick, Xing, and Zhang, 2006).

[6] Five emerging countries (India, Egypt, Poland, Romania, and Mexico) have insufficient data for the variable *BVTOPRI*, so we exclude it from the regressions for these countries. The book-to-market ratios are not available from the CRSP; we therefore exclude this variable from the regression for the United States.

We then aggregate individual country regression results into regions in Table 7. Below the mean coefficients for each region, we also report the mean t-values, along with the percentage of markets for which the corresponding variable is statistically significant at the 0.10 and 0.05 levels, with the expected sign. The aggregate developed and emerging market results are similar when we measure liquidity using the Amihud ratio, while the emerging markets results are less significant when liquidity is measured using the spread.

[Insert Table 7 Here]

We re-estimate our regression results by five-year sub-periods to explore whether regression estimates of interest change over time. In Chung and Chuwonganant (2017, p. 5), β_2 and β_3 from Equation (6) are the two coefficients associated with "the additional effect of volatility shock on stock returns that operates through its effect on liquidity". We present the global mean and median regression estimates β_2 and β_3 by period in Panel A of Table 8 and plot the estimated coefficients β_2 and β_3 in Figure 3. We find the global average of β_3, ranging from -0.0062 (-0.0234) to 0.0185 (0.0071) when we use the Amihud (spread) liquidity measure, peaks in sub-period 4, while β_2 remains relatively stable over time. According to our calculation, the average absolute percentage changes in β_2 and β_3 are 0.1382 (0.3285) and 2.6920 (2.7065), respectively, based on the Amihud (spread) value, indicating that β_3 exhibits much higher volatility over time.

In Panel B of Table 8, we find that the differences in the mean and median β_3 values between sub-period 4 and the other four sub-periods are significantly positive. In addition, we show β_3 per se is significantly different from zero in row 5. The evidence of a significantly higher β_3 in sub-period 4, which covers the 2007–2009 global financial crisis, suggests the effects of market volatility on stock returns through liquidity providers is likely to be positively

related to the level of market volatility. Consistent with Nagel (2012), our finding highlights the heightened importance of liquidity providers on stock returns during periods of high uncertainty.

[Insert Table 8 and Figure 3 Here]

4.3 Market attributes and the role of liquidity providers

Our results in Sections 4.1 and 4.2 indicate that liquidity is an important channel through which market volatility affects returns at both the portfolio and stock levels across regions in international markets and the influence of the liquidity channel is likely to be stronger during crisis periods. We now investigate which market attributes affect the influence of the liquidity channel.[7]

We begin our analysis with a two-step process. In the first step, we collect five-year sub-periods' estimates of β_2 and β_3 for each market from Section 4.2. Following Chung and Chuwonganant (2017), we compute the indirect effect of market volatility shock on stock returns through the liquidity channel as the return difference between stocks with the 75th and 25th liquidity shock percentiles, respectively, associated with the median market volatility shock for country c in sub-period s: $\lambda_{c,s} = (\beta_{2,c,s} + \beta_{3,c,s}VOLASHOCK_{50,c,s})(LIQSHOCK_{75,c,s} - LIQSHOCK_{25,c,s})$, where $\beta_{2,c,s}$ and $\beta_{3,c,s}$ are the β_2 and β_3 estimates, respectively, of country c over sub-period s, according to Equation (6); $VOLASHOCK_{50,c,s}$ is the median *VOLASHOCK* value for country c in sub-period s; and $LIQSHOCK_{75,c,s}$ and $LIQSHOCK_{25,c,s}$ are the 75th and 25th liquidity shock percentile values, measured by either *AMISHOCK* or *SPRSHOCK*, for country c in sub-period s.

In the second step, we estimate the following regression, with standard errors clustered by country and sub-period:

[7] We use the term *impact of the liquidity channel* to refer to the impact of market volatility on stock returns through the liquidity channel hereafter.

$$\lambda_{c,s} = \pi_0 + \pi_1 Attributes_{c,s} + \varepsilon_{c,s} \quad (7)$$

where $Attributes_{c,s}$ represents a set of market attributes varying across countries and over time.[8] The market attributes we investigate include the level of market volatility (*MKTVOLA*), the market trading volume (*MKTDVOL*), market capitalization (*MKTCAP*), the country's governance environment (*GOVERNANCE*), the country's economic development (*GDP_PER_CAP*), its equity market development (*DEVELOPMENT*), its trade openness (*OPENNESS*), equity market segmentation (*SEGMENTATION*), and the presence of short sellers (*SHORT_SELLING*) and market makers (*MKT_MAKER*). For each country, we calculate the mean values of *MKTVOLA*, *MKTDVOL*, *MKTCAP*, *GOVERNANCE*, *GDP_PER_CAP*, *DEVELOPMENT*, *OPENNESS*, *SEGMENTATION*, *SHORT_SELLING*, and *MKTMAKER* over each five-year sub-period. More detailed descriptions of our market attribute variables are contained in Panel B of Appendix 1.

Studies suggest that liquidity is most needed and therefore valued during market downturns and times of high uncertainty (e.g., Nagel, 2012; Rosch and Kaserer, 2013). In Section 4.2, we show the β_3 estimate is significantly higher in sub-period 4, which coincides with the global financial crisis. We therefore expect the liquidity channel to play a more important role when market volatility is higher. Prior research also provides evidence that more developed markets facilitate trading activity and incorporate market innovations into stock prices more efficiently (e.g., Claessens, Klingebiel, and Schmukler, 2006; Marshall, Nguyen, Nguyen, and Visaltanachoti, 2016). Our second hypothesis, therefore, is that market volatility exerts a greater impact on returns through the liquidity channel in more developed markets characterized by features such as better governance and a higher gross domestic product per capita.

[8] If we add a time trend to Equation (7), the results are similar.

In Bris, Goetzmann, and Zhu (2007), stock prices impound negative information faster when short selling is practiced. We conjecture that short-selling constraints create frictions and impede the liquidity channel to convey the negative effects of market volatility. We therefore expect the impact of the liquidity channel to be stronger when short selling is allowed. As noted in Chung and Chuwonganant (2014), the decreased role of designated market makers leads to increased sensitivity of liquidity to market uncertainty in the United States. Thus, we hypothesize that, in the absence of market makers, the influence of the liquidity channel is stronger.

Table 9 presents the estimation results for Equation (7). In Models [1]–[10], we include one of our market attribute variables as the explanatory variable to avoid potential multicollinearity.[9] We find market volatility and the dollar volume have a significant influence on the liquidity channel. In Model [11], we include both market volatility and the market dollar volume and the variables remain significant, suggesting that the impact of the liquidity channel is stronger when markets are more volatile and in markets with a lower trading volume. Panel B presents the results based on the spread measure. The results are consistent with our hypothesis that the liquidity channel plays a more significant role in markets with better governance, often used as a proxy for investor protection, since information is impounded in these countries more efficiently. In the final column, we include all market attributes as independent variables. We show country governance is significant across both liquidity measures and find an increase of 0.66% (1.03%) in the return difference between stocks with the 75th and 25th percentile values of *AMISHOCK* (*SPRSHOCK*) for a one standard deviation increase in our governance measure. We therefore conclude that country governance is a key determinant of the influence of liquidity

[9] Appendix 2 shows the correlation matrix of the independent variables for Equation (7). In Appendix 3, as robustness checks, we also run regressions on combinations of market attributes with pairwise correlations lower than 0.50.

providers. There is also evidence of a lower impact of the liquidity channel in the presence of the short-selling constraints in Panel A.

[Insert Table 9 Here]

The measured effects in Table 9 stemming from both the time-series and cross-sectional dimensions show no significant influence of market makers. We therefore follow an approach similar to that in Chung and Chuwonganant (2017) and, in Appendix 4, test whether the influence of market makers is more time series based. Exploiting the introduction of market maker services in seven international markets (Austria, Israel, Norway, Sweden, Singapore, South Korea, and Turkey), a reverse process of US regulatory changes that reduced market makers' obligations, we show reduced effects of the liquidity channel in the presence of market makers.

4.4 Impact of the 2007–2009 crisis

Given the large body of research suggesting that liquidity can easily dry up and the impact of liquidity shocks can be magnified during financial turmoil (e.g., Cespa and Foucault, 2014; Dow and Han, 2017), we conjecture that the sensitivity of stock returns to market volatility increases during crisis periods due to the increased sensitivity of stock liquidity to market volatility. We use sub-period 4 from Section 4.2 and estimate the following regression to directly examine the impact of crisis periods:

$$\begin{aligned} RETURN_{i,t} &= \beta_0 + \beta_1 VOLASHOCK_t + \beta_2 (AMISHOCK_{i,t} \text{ or } SPRSHOCK_{i,t}) \\ &+ \beta_3 VOLASHOCK_t \times (AMISHOCK_{i,t} \text{ or } SPRSHOCK_{i,t}) \\ &+ \beta_4 VOLASHOCK_t \times (AMISHOCK_{i,t} \text{ or } SPRSHOCK_{i,t}) \times CRISIS \\ &+ Controls + \varepsilon_{i,t} \end{aligned} \quad (8)$$

where *CRISIS* is a dummy variable set to one for the years 2007–2009 and zero for 2005–2006. The control variables are the same as in Equation (6).

We report the regression results based on the Amihud measure in Table 10. Our finding is consistent with the sub-period results in Table 8 and our results on the link between market attributes and the liquidity channel in Table 9. The coefficient of the interaction term $VOLASHOCK_t \times AMISHOCK_{i,t} \times CRISIS$ indicates that, in 16 out of 41 countries, the impact of volatility on returns through stock liquidity significantly increases during the crisis period. Table 11 reports similar results for the spread measure.

[Insert Tables 10-11 Here]

4.5 Impact of HFT

The presence of high-frequency traders tends to exacerbate the effects of market volatility and increases liquidity sensitivity to market volatility (e.g., Chung and Chuwonganant, 2014). Chung and Chuwonganant (2017) use 2005 and 2009 as pre- and post-periods to test the effects of increased HFT.[10] We extend their work in an international setting. We use the introduction of the Chi-X trading platforms in 15 countries documented in He, Jarnecic, and Liu (2015) as exogenous shocks to HFT and examine whether the volatility–liquidity effect on return is stronger following the introduction of Chi-X. For each of the 15 markets, we use one-year pre- and post-event windows. The regression model is of the form

$$\begin{aligned} RETURN_{i,t} &= \beta_0 + \beta_1 VOLASHOCK_t + \beta_2 (AMISHOCK_{i,t} \text{ or } SPRSHOCK_{i,t}) \\ &+ \beta_3 VOLASHOCK_t \times (AMISHOCK_{i,t} \text{ or } SPRSHOCK_{i,t}) \\ &+ \beta_4 VOLASHOCK_t \times (AMISHOCK_{i,t} \text{ or } SPRSHOCK_{i,t}) \times CHIX \end{aligned}$$

[10] Chung and Chuwonganant (2017) use the 1999–2005 period as the pre-HFT period and 2006–2012 as the post-HFT period for robustness checks.

$$+ Controls + \varepsilon_{i,t} \quad (9)$$

where *CHIX* is a dummy variable set to one for the one-year period following the launch of Chi-X and the control variables are the same as in Equation (6). If the Chi-X launch date is between 2007 and 2009 (crisis period), we use 2006 and 2010 as the pre- and post-periods, respectively.

[Insert Table 12 Here]

In Table 12, we show the interaction term $VOLASHOCK_t$ × ($AMISHOCK_{i,t}$ or $SPRSHOCK_{i,t}$) × *CHIX* is statistically significant for six (four) out of 15 countries when we measure liquidity based on the Amihud (spread) value. Consistent with prior literature on high-frequency traders exacerbating downward movements in prices as well as evidence that HFT facilitates price discovery (e.g., Brogaard, Hendershott, and Riordan, 2014; Easley, Lopez de Prado, and O'Hara, 2011), our results indicate the negative effects of unexpected market volatility shocks on returns through the liquidity channel are magnified when there is more HFT.

5. Conclusions

Volatility, liquidity, and returns are of importance to market participants and regulators. We use 37,677 stocks in 41 markets to document that liquidity is a key channel through which unexpected changes in market volatility affect stock returns and highlight the importance of liquidity providers in determining security returns. More importantly, we answer the question of whether market-specific characteristics affect the influence of the liquidity channel through which market volatility affects returns.

In Chung and Chuwonganant (2017), market volatility affects stock returns directly, as well as indirectly, through liquidity, in the US markets. Using an approach similar to that in Chung and Chuwonganant (2017), we show, across six geographical regions around the globe,

that returns are significantly lower for stocks with greater liquidity sensitivity to market volatility, after controlling for other stock- and market-level determinants of stock returns, such as stock idiosyncratic volatility, trading volume, stock past returns, market returns, and market liquidity.

Overall, our results indicate country governance, as a proxy for investor protection, is a key determinant of the role of the liquidity channel. Our results also show market volatility exerts stronger effects on returns via liquidity when the level of market volatility is higher and in markets with lower trading value and no short-selling constraints. In addition, we find that the influence of this liquidity channel that links market volatility and returns is greater during the crisis period and when there are no market makers as intermediaries and more HFT.

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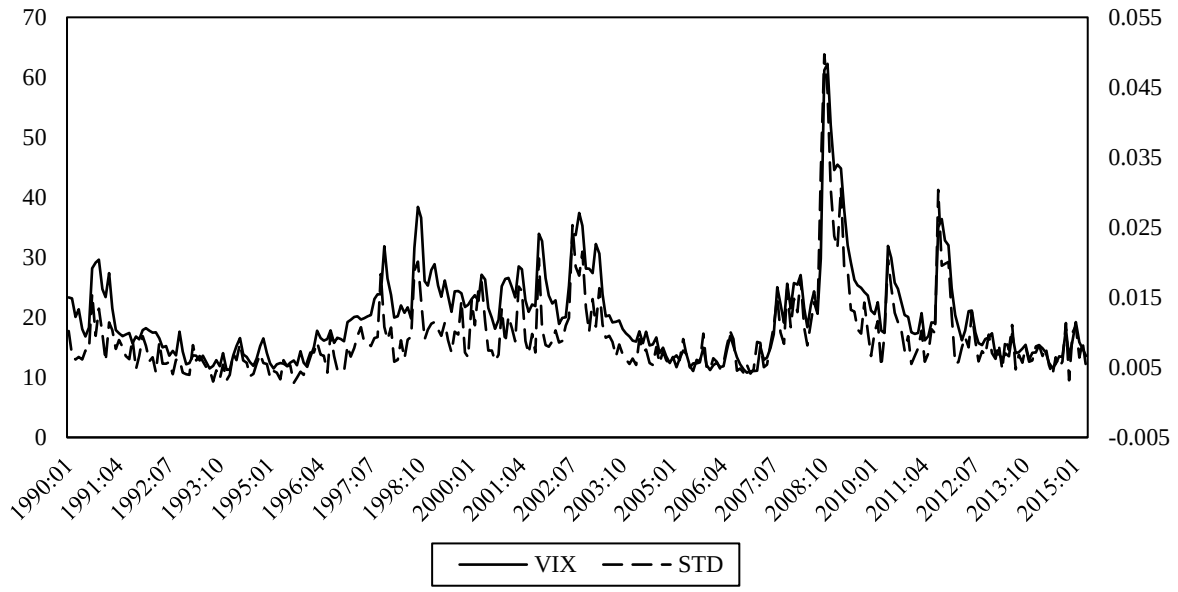
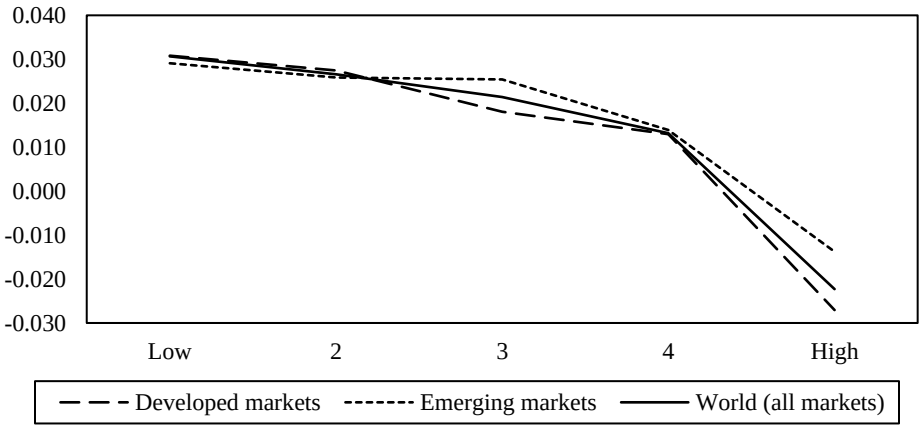
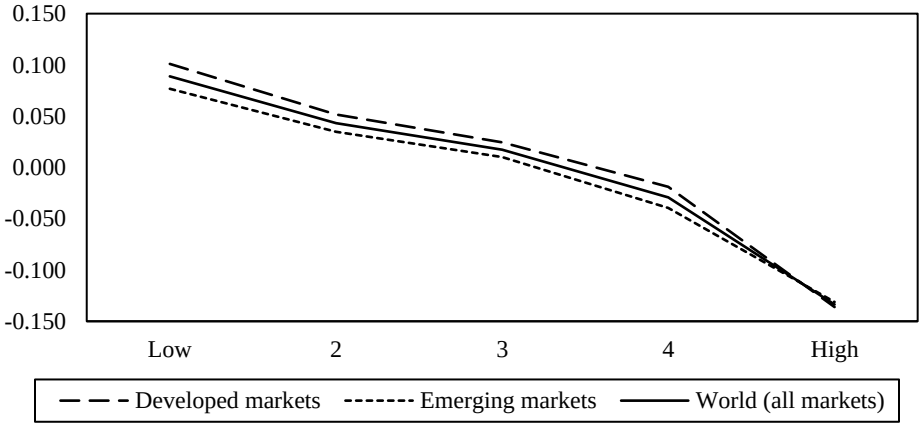


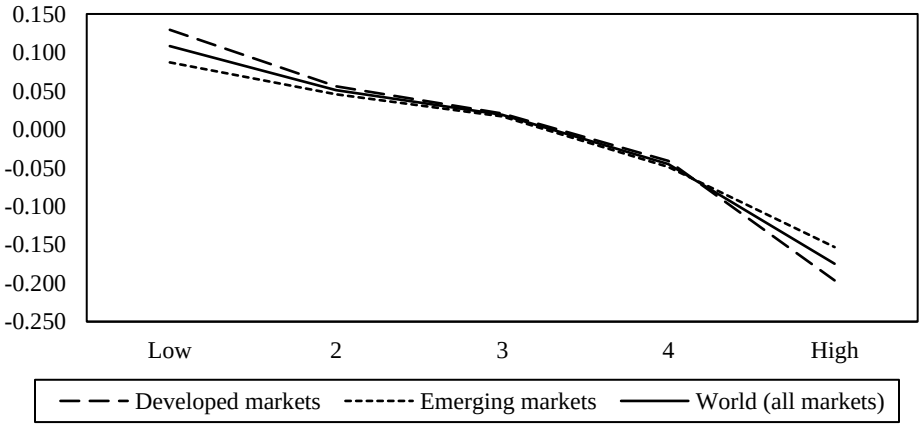
Figure 1. Monthly VIX and realized volatility levels. This figure presents the time series of monthly VIX levels, calculated as the average daily VIX level in a month, and the monthly realized market volatility, defined as the standard deviation of daily value-weighted market returns in a month.



(a) *RETURN*

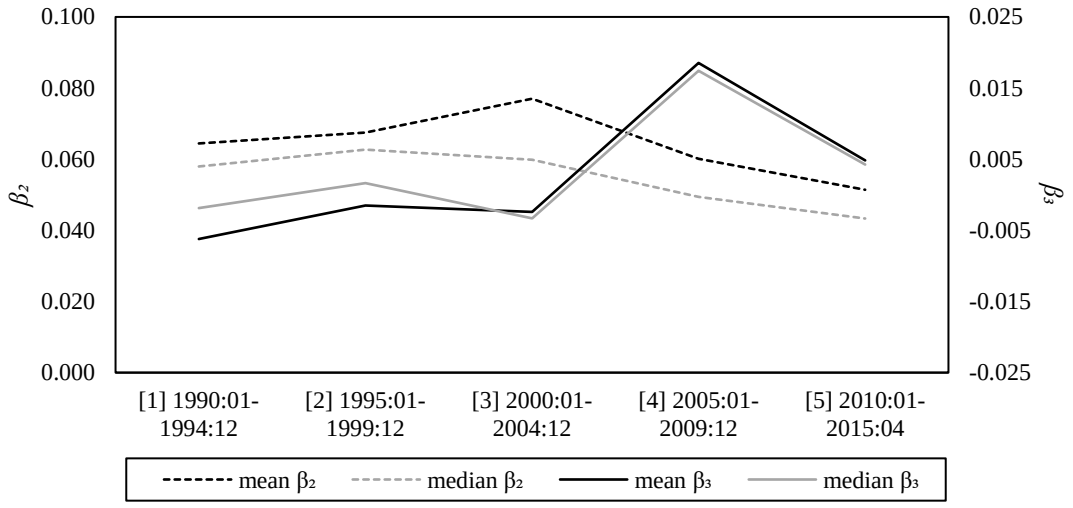


(b) *AMISHOCK*

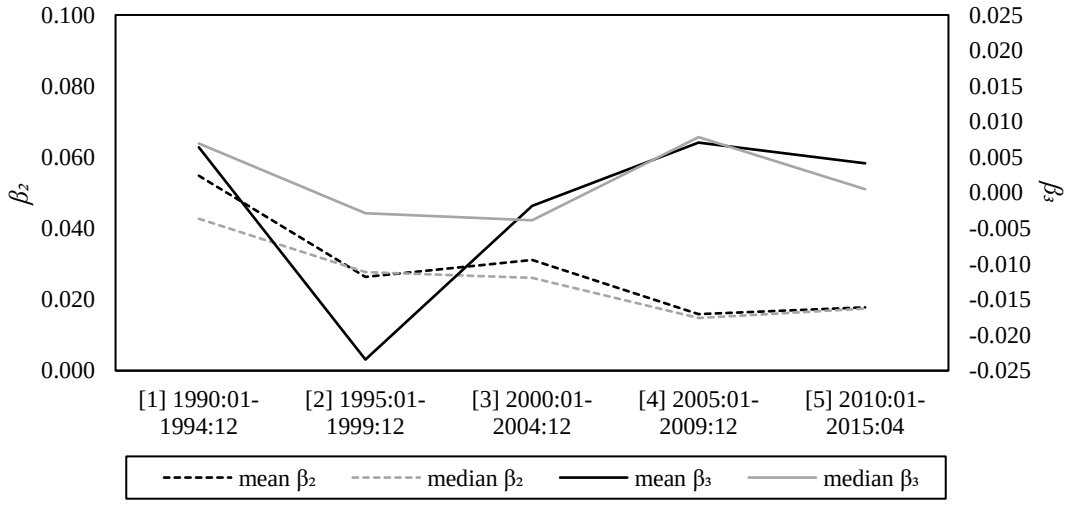


(c) *SPRSHOCK*

Figure 2. Monthly returns and liquidity shocks across *VOLASHOCK* quintiles. For each market, we sort stocks on market volatility shocks in each month into five portfolios and then calculate the average return (*RETURN*) and liquidity shocks (*AMISHOCK* and *SPRSHOCK*) for each portfolio. This figure presents the average monthly portfolio returns, *AMISHOCK*, and *SPRSHOCK* across *VOLASHOCK* quintiles for all sample countries and for developed and emerging markets.



(a) *AMISHOCK*



(b) *SPRSHOCK*

Figure 3. Estimated beta coefficients over five-year sub-periods. We re-estimate our regression according to Equation (6) by five-year sub-periods to explore whether regression estimates of interest change over time. This figure plots the global mean and median regression estimates β_2 and β_3 by time period.

Table 1
Summary statistics.
This table presents summary statistics for 37,677 stocks listed in 41 markets over the period January 1990 to April 2015. The markets are divided into 25 developed markets and 16 emerging markets, following the classification of Griffin, Kelly, and Nardari (2010). The first four columns present the geographic region, the starting month, the number of months with valid observations, and the number of unique stocks for each market. The next three columns present the average monthly market volatility shock and stock liquidity shock. Stock liquidity in a given month is measured by the Amihud (2002) ratio and the closing percent quoted spread from Chung and Zhang (2014). The final columns present the average monthly stock returns, prices in US dollars, trading values, and idiosyncratic volatility.

	Region	Starting month	No. of months	No. of unique stocks	VOLASHOCK	AMISHOCK	SPRSHOCK	Return	Price (US$)	Volume (US$ million)	Volatility
Panel A: Developed Markets											
Australia	Asia-Pacific	1990:07	297	2331	0.0284	0.0078	-0.0184	0.0135	2.46	19.5839	0.0424
Hong Kong	Asia-Pacific	1990:07	298	1583	0.0085	-0.0060	0.0012	0.0199	1.55	33.3786	0.0321
Japan	Asia-Pacific	1990:07	298	3475	0.0079	0.0084	0.0490	0.0066	12.04	56.1454	0.0242
New Zealand	Asia-Pacific	2001:02	171	157	0.0006	0.0094	0.0059	0.0124	1.53	6.6681	0.0211
Singapore	Asia-Pacific	1999:10	187	696	-0.0054	-0.0425	-0.0073	0.0121	0.63	15.2142	0.0305
South Korea	Asia-Pacific	1990:07	298	2132	0.0009	0.0187	0.0190	0.0213	28.04	46.2710	0.0464
Taiwan	Asia-Pacific	1991:11	282	972	-0.0100	-0.0225	0.0074	0.0125	0.87	70.2952	0.0206
Austria	Europe-ME	1990:08	297	153	0.0068	-0.0248	0.0233	0.0063	39.69	31.4346	0.0179
Belgium	Europe-ME	1995:06	239	171	0.0322	0.0040	-0.0162	0.0082	60.25	41.4975	0.0196
Denmark	Europe-ME	1992:04	236	283	0.0408	0.0033	0.0222	0.0084	32.83	27.8286	0.0224
Finland	Europe-ME	1995:02	243	189	0.0104	0.0087	0.0287	0.0120	10.41	55.6415	0.0225
France	Europe-ME	1992:01	280	1227	0.0260	0.0050	0.0041	0.0099	38.60	83.4317	0.0241
Germany	Europe-ME	1990:08	269	989	0.0271	-0.0390	-0.0186	0.0048	24.12	3.5191	0.0329
Greece	Europe-ME	1990:07	297	375	0.0285	-0.0435	-0.0734	0.0068	6.27	9.7029	0.0277
Israel	Europe-ME	1993:08	261	460	0.0100	0.0008	0.0007	0.0147	14.65	6.4566	0.0229
Italy	Europe-ME	1994:06	149	395	0.0204	-0.0004	-0.0223	0.0062	8.65	132.8661	0.0198
Netherlands	Europe-ME	1990:07	298	241	0.0292	-0.0004	0.0055	0.0089	23.95	220.6272	0.0210
Norway	Europe-ME	1990:07	298	433	0.0342	-0.0063	-0.0014	0.0106	11.62	44.8422	0.0282
Portugal	Europe-ME	1994:04	253	106	0.0399	-0.0250	-0.0066	0.0077	5.36	33.6334	0.0197
Spain	Europe-ME	1990:08	297	237	0.0218	-0.0027	0.0005	0.0087	12.87	188.3816	0.0188
Sweden	Europe-ME	1990:07	298	755	0.0202	0.0196	0.0520	0.0122	7.75	51.5587	0.0287
Switzerland	Europe-ME	1990:11	294	363	0.0077	0.0229	0.0272	0.0121	199.71	157.7676	0.0184
United Kingdom	Europe-ME	1990:07	298	3162	0.0208	0.0021	0.0184	0.0094	4.15	77.3885	0.0238
Canada	N-America	1990:07	298	1661	0.0297	0.0227	-0.0335	0.0169	7.99	35.1410	0.0341
United States	N-America	1990:07	298	5055	0.0226	0.0360	0.0342	0.0121	20.61	395.9326	0.0242
Mean			269	1104	0.0184	-0.0018	0.0041	0.0110	23.07	73.8083	0.0257
Median			297	460	0.0208	0.0021	0.0041	0.0106	11.62	44.8422	0.0238

Panel B: Emerging Markets											
China	Asia-Pacific	1993:06	262	2497	0.0068	0.0366	-0.0112	0.0197	1.12	179.9139	0.0211
India	Asia-Pacific	1995:12	233	2283	0.0112	-0.0115	-0.0189	0.0214	1.06	0.3009	0.0397
Malaysia	Asia-Pacific	1990:07	298	1072	0.0238	-0.0213	0.0066	0.0109	0.59	6.1278	0.0260
Pakistan	Asia-Pacific	1993:02	264	211	0.0024	0.0070	0.0141	0.0242	0.86	9.5540	0.0247
Philippines	Asia-Pacific	1990:08	297	272	0.0106	-0.0118	0.0267	0.0162	0.47	7.7260	0.0293
Sri Lanka	Asia-Pacific	1993:01	250	225	0.0180	-0.0066	-0.0363	0.0209	0.53	0.7638	0.0290
Thailand	Asia-Pacific	1990:07	298	697	0.0077	-0.0173	-0.0513	0.0152	0.72	18.1416	0.0246
Egypt	Europe-MEA	1997:06	213	142	0.0040	-0.0195	-0.0481	0.0138	3.78	10.6923	0.0218
Poland	Europe-MEA	1995:06	239	814	-0.0108	-0.0186	-0.0036	0.0091	6.71	5.2330	0.0313
Romania	Europe-MEA	1997:11	203	152	-0.0086	-0.0202	-0.0185	0.0151	0.66	1.0191	0.0331
South Africa	Europe-MEA	1995:08	237	651	0.0397	0.0004	0.0443	0.0082	2.95	26.3682	0.0289
Turkey	Europe-MEA	1992:02	277	377	0.0027	-0.0163	0.0149	0.0181	3.09	41.2122	0.0243
Brazil	L-America	1996:12	214	257	0.0313	-0.0101	0.0502	0.0139	8.26	91.8939	0.0265
Chile	L-America	1990:07	297	150	-0.0193	0.0079	-0.0052	0.0153	2.95	14.5197	0.0191
Mexico	L-America	1990:07	295	182	0.0419	-0.0176	0.0072	0.0169	1.98	35.0549	0.0215
Peru	L-America	1993:10	211	94	0.0135	-0.0134	-0.0163	0.0238	4.29	2.8379	0.0230
Mean			256	630	0.0109	-0.0083	-0.0028	0.0164	2.50	28.2099	0.0265
Median			256	265	0.0091	-0.0126	-0.0044	0.0157	1.55	10.1231	0.0254

Table 2
Monthly portfolio returns and liquidity for volatility shock quintiles.
For each market, we sort the stocks into five portfolios based on market volatility shocks (*VOLASHOCK*) in each month. We then calculate the average stock returns and liquidity shocks (*AMISHOCK* and *SPRSHOCK*) for each portfolio. This table presents the cross-market means (within each region) of the portfolio returns and liquidity shocks. In the final two columns, we report the percentage of markets for which High-Low is negative and significant at the 0.10 and 0.05 levels, respectively.

Panel A: Developed Markets

	VOLASHOCK							
	Low	2	3	4	High	High-Low	% Negative Significant at 0.10 Level	% Negative Significant at 0.05 Level
Panel A1: Asia-Pacific								
RETURN	0.0288	0.0312	0.0183	0.0163	-0.0273	-0.0562	100.00%	100.00%
AMISHOCK	0.0959	0.0567	0.0179	-0.0345	-0.1649	-0.2608	100.00%	100.00%
SPRSHOCK	0.0986	0.0627	0.0168	-0.0263	-0.1442	-0.2429	100.00%	100.00%
Panel A2: Europe-ME								
RETURN	0.0260	0.0179	0.0162	0.0070	-0.0229	-0.0488	100.00%	100.00%
AMISHOCK	0.0817	0.0355	0.0154	-0.0232	-0.1365	-0.2182	100.00%	100.00%
SPRSHOCK	0.0967	0.0507	0.0136	-0.0502	-0.2118	-0.3085	100.00%	100.00%
Panel A3: N-America								
RETURN	0.0377	0.0331	0.0197	0.0157	-0.0309	-0.0686	100.00%	100.00%
AMISHOCK	0.1254	0.0631	0.0403	0.0009	-0.1069	-0.2323	100.00%	100.00%
SPRSHOCK	0.1928	0.0546	0.0314	-0.0466	-0.2332	-0.4260	100.00%	100.00%

Panel B: Emerging Markets

	VOLASHOCK							
	Low	2	3	4	High	High-Low	% Negative Significant at 0.10 Level	% Negative Significant at 0.05 Level
Panel B1: Asia-Pacific								
RETURN	0.0276	0.0255	0.0211	0.0160	-0.0015	-0.0291	57.14%	42.86%
AMISHOCK	0.0583	0.0190	0.0089	-0.0355	-0.1136	-0.1718	100.00%	85.71%
SPRSHOCK	0.0836	0.0226	0.0165	-0.0476	-0.1223	-0.2059	100.00%	100.00%
Panel B2: Europe-MEA								
RETURN	0.0333	0.0252	0.0318	0.0111	-0.0288	-0.0621	100.00%	100.00%
AMISHOCK	0.0664	0.0265	0.0162	-0.0313	-0.1245	-0.1909	100.00%	100.00%
SPRSHOCK	0.0834	0.0524	-0.0022	-0.0136	-0.1411	-0.2244	100.00%	100.00%
Panel B3: L-America								
RETURN	0.0264	0.0268	0.0234	0.0146	-0.0110	-0.0374	50.00%	50.00%
AMISHOCK	0.1055	0.0585	0.0057	-0.0513	-0.1553	-0.2608	100.00%	100.00%
SPRSHOCK	0.0942	0.0620	0.0366	-0.0856	-0.1959	-0.2901	100.00%	75.00%

Table 3

Monthly returns for liquidity shock portfolios within each volatility shock quintile: *AMISHOCK*.

For each market, we first sort stocks on monthly market volatility shocks (*VOLASHOCK*) into five portfolios. We then sort the stocks in each market volatility quintile into five portfolios based on their liquidity shocks (*AMISHOCK*) and calculate the mean returns for the 25 portfolios. This table presents the cross-market means (within each region) for the 25 portfolio returns. The High-Low section shows the percentages of markets for which High-Low is positive and significant at the 0.10 and 0.05 levels, respectively.

Panel A: Developed Markets

	VOLASHOCK					
	Low	2	3	4	High	Average
Panel A1: Asia-Pacific						
Low	0.0097	0.0100	-0.0050	-0.0056	-0.0549	-0.0091
2	0.0174	0.0167	0.0047	0.0038	-0.0442	-0.0003
3	0.0265	0.0261	0.0149	0.0139	-0.0347	0.0094
4	0.0387	0.0396	0.0260	0.0262	-0.0207	0.0220
High	0.0548	0.0571	0.0451	0.0469	0.0051	0.0418
Average	0.0295	0.0299	0.0172	0.0170	-0.0299	
High-Low	0.0451	0.0471	0.0501	0.0525	0.0600	
% Positive Significant at 0.10	85.71%	85.71%	85.71%	85.71%	85.71%	
% Positive Significant at 0.05	85.71%	85.71%	85.71%	85.71%	71.43%	
Panel A2: Europe-ME						
Low	0.0021	-0.0094	-0.0078	-0.0189	-0.0520	-0.0172
2	0.0136	0.0061	0.0036	-0.0060	-0.0418	-0.0049
3	0.0275	0.0174	0.0154	0.0036	-0.0302	0.0067
4	0.0380	0.0315	0.0274	0.0150	-0.0168	0.0190
High	0.0544	0.0481	0.0463	0.0349	0.0081	0.0384
Average	0.0271	0.0187	0.0170	0.0057	-0.0265	
High-Low	0.0523	0.0575	0.0541	0.0538	0.0601	
% Positive Significant at 0.10	100.00%	100.00%	100.00%	100.00%	100.00%	
% Positive Significant at 0.05	100.00%	100.00%	100.00%	100.00%	100.00%	
Panel A3: N-America						
Low	0.0113	0.0027	-0.0103	-0.0135	-0.0480	-0.0116
2	0.0217	0.0161	0.0009	-0.0005	-0.0409	-0.0005
3	0.0330	0.0225	0.0134	0.0097	-0.0331	0.0091
4	0.0405	0.0383	0.0251	0.0264	-0.0199	0.0221
High	0.0562	0.0592	0.0476	0.0464	-0.0012	0.0416
Average	0.0325	0.0277	0.0153	0.0137	-0.0286	
High-Low	0.0450	0.0565	0.0579	0.0599	0.0468	
% Positive Significant at 0.10	100.00%	100.00%	100.00%	100.00%	100.00%	
% Positive Significant at 0.05	100.00%	100.00%	100.00%	100.00%	100.00%	

Panel B: Emerging Markets						
			VOLASHOCK			
	Low	2	3	4	High	Average
Panel B1: Asia-Pacific						
Low	0.0026	0.0003	-0.0025	-0.0085	-0.0292	-0.0075
2	0.0114	0.0125	0.0077	-0.0007	-0.0219	0.0018
3	0.0255	0.0229	0.0191	0.0133	-0.0079	0.0146
4	0.0377	0.0371	0.0355	0.0260	0.0013	0.0275
High	0.0578	0.0569	0.0521	0.0528	0.0248	0.0489
Average	0.0270	0.0259	0.0224	0.0166	-0.0066	
High-Low	0.0552	0.0567	0.0546	0.0612	0.0540	
% Positive Significant at 0.10	100.00%	100.00%	85.71%	85.71%	85.71%	
% Positive Significant at 0.05	100.00%	100.00%	71.43%	71.43%	42.86%	
Panel B2: Europe-MEA						
Low	0.0027	-0.0032	0.0084	-0.0201	-0.0598	-0.0144
2	0.0206	0.0134	0.0227	-0.0082	-0.0456	0.0006
3	0.0337	0.0307	0.0319	0.0087	-0.0312	0.0148
4	0.0458	0.0408	0.0455	0.0241	-0.0173	0.0278
High	0.0621	0.0539	0.0651	0.0454	0.0026	0.0458
Average	0.0330	0.0271	0.0347	0.0100	-0.0303	
High-Low	0.0594	0.0571	0.0567	0.0656	0.0625	
% Positive Significant at 0.10	100.00%	100.00%	100.00%	100.00%	40.00%	
% Positive Significant at 0.05	100.00%	100.00%	100.00%	100.00%	40.00%	
Panel B3: L-America						
Low	0.0161	0.0152	0.0142	0.0086	-0.0383	0.0032
2	0.0304	0.0303	0.0219	0.0113	-0.0324	0.0123
3	0.0369	0.0336	0.0282	0.0194	-0.0245	0.0187
4	0.0442	0.0423	0.0354	0.0308	-0.0118	0.0282
High	0.0534	0.0486	0.0425	0.0438	-0.0042	0.0368
Average	0.0362	0.0340	0.0284	0.0228	-0.0222	
High-Low	0.0373	0.0334	0.0283	0.0353	0.0341	
% Positive Significant at 0.10	75.00%	75.00%	50.00%	75.00%	25.00%	
% Positive Significant at 0.05	75.00%	50.00%	50.00%	25.00%	25.00%	

Table 4

Monthly returns for liquidity shock portfolios within each volatility shock quintile: *SPRSHOCK*.

For each market, we first sort stocks on monthly market volatility shocks (*VOLASHOCK*) into five portfolios. We then sort the stocks in each market volatility quintile into five portfolios based on their liquidity shocks (*SPRSHOCK*) and calculate the mean returns for the 25 portfolios. This table presents the cross-market means (within each region) for the 25 portfolio returns. In the High-Low section, we report the percentages of markets for which High-Low is positive and significant at the 0.10 and 0.05 levels, respectively.

Panel A: Developed Markets

	VOLASHOCK					
	Low	2	3	4	High	Average
Panel A1: Asia-Pacific						
Low	0.0209	0.0140	0.0065	0.0054	-0.0478	-0.0002
2	0.0286	0.0210	0.0156	0.0135	-0.0413	0.0075
3	0.0354	0.0290	0.0210	0.0182	-0.0361	0.0135
4	0.0417	0.0342	0.0265	0.0263	-0.0300	0.0197
High	0.0502	0.0404	0.0388	0.0336	-0.0177	0.0291
Average	0.0354	0.0277	0.0217	0.0194	-0.0346	
High-Low	0.0292	0.0264	0.0323	0.0282	0.0302	
% Positive Significant at 0.10	42.86%	42.86%	42.86%	42.86%	28.57%	
% Positive Significant at 0.05	42.86%	42.86%	42.86%	28.57%	14.29%	
Panel A2: Europe-ME						
Low	0.0191	0.0052	0.0037	-0.0070	-0.0413	-0.0041
2	0.0241	0.0148	0.0119	-0.0003	-0.0329	0.0035
3	0.0291	0.0201	0.0161	0.0040	-0.0279	0.0083
4	0.0349	0.0256	0.0237	0.0110	-0.0208	0.0149
High	0.0414	0.0332	0.0299	0.0192	-0.0105	0.0226
Average	0.0297	0.0198	0.0171	0.0054	-0.0267	
High-Low	0.0223	0.0280	0.0262	0.0261	0.0309	
% Positive Significant at 0.10	50.00%	68.75%	62.50%	56.25%	56.25%	
% Positive Significant at 0.05	50.00%	62.50%	43.75%	50.00%	37.50%	
Panel A3: N-America						
Low	0.0229	0.0105	0.0082	-0.0105	-0.0703	-0.0079
2	0.0305	0.0178	0.0141	-0.0027	-0.0528	0.0014
3	0.0352	0.0233	0.0227	0.0050	-0.0408	0.0091
4	0.0404	0.0292	0.0251	0.0118	-0.0361	0.0141
High	0.0505	0.0426	0.0366	0.0265	-0.0218	0.0269
Average	0.0359	0.0247	0.0213	0.0060	-0.0444	
High-Low	0.0276	0.0322	0.0284	0.0370	0.0485	
% Positive Significant at 0.10	100%	100%	50%	100%	100%	
% Positive Significant at 0.05	100%	100%	50%	100%	100%	

Panel B: Emerging Markets						
			VOLASHOCK			
	Low	2	3	4	High	Average
Panel B1: Asia-Pacific						
Low	0.0205	0.0224	0.0147	0.0054	-0.0163	0.0093
2	0.0255	0.0224	0.0143	0.0051	-0.0142	0.0106
3	0.0252	0.0296	0.0221	0.0088	-0.0098	0.0152
4	0.0339	0.0323	0.0284	0.0171	-0.0037	0.0216
High	0.0304	0.0341	0.0275	0.0143	-0.0069	0.0199
Average	0.0271	0.0282	0.0214	0.0101	-0.0102	
High-Low	0.0099	0.0117	0.0128	0.0089	0.0094	
% Positive Significant at 0.10	14.29%	28.57%	28.57%	14.29%	0.00%	
% Positive Significant at 0.05	0.00%	28.57%	28.57%	14.29%	0.00%	
Panel B2: Europe-MEA						
Low	0.0374	0.0287	0.0242	0.0122	-0.0477	0.0110
2	0.0333	0.0330	0.0312	0.0054	-0.0470	0.0112
3	0.0373	0.0362	0.0312	0.0083	-0.0458	0.0134
4	0.0373	0.0373	0.0310	0.0133	-0.0404	0.0157
High	0.0403	0.0335	0.0368	0.0177	-0.0336	0.0190
Average	0.0371	0.0338	0.0309	0.0114	-0.0429	
High-Low	0.0029	0.0048	0.0126	0.0055	0.0141	
% Positive Significant at 0.10	20.00%	0.00%	0.00%	40.00%	0.00%	
% Positive Significant at 0.05	0.00%	0.00%	0.00%	20.00%	0.00%	
Panel B3: L-America						
Low	0.0265	0.0226	0.0131	0.0021	-0.0422	0.0044
2	0.0294	0.0202	0.0203	-0.0021	-0.0321	0.0071
3	0.0378	0.0207	0.0218	0.0076	-0.0326	0.0110
4	0.0394	0.0284	0.0247	0.0099	-0.0299	0.0145
High	0.0394	0.0372	0.0269	0.0128	-0.0250	0.0183
Average	0.0345	0.0258	0.0214	0.0061	-0.0324	
High-Low	0.0129	0.0146	0.0138	0.0107	0.0172	
% Positive Significant at 0.10	0.00%	0.00%	0.00%	0.00%	0.00%	
% Positive Significant at 0.05	0.00%	0.00%	0.00%	0.00%	0.00%	

Table 5

Regression results: *AMISHOCK*.

This table presents the panel regression results according to Equation (6) based on *AMISHOCK* over the full sample period for each country. Standard errors are clustered by country and month. We report the coefficients for only the key variables for brevity. The controls represent other stock-level return determinants in the regression. *t*-Statistics are in parentheses. * = significance at the 0.10 level; ** = significance at the 0.05 level; *** = significance at the 0.01 level.

Panel A: Developed Markets

	VOLASHOCK	*AMISHOCK*	*VOLASHOCK* × *AMISHOCK*	*IVOSHOCK*	*DVOLSHOCK*	*MKTRET*	*MKTAMISHOCK*	Controls	Obs	R^2
Panel A1: Asia-Pacific										
Australia	-0.0287***	0.1307***	0.0028	0.0727***	0.0149***	1.1086***	-0.0420	YES	184190	0.2776
	(-3.03)	(18.49)	(0.18)	(12.64)	(12.11)	(23.40)	(-1.51)	YES		
Hong Kong	-0.0139	0.0670***	0.0140	0.0897***	0.0092***	0.9187***	0.0462**	YES	163460	0.3206
	(-1.51)	(15.41)	(0.94)	(14.67)	(10.00)	(13.28)	(2.37)	YES		
Japan	-0.0221***	0.0385***	-0.0053	0.0495***	0.0077***	0.9643***	-0.0137	YES	601293	0.3030
	(-4.16)	(16.39)	(-0.87)	(10.86)	(12.69)	(22.99)	(-1.03)	YES		
New Zealand	-0.007	0.0596***	-0.0134	0.0161*	0.0026*	1.0014***	-0.0247	YES	11766	0.2473
	(-1.20)	(6.80)	(-1.08)	(1.83)	(1.84)	(18.86)	(-1.54)	YES		
Singapore	-0.0078	0.0612***	0.0123	0.0437***	0.0069***	1.1070***	0.0074	YES	61425	0.3771
	(-1.19)	(14.46)	(1.30)	(7.59)	(9.09)	(21.82)	(0.48)	YES		
South Korea	-0.0120	0.0213***	0.0174***	0.0647***	0.0154***	0.8441***	0.0329	YES	233459	0.2826
	(-1.48)	(6.49)	(4.77)	(10.47)	(12.77)	(19.16)	(1.54)	YES		
Taiwan	-0.0193***	0.0407***	-0.0071	0.0480***	0.0190***	0.9413***	-0.0215**	YES	137000	0.4368
	(-3.24)	(9.90)	(-1.07)	(8.31)	(7.58)	(23.82)	(-2.27)	YES		
Panel A2: Europe-ME										
Austria	-0.0026	0.0308***	0.0067	0.0062	0.0221***	0.8388***	-0.0200**	YES	14229	0.2985
	(-0.56)	(4.85)	(0.58)	(0.97)	(8.27)	(19.61)	(-2.02)	YES		
Belgium	-0.0126**	0.0590***	0.0146	0.0259***	0.0145***	0.8024***	-0.0203**	YES	18127	0.3061
	(-2.52)	(5.98)	(1.59)	(4.35)	(3.24)	(18.84)	(-2.53)	YES		
Denmark	-0.0207***	0.0733***	0.0207*	0.0352***	0.0102***	0.7643***	-0.0340**	YES	27133	0.2317
	(-4.21)	(10.36)	(1.95)	(6.60)	(4.89)	(16.53)	(-2.39)	YES		
Finland	-0.0340***	0.0661***	-0.0078	0.0449***	0.0028***	0.5176***	-0.0101	YES	22141	0.2340
	(-4.86)	(9.26)	(-0.50)	(5.76)	(3.91)	(11.03)	(-1.07)	YES		
France	-0.0249***	0.1049***	0.0254*	0.0587***	0.0012	0.8191***	-0.0148	YES	117942	0.2256
	(-4.99)	(17.34)	(1.73)	(10.48)	(1.54)	(20.90)	(-1.34)	YES		
Germany	-0.0198***	0.1032***	0.0036	0.0453***	0.0158***	0.8942***	-0.0308**	YES	86435	0.2020
	(-3.01)	(7.20)	(0.16)	(6.14)	(3.95)	(17.65)	(-1.96)	YES		
Greece	-0.0222***	0.1332***	-0.0052	0.0667***	0.0045**	0.9534***	-0.0522***	YES	49937	0.3755

	(-2.62)	(13.81)	(-0.24)	(8.38)	(2.10)	(18.95)	(-3.44)	YES		
Israel	-0.0063	0.0740***	0.0174	0.0492***	0.0111***	0.9261***	-0.0239	YES	35432	0.2828
	(-0.79)	(7.41)	(1.08)	(4.81)	(7.94)	(23.24)	(-0.60)	YES		
Italy	-0.0209***	0.0361***	-0.0004	0.0441***	0.0120***	0.8709***	-0.0190*	YES	34086	0.3996
	(-3.02)	(7.36)	(-0.05)	(6.29)	(6.50)	(22.26)	(-1.67)	YES		
Netherlands	-0.0043	0.0396***	-0.0033	0.0049	0.0183***	0.8452***	-0.0071	YES	31638	0.2348
	(-0.89)	(9.18)	(-0.41)	(0.88)	(9.58)	(19.01)	(-0.89)	YES		
Norway	-0.0099*	0.0741***	0.0154	0.0400***	0.0099***	0.8725***	-0.0006	YES	33307	0.2717
	(-1.85)	(8.13)	(1.33)	(5.84)	(2.94)	(27.47)	(-0.04)	YES		
Portugal	-0.0253***	0.0760***	0.0026	0.0612***	0.0026*	0.8067***	-0.0394***	YES	9826	0.2958
	(-4.21)	(10.04)	(0.26)	(5.53)	(1.70)	(15.73)	(-3.70)	YES		
Spain	-0.0092*	0.0457***	0.0046	0.0381***	0.0138***	0.8216***	-0.0172	YES	31197	0.3371
	(-1.75)	(7.45)	(0.77)	(6.78)	(4.25)	(21.08)	(-1.36)	YES		
Sweden	-0.0221***	0.0894***	-0.0053	0.0637***	0.0075***	0.8402***	-0.0245*	YES	74119	0.2528
	(-3.97)	(13.41)	(-0.47)	(10.49)	(5.15)	(22.39)	(-1.65)	YES		
Switzerland	-0.0196***	0.0432***	0.0151	0.0188**	0.0155**	0.8175***	-0.0114	YES	45717	0.2512
	(-4.10)	(3.03)	(1.25)	(2.32)	(2.08)	(18.81)	(-0.96)	YES		
United Kingdom	-0.0156***	0.0834***	0.0163*	0.0292***	0.0133***	0.9066***	-0.0039	YES	246986	0.1892
	(-2.94)	(16.39)	(1.68)	(8.29)	(6.15)	(14.67)	(-0.27)	YES		
Panel A3: N-America										
Canada	-0.0259***	0.0898***	0.0107	0.0460***	0.0197***	1.0517***	-0.0572*	YES	164684	0.2512
	(-3.97)	(13.72)	(0.79)	(9.34)	(10.61)	(24.28)	(-1.94)	YES		
United States	-0.0108***	0.0179***	-0.0001	0.0085***	0.0113***	0.9730***	0.0317**	YES	421552	0.1046
	(-3.03)	(5.67)	(-0.02)	(3.52)	(5.69)	(19.45)	(2.37)	YES		

Panel B: Emerging Markets										
	VOLASHOCK	*AMISHOCK*	*VOLASHOCK* × *AMISHOCK*	*IVOSHOCK*	*DVOLSHOCK*	*MKTRET*	*MKTAMISHOCK*	Controls	Obs	R^2
Panel B1: Asia-Pacific										
China	-0.0251	0.0211***	-0.0051	0.0239***	0.0314***	0.8582***	0.0004	YES	261730	0.4574
	(-1.47)	(3.81)	(-0.34)	(3.79)	(10.93)	(13.59)	(0.03)	YES		
India	0.0081	0.1519***	0.0023	0.0933***	0.0064	1.3011***	-0.0831***	YES	129218	0.3141
	(0.68)	(6.32)	(0.09)	(10.37)	(1.55)	(18.57)	(-2.74)	YES		
Malaysia	-0.0067	0.0686***	0.0023	0.0478***	0.0052***	1.1693***	-0.0515***	YES	143940	0.4556
	(-1.46)	(17.05)	(0.28)	(11.18)	(9.11)	(19.03)	(-3.45)	YES		
Pakistan	-0.0245***	0.0428***	-0.0004	0.0758***	0.0088**	0.9476***	-0.0083	YES	21425	0.3553
	(-4.57)	(4.19)	(-0.05)	(8.51)	(2.55)	(18.97)	(-0.57)	YES		

Philippines	-0.0070	0.0896***	0.0022	0.0877***	0.0041*	1.2188***	-0.0528***	YES	23916	0.3749
	(-1.06)	(9.61)	(0.25)	(7.96)	(1.78)	(14.89)	(-3.02)	YES		
Sri Lanka	-0.0300***	0.1002***	-0.0111	0.0977***	0.0060***	1.1332***	-0.0968***	YES	17895	0.4645
	(-6.31)	(9.48)	(-0.88)	(9.25)	(3.28)	(16.52)	(-4.97)	YES		
Thailand	-0.0055	0.0526***	0.0231**	0.0621***	0.0040***	0.9123***	-0.0085	YES	72655	0.3466
	(-0.87)	(12.17)	(2.39)	(12.10)	(4.85)	(15.33)	(-0.56)	YES		
Panel B2: Europe-MEA										
Egypt	-0.0185**	0.0567***	0.0054	0.0590***	0.0091***	0.9559***	-0.0352*	YES	15914	0.3275
	(-2.18)	(7.85)	(0.36)	(6.24)	(4.15)	(15.83)	(-1.94)	YES		
Poland	-0.0158	0.1266***	-0.0042	0.0520***	0.0117***	0.8465***	-0.0483*	YES	48785	0.2781
	(-1.47)	(10.05)	(-0.27)	(6.25)	(3.65)	(19.10)	(-1.68)	YES		
Romania	-0.0378***	0.2133***	-0.0027	0.0647***	0.0002	0.6789***	-0.0221	YES	6501	0.2936
	(-3.37)	(8.78)	(-0.08)	(5.05)	(0.49)	(15.31)	(-0.94)	YES		
South Africa	-0.0034	0.0750***	0.0152*	0.0278***	0.0091***	0.8661***	-0.0064	YES	46012	0.2514
	(-0.98)	(11.72)	(1.66)	(6.64)	(7.15)	(38.37)	(-0.44)	YES		
Turkey	-0.0305***	0.0254***	0.0008	0.0815***	0.0206***	0.8358***	-0.0003	YES	49251	0.5025
	(-3.64)	(3.21)	(0.07)	(12.42)	(4.79)	(32.31)	(-0.02)	YES		
Panel B3: L-America										
Brazil	-0.0276***	0.0784***	-0.0013	0.0710***	0.0006	0.8136***	0.0167	YES	19544	0.323
	(-3.10)	(10.27)	(-0.10)	(5.97)	(0.81)	(12.58)	(0.86)	YES		
Chile	-0.0233***	0.0312***	0.0026	0.0475***	0.0007	0.8963***	-0.0138	YES	15214	0.3197
	(-3.17)	(6.98)	(0.47)	(5.41)	(1.43)	(14.78)	(-1.01)	YES		
Mexico	-0.0115*	0.0779***	0.0044	0.0541***	0.0031**	0.6346***	0.0056	YES	12773	0.2841
	(-1.78)	(9.68)	(0.35)	(5.53)	(2.46)	(5.23)	(0.28)	YES		
Peru	0.0074	0.0904***	0.0166	0.0503***	0.0065**	1.4625***	-0.0622***	YES	5815	0.3298
	(0.49)	(6.25)	(0.54)	(5.38)	(2.49)	(14.61)	(-2.64)	YES		

Table 6

Regression results: *SPRSHOCK*.

This table presents the panel regression results according to Equation (6) based on *SPRSHOCK* over the full sample period for each country. Standard errors are clustered by country and month. We report the coefficients for only the key variables for brevity. The controls represent other stock-level return determinants in the regression. *t*-Statistics are in parentheses. * = significance at the 0.10 level; ** = significance at the 0.05 level; *** = significance at the 0.01 level.

Panel A: Developed Markets

	VOLASHOCK	*SPRSHOCK*	*VOLASHOCK* × *SPRSHOCK*	*IVOSHOCK*	*DVOLSHOCK*	*MKTRET*	*MKTSPRSHOCK*	Controls	Obs	R^2
Panel A1: Asia-Pacific										
Australia	-0.0181***	0.0463***	0.0101*	0.0477***	0.0223***	1.0811***	-0.0072	YES	110954	0.2984
	(-2.58)	(13.90)	(1.92)	(7.90)	(15.40)	(26.85)	(-1.19)	YES		
Hong Kong	-0.0138*	0.0334***	-0.0002	0.0675***	0.0111***	1.0034***	0.0414*	YES	114379	0.2984
	(-1.65)	(8.50)	(-0.03)	(9.42)	(4.76)	(15.64)	(1.69)	YES		
Japan	-0.0192***	0.0203***	-0.0209***	0.0492***	0.0069***	0.9393***	0.0267	YES	365012	0.2469
	(-3.18)	(7.10)	(-3.77)	(11.64)	(11.02)	(19.72)	(1.34)	YES		
New Zealand	-0.0046	0.0183***	0.0087*	0.0194**	0.0012	1.0048***	0.0002	YES	11140	0.2776
	(-0.95)	(4.55)	(1.86)	(2.16)	(1.51)	(17.44)	(0.03)	YES		
Singapore	-0.0111*	0.0287***	-0.004	0.0344***	0.0072***	1.1140***	0.0128	YES	44887	0.3671
	(-1.79)	(7.50)	(-1.03)	(3.49)	(5.55)	(24.09)	(0.68)	YES		
South Korea	-0.0137*	0.0121***	0.0143*	0.0340***	0.0174***	0.8656***	0.0559*	YES	208369	0.2584
	(-1.73)	(2.99)	(1.93)	(9.77)	(13.00)	(17.62)	(1.67)	YES		
Taiwan	-0.0162**	0.0038***	-0.0013	0.0449***	0.0179***	1.0338***	0.0253	YES	73359	0.4828
	(-2.13)	(3.50)	(-0.32)	(7.80)	(10.70)	(22.34)	(0.86)	YES		
Panel A2: Europe-ME										
Austria	-0.0039	0.0077*	-0.0172**	0.0098	0.0126**	0.9005***	-0.0003	YES	6143	0.2930
	(-0.60)	(1.87)	(-2.06)	(0.95)	(2.39)	(17.98)	(-0.05)	YES		
Belgium	-0.0106*	0.0282***	0.0059	0.0195***	0.0196***	0.8056***	-0.0091	YES	16655	0.3282
	(-1.91)	(6.62)	(1.08)	(3.20)	(6.46)	(18.73)	(-1.14)	YES		
Denmark	-0.0184***	0.0320***	0.0064	0.0427***	0.0113***	0.8341***	-0.005	YES	22488	0.2496
	(-3.75)	(7.08)	(1.08)	(7.58)	(4.48)	(17.54)	(-0.86)	YES		
Finland	-0.0367***	0.0355***	-0.0010	0.0493***	0.0031***	0.5340***	-0.0028	YES	22063	0.2398
	(-5.16)	(6.76)	(-0.08)	(5.84)	(4.47)	(11.68)	(-0.31)	YES		
France	-0.0207***	0.0545***	0.0135***	0.0718***	0.0017	0.8361***	0.0162*	YES	116613	0.2313
	(-4.24)	(16.65)	(2.79)	(12.05)	(1.61)	(22.61)	(1.87)	YES		
Germany	-0.0215***	0.0542***	0.0030	0.0427***	0.0212***	0.9090***	-0.0473***	YES	82897	0.2196
	(-3.12)	(7.72)	(0.27)	(5.41)	(5.16)	(18.59)	(-2.91)	YES		
Greece	-0.0187	0.0364***	-0.0192	0.0593***	0.0114***	0.9685***	-0.0124	YES	25173	0.4027

	(-1.50)	(7.07)	(-1.28)	(6.12)	(5.30)	(18.39)	(-0.71)	YES		
Israel	-0.0071	0.0131***	0.0032	0.0471***	0.0109***	0.8750***	0.0239	YES	22837	0.2496
	(-0.72)	(2.79)	(0.27)	(3.85)	(6.45)	(14.73)	(1.17)	YES		
Italy	-0.0273***	0.0049	0.0009	0.0494***	0.0095***	0.8888***	-0.0082***	YES	33973	0.3964
	(-4.57)	(1.39)	(0.24)	(5.85)	(2.81)	(22.82)	(-2.74)	YES		
Netherlands	-0.0059	0.0211***	0.0008	0.0000	0.0230***	0.9221***	-0.0096***	YES	18419	0.2519
	(-1.11)	(4.85)	(0.15)	(-0.01)	(10.03)	(19.40)	(-3.56)	YES		
Norway	-0.0130**	0.0416***	0.0018	0.0472***	0.0099***	0.8885***	0.0095	YES	28409	0.2740
	(-2.17)	(6.80)	(0.23)	(6.18)	(2.77)	(25.06)	(0.66)	YES		
Portugal	-0.0254***	0.0482***	-0.0093	0.0614***	0.0028*	0.8197***	-0.0126**	YES	9712	0.3166
	(-4.58)	(9.04)	(-1.26)	(7.38)	(1.83)	(17.65)	(-2.20)	YES		
Spain	-0.0176***	0.0343***	0.0011	0.0552***	0.0047	0.8168***	-0.0014	YES	29016	0.2947
	(-3.73)	(6.65)	(0.26)	(7.55)	(1.11)	(20.14)	(-0.49)	YES		
Sweden	-0.0204***	0.0380***	-0.0075	0.0579***	0.0080***	0.8952***	-0.0076	YES	48326	0.2581
	(-3.94)	(9.49)	(-1.10)	(8.71)	(4.83)	(21.31)	(-0.82)	YES		
Switzerland	-0.0190***	0.0097**	0.0146**	0.0095**	0.0291***	0.8292***	-0.0071	YES	45278	0.2899
	(-4.56)	(2.32)	(2.02)	(2.06)	(8.06)	(19.04)	(-1.46)	YES		
United Kingdom	-0.0258***	0.0585***	0.0124**	0.0256***	0.0144***	0.9062***	-0.0274*	YES	223248	0.1918
	(-6.39)	(20.90)	(2.12)	(8.78)	(8.71)	(17.91)	(-1.92)	YES		
Panel A3: N-America										
Canada	-0.0108	0.0608***	0.0142**	0.0550***	0.0195***	1.0652***	-0.0005	YES	67145	0.2766
	(-1.10)	(11.17)	(2.43)	(6.49)	(7.00)	(20.45)	(-0.02)	YES		
United States	-0.0149***	0.0251***	0.0034	0.0115***	0.0083***	1.0179***	-0.0004	YES	337069	0.1091
	(-3.79)	(11.16)	(0.96)	(5.16)	(4.93)	(21.10)	(-0.07)	YES		

Panel B: Emerging Markets

	VOLASHOCK	*SPRSHOCK*	*VOLASHOCK × SPRSHOCK*	*IVOSHOCK*	*DVOLSHOCK*	*MKTRET*	*MKTSPRSHOCK*	Controls	Obs	R^2
Panel B1: Asia-Pacific										
China	-0.0300*	0.0014	0.0009	0.0267***	0.0311***	0.8794***	0.013	YES	260910	0.4522
	(-1.81)	(1.54)	(0.15)	(4.07)	(11.70)	(14.65)	(0.49)	YES		
India	-0.0033	0.0214***	-0.0025	0.0979***	0.0157***	1.1654***	-0.0095	YES	68314	0.4087
	(-0.34)	(7.74)	(-0.33)	(16.01)	(11.10)	(23.82)	(-0.97)	YES		
Malaysia	-0.0027	0.0245***	-0.0069	0.0466***	0.0050***	1.1582***	0.0070	YES	107804	0.4515
	(-0.46)	(9.44)	(-1.01)	(8.10)	(6.19)	(18.83)	(0.49)	YES		
Pakistan	-0.0163**	-0.0001	-0.0024	0.0548***	0.0145***	0.9627***	-0.0135	YES	8894	0.3191
	(-1.98)	(-0.05)	(-0.50)	(6.15)	(5.32)	(18.59)	(-0.70)	YES		

Philippines	-0.0088	0.0150***	0.0102	0.0804***	0.001	1.2729***	-0.0212**	YES	11425	0.3812
	(-1.39)	(3.42)	(1.19)	(8.49)	(0.88)	(13.13)	(-2.14)	YES		
Sri Lanka	-0.0234***	-0.0003	0.0071	0.0943***	0.0050**	1.0884***	0.014	YES	8519	0.4414
	(-2.86)	(-0.10)	(0.90)	(7.21)	(2.48)	(12.77)	(1.20)	YES		
Thailand	-0.0175***	-0.0022**	-0.0003	0.0506***	0.0027***	0.8186***	0.0604***	YES	29442	0.3477
	(-2.71)	(-2.01)	(-0.08)	(9.43)	(5.70)	(13.84)	(2.59)	YES		
Panel B2: Europe-MEA										
Egypt	-0.0222***	0.0088	0.0126**	0.0618***	0.0080***	0.9847***	-0.0158*	YES	13747	0.3710
	(-2.73)	(1.49)	(1.97)	(6.11)	(3.71)	(17.48)	(-1.68)	YES		
Poland	0.0071	0.0286***	0.0123	0.0670***	0.0129***	0.9651***	0.0162	YES	36221	0.3181
	(1.01)	(5.70)	(1.53)	(6.64)	(3.65)	(23.72)	(1.22)	YES		
Romania	-0.0285**	0.0348***	0.0154**	0.0948***	0.0042	0.8132***	0.0282	YES	852	0.3538
	(-2.01)	(2.66)	(1.89)	(3.46)	(1.60)	(10.87)	(0.64)	YES		
South Africa	-0.0082*	0.0111***	0.0093**	0.0190***	0.0094***	0.8914***	0.0003	YES	38961	0.2815
	(-1.91)	(4.14)	(2.43)	(4.13)	(6.54)	(38.79)	(0.05)	YES		
Turkey	-0.0262***	0.0078*	0.0050	0.0777***	0.0183***	0.8704***	0.0227	YES	38813	0.4698
	(-3.14)	(1.87)	(0.43)	(10.35)	(4.10)	(20.99)	(0.98)	YES		
Panel B3: L-America										
Brazil	-0.0398***	0.0337***	-0.0044	0.0711***	0.001	0.8525***	0.0002	YES	18805	0.3185
	(-4.80)	(5.04)	(-0.39)	(5.51)	(0.93)	(11.95)	(0.10)	YES		
Chile	-0.0223***	0.0128***	-0.0038	0.0580***	0.0038***	1.0417***	-0.0014	YES	4844	0.4201
	(-4.69)	(3.42)	(-0.89)	(4.35)	(2.98)	(18.90)	(-0.31)	YES		
Mexico	-0.0157***	0.0088*	-0.0030	0.0338**	0.0063***	1.0496***	0.0096*	YES	8294	0.3646
	(-2.58)	(1.75)	(-0.92)	(1.96)	(2.61)	(24.85)	(1.67)	YES		
Peru	-0.0224	0.0166***	0.0063	0.0260**	0.0057*	1.3047***	-0.0157	YES	1333	0.4049
	(-1.54)	(3.27)	(0.55)	(2.10)	(1.90)	(17.66)	(-1.03)	YES		

Table 7

Mean regression coefficients.

This table presents the cross-market means of our regression coefficients within each region. The mean *t*-statistics within a region are in parentheses. * = significance at the 0.10 level; ** = significance at the 0.05 level; *** = significance at the 0.01 level.

Panel A: Developed Markets

	VOLASHOCK	*AMISHOCK* (or *SPRSHOCK*)	*VOLASHOCK* ×*AMISHOCK* (or *SPRSHOCK*)	*IVOSHOCK*	*DVOLSHOCK*	*MKTRET*	*MTKAMISHOCK* (or *MKTSPRSHOCK*)
Panel A1: *AMISHOCK*							
Asia-Pacific Mean	-0.0158**	0.0599***	0.0030	0.0549***	0.0108***	0.9836***	-0.0022
	(-2.26)	(12.56)	(0.60)	(9.48)	(9.44)	(20.48)	(-0.28)
% Positive (Negative) Significant at 0.10	(42.86%)	100.00%	14.29%	100.00%	100.00%	100.00%	14.29%
% Positive (Negative) Significant at 0.05	(42.86%)	100.00%	14.29%	85.71%	85.71%	100.00%	14.29%
Europe-ME Mean	-0.0169***	0.0707***	0.0075	0.0395***	0.0109***	0.8311***	-0.0206
	(-2.89)	(9.45)	(0.67)	(5.87)	(4.64)	(19.26)	(-1.62)
% Positive (Negative) Significant at 0.10	(81.25%)	100.00%	18.75%	87.50%	93.75%	100.00%	0.00%
% Positive (Negative) Significant at 0.05	(68.75%)	100.00%	0.00%	87.50%	87.50%	100.00%	0.00%
N-America Mean	-0.0183***	0.0539***	0.0053	0.0272***	0.0155***	1.0124***	-0.0128
	(-3.50)	(9.70)	(0.38)	(6.43)	(8.15)	(21.86)	(0.21)
% Positive (Negative) Significant at 0.10	(100.00%)	100.00%	0.00%	100.00%	100.00%	100.00%	50.00%
% Positive (Negative) Significant at 0.05	(100.00%)	100.00%	0.00%	100.00%	100.00%	100.00%	50.00%
Panel A2: SPRSHOCK							
Asia-Pacific Mean	-0.0138**	0.0233***	0.0010	0.0424***	0.0120***	1.0060***	0.0222
	(-2.00)	(6.86)	(0.08)	(7.45)	(8.85)	(20.53)	(0.72)
% Positive (Negative) Significant at 0.10	(85.71%)	100.00%	42.86%	100.00%	85.71%	100.00%	28.57%
% Positive (Negative) Significant at 0.05	(42.86%)	100.00%	0.00%	100.00%	85.71%	100.00%	0.00%
Europe-ME Mean	-0.0183***	0.0324***	0.0006	0.0405***	0.0121***	0.8518***	-0.0063
	(-3.25)	(7.38)	(0.30)	(5.72)	(4.78)	(18.97)	(-0.97)
% Positive (Negative) Significant at 0.10	(75.00%)	93.75%	18.75%	87.50%	87.50%	100.00%	6.25%
% Positive (Negative) Significant at 0.05	(68.75%)	87.50%	18.75%	87.50%	81.25%	100.00%	0.00%
N-America Mean	-0.0128**	0.0430***	0.0088*	0.0333***	0.0139***	1.0416***	-0.0005
	(-2.45)	(11.17)	(1.70)	(5.83)	(5.96)	(20.78)	(-0.04)
% Positive (Negative) Significant at 0.10	(50.00%)	100.00%	50.00%	100.00%	100.00%	100.00%	0.00%
% Positive (Negative) Significant at 0.05	(50.00%)	100.00%	50.00%	100.00%	100.00%	100.00%	0.00%

Panel B: Emerging Markets	*VOLASHOCK*	*AMISHOCK* (or *SPRSHOCK*)	*VOLASHOCK* ×*AMISHOCK* (or *SPRSHOCK*)	*IVOSHOCK*	*DVOLSHOCK*	*MKTRET*	*MTKAMISHOCK* (or *MKTSPRSHOCK*)
Panel B1: *AMISHOCK*							
Asia-Pacific Mean	-0.0130**	0.0753***	0.0019	0.0697***	0.0094***	1.0772***	-0.0429**
	(-2.15)	(8.95)	(0.25)	(9.02)	(4.86)	(16.70)	(-2.18)
% Positive (Negative) Significant at 0.10	(28.57%)	100.00%	14.29%	100.00%	85.71%	100.00%	0.00%
% Positive (Negative) Significant at 0.05	(28.57%)	100.00%	14.29%	100.00%	71.43%	100.00%	0.00%
Europe-MEA Mean	-0.0212**	0.0994***	0.0029	0.0570***	0.0101***	0.8366***	-0.0225
	(-2.33)	(8.32)	(0.35)	(7.32)	(4.05)	(24.18)	(-1.00)
% Positive (Negative) Significant at 0.10	(60.00%)	100.00%	20.00%	100.00%	80.00%	100.00%	0.00%
% Positive (Negative) Significant at 0.05	(60.00%)	100.00%	0.00%	100.00%	80.00%	100.00%	0.00%
L-America Mean	-0.0137*	0.0695***	0.0056	0.0557***	0.0027*	0.9517***	-0.0134
	(-1.89)	(8.30)	(0.32)	(5.57)	(1.79)	(11.80)	(-0.63)
% Positive (Negative) Significant at 0.10	(75.00%)	100.00%	0.00%	100.00%	50.00%	100.00%	0.00%
% Positive (Negative) Significant at 0.05	(50.00%)	100.00%	0.00%	100.00%	50.00%	100.00%	0.00%
Panel B2: *SPRSHOCK*							
Asia-Pacific Mean	-0.0146*	0.0085***	0.0009	0.0645***	0.0107***	1.0494***	0.0072
	(-1.65)	(2.86)	(0.05)	(8.49)	(6.19)	(16.52)	(0.14)
% Positive (Negative) Significant at 0.10	(66.67%)	50.00%	0.00%	100.00%	85.71%	100.00%	14.29%
% Positive (Negative) Significant at 0.05	(50.00%)	50.00%	0.00%	100.00%	85.71%	100.00%	0.00%
Europe-MEA Mean	-0.0156*	0.0182***	0.0109*	0.0641***	0.0105***	0.9050***	0.0103
	(-1.76)	(3.17)	(1.65)	(6.14)	(3.92)	(22.37)	(0.24)
% Positive (Negative) Significant at 0.10	(80.00%)	80.00%	60.00%	100.00%	80.00%	100.00%	0.00%
% Positive (Negative) Significant at 0.05	(60.00%)	60.00%	60.00%	100.00%	80.00%	100.00%	0.00%
L-America Mean	-0.0251***	0.0180***	-0.0012	0.0472***	0.0042**	1.0621***	-0.0018
	(-3.40)	(3.37)	(-0.41)	(3.48)	(2.11)	(18.34)	(0.11)
% Positive (Negative) Significant at 0.10	(75.00%)	100.00%	0.00%	100.00%	75.00%	100.00%	25.00%
% Positive (Negative) Significant at 0.05	(75.00%)	75.00%	0.00%	100.00%	50.00%	100.00%	0.00%

Table 8

Estimated coefficients over sub-periods.

Panel A presents the estimated β_2 and β_3 coefficients over five-year sub-periods based on *AMISHOCK* and *SPRSHOCK*. In Panel B, we test the differences in the means and medians of β_2 and β_3 using the *t*-test and Wilcoxon test, respectively. * = significance at the 0.10 level; ** = significance at the 0.05 level; *** = significance at the 0.01 level.

Panel A: β_2 and β_3 over Five-Year Sub-periods

Panel A1: *AMISHOCK*

Sub-period	mean β_2	median β_2	mean β_3	median β_3
[1] 1990:01-1994:12	0.0644	0.0580	-0.0062	-0.0019
[2] 1995:01-1999:12	0.0675	0.0627	-0.0015	0.0017
[3] 2000:01-2004:12	0.0770	0.0599	-0.0024	-0.0033
[4] 2005:01-2009:12	0.0601	0.0494	0.0185	0.0174
[5] 2010:01-2015:04	0.0514	0.0433	0.0048	0.0043

Panel A2: *SPRSHOCK*

Sub-period	mean β_2	median β_2	mean β_3	median β_3
[1] 1990:01-1994:12	0.0548	0.0427	0.0064	0.0069
[2] 1995:01-1999:12	0.0263	0.0277	-0.0234	-0.0029
[3] 2000:01-2004:12	0.0312	0.0261	-0.0018	-0.0039
[4] 2005:01-2009:12	0.0159	0.0148	0.0071	0.0078
[5] 2010:01-2015:04	0.0178	0.0174	0.0042	0.0005

Panel B: Differences in β Means and Medians

	Amihud		Spread	
	Diff in mean β_3	Diff in median β_3	Diff in mean β_3	Diff in median β_3
H0: [4]-[1] = 0	0.0248***	0.0193***	0.0007	0.0009
H0: [4]-[2] = 0	0.0200***	0.0158***	0.0305	0.0107***
H0: [4]-[3] = 0	0.0210***	0.0208***	0.0089*	0.0117**
H0: [4]-[5] = 0	0.0137***	0.0132***	0.0029	0.0073
H0: [4] = 0	0.0185***	0.0174***	0.0071***	0.0078***

Table 9

Market attributes and the role of liquidity providers.

This table presents our regression results for Equation (5). The variables *MKTDVOL* and *MKTCAP* are logarithmically scaled. Standard errors are clustered by country and time. *t*-Statistics are in parentheses. * = significance at the 0.10 level; ** = significance at the 0.05 level; *** = significance at the 0.01 level.

Panel A: Dependent variable - $(\beta_2 + \beta_3 VOLASHOCK_{50})(AMISHOCK_{75} - AMISHOCK_{25})$

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
MKTVOLA	0.5399**										0.5007**	0.2099
	(1.99)										(2.05)	(0.90)
MKTDVOL		-0.0021**									-0.0021**	-0.0003
		(-2.22)									(-2.28)	(-0.31)
MKTCAP			-0.0051									-0.0009
			(-1.39)									(-0.58)
GOVERNANCE				-0.0003								0.0080*
				(-0.12)								(1.67)
GDP_PER_CAP					-0.0059							-0.0052
					(-1.12)							(-1.19)
DEVELOPMENT						-0.0011						0.0010
						(-0.44)						(0.27)
OPENNESS							0.0006					0.0007
							(0.58)					(0.36)
SEGMENTATION								0.0165				0.0012
								(0.36)				(0.02)
SHORT_SELLING									0.0156			-0.0081*
									(1.08)			(-1.77)
MKT_MAKER										-0.0021		0.0001
										(-0.52)		(0.03)
Constant	0.0186***	0.0517***	0.1217*	0.0235***	0.0810	0.0262***	0.0254***	0.0253***	0.0224***	0.0236***	0.0445***	0.0834***
	(4.47)	(4.30)	(1.73)	(14.94)	(1.59)	(7.97)	(6.80)	(5.67)	(8.43)	(15.13)	(4.41)	(6.15)
Obs	193	193	193	162	193	187	188	193	193	140	193	110
R^2	0.0038	0.0126	0.0501	0.0003	0.0399	0.0003	0.0001	0.0002	0.0236	0.0067	0.0158	0.1134

Panel B: Dependent variable - ($\beta_2 + \beta_3 VOLASHOCK_{50}$)($SPRSHOCK_{75}$ - $SPRSHOCK_{25}$)												
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
MKTVOLA	-0.2579										-0.0642	0.0412
	(-0.97)										(-0.33)	(0.15)
MKTDVOL		0.0004										-0.0012*
		(0.82)										(-1.75)
MKTCAP			0.0006									0.0000
			(0.70)									(-0.02)
GOVERNANCE				0.0046***							0.0046***	0.0126***
				(2.94)							(3.01)	(4.09)
GDP_PER_CAP					0.0017							-0.0032
					(1.57)							(-1.65)
DEVELOPMENT						0.0016						0.0041
						(1.09)						(1.59)
OPENNESS							-0.0002					-0.0021*
							(-0.21)					(-1.73)
SEGMENTATION								0.0232				0.0872
								(0.18)				(0.96)
SHORT_SELLING									-0.0041			0.0003
									(-1.58)			(0.09)
MKT_MAKER										0.0033		0.0022
										(1.17)		(0.81)
Constant	0.0141***	0.0054	-0.0004	0.0068***	-0.0055	0.0103***	0.0110***	0.0100**	0.0113***	0.0090***	0.0077**	0.0421**
	(2.99)	(0.92)	(-0.03)	(3.54)	(-0.52)	(4.42)	(3.87)	(2.58)	(4.88)	(3.94)	(2.55)	(2.45)
Obs	136	136	136	136	136	130	134	136	136	104	136	98
R^2	0.0094	0.0054	0.0073	0.1311	0.0439	0.0104	0.0003	0.0010	0.0171	0.0229	0.1317	0.3074

Table 10
Impact of the 2007–2009 crisis period: *AMISHOCK*.
This table presents the regression results for our Equation (8) over the 2005–2009 sub-period. Standard errors are clustered by country and time. *t*-Statistics are in parentheses. * = significance at the 0.10 level; ** = significance at the 0.05 level; *** = significance at the 0.01 level.

	VOLASHOCK	*AMISHOCK*	*VOLASHOCK* × *AMISHOCK*	*VOLASHOCK* × *AMISHOCK* × *CRISIS*	Controls	Obs	R^2
Panel A: Developed Markets							
Panel A1: Asia-Pacific							
Australia	-0.0414***	0.1400***	-0.0846***	0.0938**	YES	59017	0.3178
	(-2.65)	(13.38)	(-2.75)	(2.09)	YES		
Hong Kong	-0.0264	0.0594***	0.0130	0.0295	YES	43970	0.3530
	(-1.50)	(5.68)	(0.52)	(0.84)	YES		
Japan	-0.0219**	0.0337***	-0.0041	-0.0136	YES	139181	0.1993
	(-2.16)	(8.04)	(-0.30)	(-0.93)	YES		
New Zealand	-0.0044	0.0499***	-0.0005	-0.0222	YES	4338	0.3119
	(-0.51)	(4.71)	(-0.01)	(-0.37)	YES		
Singapore	-0.0059	0.0649***	-0.0275**	0.0524***	YES	22273	0.4401
	(-0.62)	(6.09)	(-2.70)	(3.40)	YES		
South Korea	-0.0040	0.0116**	0.0414***	-0.0248	YES	72591	0.3277
	(-0.31)	(2.06)	(2.71)	(-1.54)	YES		
Taiwan	-0.0128	0.0422***	-0.0152	0.0198	YES	40517	0.5172
	(-1.46)	(6.16)	(-0.90)	(0.96)	YES		
Panel A2: Europe-ME							
Austria	-0.0154	0.0249	-0.0210	0.0601*	YES	2929	0.3254
	(-1.30)	(1.18)	(-0.84)	(1.91)	YES		
Belgium	-0.0002	0.0406***	-0.0034	0.0388**	YES	5027	0.3943
	(-0.02)	(26.74)	(-0.18)	(2.24)	YES		
Denmark	-0.0038	0.0393***	-0.0162	0.0409***	YES	7418	0.3147
	(-0.41)	(4.09)	(-0.98)	(3.19)	YES		
Finland	-0.0324***	0.0342***	-0.0310*	0.0376	YES	6629	0.3112
	(-2.65)	(3.14)	(-1.69)	(1.23)	YES		
France	-0.0222***	0.0340***	-0.0082	0.0461*	YES	28512	0.3403
	(-3.32)	(3.99)	(-0.33)	(1.90)	YES		
Germany	-0.0189***	0.0854***	-0.0243	0.0468	YES	29884	0.2255
	(-2.59)	(5.59)	(-0.90)	(1.48)	YES		
Greece	-0.0235*	0.1178***	0.0367*	0.0105	YES	14704	0.3825
	(-1.86)	(10.97)	(1.86)	(0.48)	YES		
Israel	0.0020	0.0986***	0.0325	0.0483	YES	14195	0.2685
	(0.10)	(5.92)	(0.92)	(1.02)	YES		
Italy	-0.0109	0.0255***	0.0047	0.0017	YES	14084	0.4254
	(-1.17)	(3.29)	(0.28)	(0.12)	YES		
Netherlands	-0.0085	0.0245***	-0.0200	0.0247*	YES	5877	0.3027
	(-0.98)	(4.61)	(-1.50)	(1.82)	YES		
Norway	-0.0293**	0.0618***	-0.0477***	0.0920***	YES	8061	0.3174
	(-2.24)	(7.90)	(-4.52)	(4.23)	YES		
Portugal	-0.0305*	0.0517***	-0.0096	0.0092	YES	2018	0.2949
	(-1.77)	(3.17)	(-0.28)	(0.27)	YES		
Spain	-0.0045	0.0339***	0.0021	0.0048	YES	6115	0.3384
	(-0.53)	(4.48)	(0.08)	(0.19)	YES		
Sweden	-0.0194**	0.0648***	-0.0283*	0.0465**	YES	18642	0.2679
	(-2.13)	(5.56)	(-1.80)	(2.01)	YES		
Switzerland	-0.0235***	0.0447***	-0.0171	0.0463**	YES	10457	0.3243
	(-3.13)	(4.25)	(-1.08)	(2.46)	YES		
United Kingdom	-0.0165	0.0827***	0.0053	0.0156	YES	65608	0.2035
	(-1.58)	(11.25)	(0.33)	(0.69)	YES		
Panel A2: Europe-ME							
Canada	-0.0455***	0.0830***	-0.0411	0.0706**	YES	45169	0.3105
	(-2.68)	(6.84)	(-1.38)	(2.26)	YES		
United States	-0.0202**	0.0178**	0.0156	-0.0042	YES	68273	0.1323
	(-2.49)	(2.33)	(1.35)	(-0.26)	YES		

Panel B: Emerging Markets							
	VOLASHOCK	*AMISHOCK*	*VOLASHOCK* × *AMISHOCK*	*VOLASHOCK* × *AMISHOCK* × *CRISIS*	Controls	Obs	R^2
Panel B1: Asia-Pacific							
China	-0.0177	0.0044	-0.0391	0.1472	YES	7141	0.4566
	(-0.55)	(0.31)	(-0.41)	(1.48)	YES		
India	0.0234	0.0781***	-0.0016	0.1214	YES	5160	0.4406
	(0.97)	(3.40)	(-0.02)	(1.35)	YES		
Malaysia	-0.0053	0.0703***	-0.0475***	0.0582***	YES	3983	0.2885
	(-0.83)	(9.77)	(-4.37)	(2.79)	YES		
Pakistan	-0.0209**	0.0326***	-0.0098	0.0387*	YES	6654	0.2828
	(-2.56)	(3.18)	(-0.74)	(1.94)	YES		
Philippines	-0.0277	0.0496**	-0.0457	0.0787**	YES	5638	0.4721
	(-1.61)	(2.29)	(-1.49)	(2.29)	YES		
Sri Lanka	-0.0365***	0.1050***	-0.0107	0.0044	YES	5939	0.5027
	(-4.32)	(12.79)	(-0.36)	(0.10)	YES		
Thailand	-0.0094*	0.0352***	0.0095	0.0318**	YES	1821	0.3426
	(-1.69)	(5.94)	(1.56)	(2.32)	YES	6	
Panel B2: Europe-MEA							
Egypt	-0.0239	0.0569***	-0.1290**	0.1703***	YES	4604	0.3900
	(-1.35)	(4.04)	(-2.47)	(2.83)	YES		
Poland	-0.0054	0.0887***	-0.024	0.0298	YES	1279	0.4031
	(-0.47)	(4.29)	(-0.50)	(0.67)	YES	3	
Romania	-0.0225	0.2547***	-0.0379	0.0771	YES	2144	0.3995
	(-1.00)	(7.68)	(-0.51)	(0.94)	YES		
South Africa	-0.0146	0.0518***	0.0376**	-0.0429**	YES	1116	0.3368
	(-1.28)	(6.22)	(2.16)	(-2.55)	YES	0	
Turkey	-0.0563***	0.0159	-0.0059	0.0290	YES	1558	0.5237
	(-3.44)	(0.92)	(-0.36)	(1.22)	YES	2	
Panel B3: L-America							
Brazil	-0.0335***	0.0697***	-0.0050	0.0411	YES	5890	0.4405
	(-3.50)	(4.89)	(-0.21)	(1.25)	YES		
Chile	-0.0154***	0.0320***	-0.0050	0.0200	YES	3393	0.4439
	(-2.86)	(4.80)	(-0.33)	(1.17)	YES		
Mexico	-0.0114	0.0411***	0.0217	0.0119	YES	2187	0.4165
	(-1.50)	(2.72)	(1.36)	(0.59)	YES		
Peru	0.0005	0.1164***	0.1414***	-0.1494*	YES	2115	0.3753
	(0.02)	(4.93)	(4.98)	(-1.78)	YES		

Table 11
Impact of the 2007–2009 crisis period: *SPRSHOCK*.
This table presents the regression results for our Equation (8) over the 2005–2009 sub-period. Standard errors are clustered by country and time. *t*-Statistics are in parentheses. * = significance at the 0.10 level; ** = significance at the 0.05 level; *** = significance at the 0.01 level.

Panel A: Developed Markets	*VOLASHOCK*	*SPRSHOCK*	*VOLASHOCK* × *SPRSHOCK*	*VOLASHOCK* × *SPRSHOCK* × *CRISIS*	Controls	Obs	R^2
Panel A1: Asia-Pacific							
Australia	-0.0227**	0.0552***	0.0011	0.0082	YES	46771	0.3220
	(-2.32)	(9.03)	(0.06)	(0.37)	YES		
Hong Kong	-0.0331**	0.0275***	-0.008	0.0171	YES	31161	0.3259
	(-2.30)	(4.62)	(-0.50)	(0.84)	YES		
Japan	-0.0194**	0.0180***	-0.0087	-0.0104	YES	137012	0.1955
	(-2.05)	(4.28)	(-0.45)	(-0.49)	YES		
New Zealand	0.0003	0.0069	0.0598	-0.0573	YES	4141	0.3325
	(0.04)	(1.35)	(1.47)	(-1.37)	YES		
Singapore	-0.011	0.0182***	-0.0229***	0.0243***	YES	16705	0.4456
	(-1.24)	(3.40)	(-3.01)	(3.23)	YES		
South Korea	-0.0146	-0.0072	0.0494	-0.0330	YES	70731	0.3253
	(-1.30)	(-1.18)	(1.33)	(-0.87)	YES		
Taiwan							
Panel A2: Europe-ME							
Austria	-0.0105	0.0148*	-0.0153	0.0042	YES	2029	0.2686
	(-1.33)	(1.95)	(-0.61)	(0.15)	YES		
Belgium	-0.0030	0.0215***	0.0113	-0.0009	YES	5085	0.3966
	(-0.35)	(6.19)	(1.36)	(-0.12)	YES		
Denmark	0.0063	0.0092	0.0162	-0.0024	YES	7378	0.3253
	(0.83)	(1.11)	(1.14)	(-0.21)	YES		
Finland	-0.0270***	0.0218**	-0.0107	0.0178	YES	6721	0.3229
	(-2.77)	(1.96)	(-0.58)	(0.60)	YES		
France	-0.0111	0.0213***	0.0124	0.0137	YES	28561	0.3517
	(-1.58)	(4.10)	(1.15)	(1.63)	YES		
Germany	-0.0205***	0.0435***	-0.0153	0.0306**	YES	28695	0.2521
	(-2.94)	(4.64)	(-1.21)	(2.18)	YES		
Greece	0.1336***	0.0006	-0.2836***	0.3062***	YES	552	0.3966
	(10.60)	(0.05)	(-14.40)	(13.90)	YES		
Israel							
Italy	-0.0110**	-0.0034	0.0343***	-0.0260**	YES	14187	0.4396
	(-2.02)	(-0.85)	(3.16)	(-2.46)	YES		
Netherlands	-0.0106	0.0195***	-0.0128	0.0206	YES	6017	0.3158
	(-1.28)	(3.00)	(-0.87)	(1.31)	YES		
Norway	-0.0288**	0.0253***	-0.0333**	0.0496***	YES	8132	0.3191
	(-2.05)	(3.26)	(-2.37)	(2.83)	YES		
Portugal	-0.0152	0.0271**	-0.0119	0.0079	YES	2059	0.3972
	(-1.46)	(2.56)	(-0.61)	(0.39)	YES		
Spain	-0.0051	0.0169***	0.0226	-0.0215	YES	6394	0.3441
	(-0.59)	(2.62)	(1.26)	(-1.25)	YES		
Sweden	-0.0154*	0.0308***	-0.0053	0.0226	YES	18681	0.2774
	(-1.81)	(4.54)	(-0.40)	(1.29)	YES		
Switzerland	-0.0337***	0.0021	0.0051	0.0138	YES	10643	0.3631
	(-4.35)	(0.40)	(0.38)	(0.92)	YES		
United Kingdom	-0.0189***	0.0384***	0.0018	0.0145	YES	57631	0.2057
	(-2.77)	(8.81)	(0.24)	(1.51)	YES		
Panel A2: Europe-ME							
Canada							
United States	-0.0175**	0.0147***	-0.0009	0.0071	YES	69634	0.1400
	(-2.04)	(4.57)	(-0.15)	(0.82)	YES		

Panel B: Emerging Markets							
	VOLASHOCK	*SPRSHOCK*	*VOLASHOCK* × *SPRSHOCK*	*VOLASHOCK* × *SPRSHOCK* × *CRISIS*	Controls	Obs	R^2
Panel B1: Asia-Pacific							
China	-0.0043	-0.0025	0.0033	0.0211	YES	71556	0.4588
	(-0.14)	(-1.56)	(0.77)	(1.16)	YES		
India	-0.0043	0.0139***	-0.0121	0.0336	YES	25259	0.5284
	(-0.23)	(5.46)	(-0.64)	(1.40)	YES		
Malaysia	-0.0081	0.0196***	-0.0246***	0.0196*	YES	32511	0.2835
	(-1.35)	(5.60)	(-3.29)	(1.88)	YES		
Pakistan							
Philippines	-0.0327***	-0.0014	-0.0182	0.0088	YES	2829	0.4085
	(-3.55)	(-0.17)	(-0.89)	(0.35)	YES		
Sri Lanka							
Thailand	-0.0119	-0.0065***	-0.0072***	-0.0008	YES	9494	0.3705
	(-1.53)	(-4.40)	(-2.60)	(-0.17)	YES		
Panel B2: Europe-MEA							
Egypt	-0.0349*	0.0111	0.0409**	-0.0189	YES	4448	0.4158
	(-1.92)	(1.11)	(2.23)	(-1.07)	YES		
Poland	-0.0021	0.0223**	-0.0185	0.0226	YES	12365	0.4111
	(-0.18)	(2.35)	(-0.87)	(1.35)	YES		
Romania							
South Africa	-0.0067	0.0032	0.0242***	-0.0132	YES	9841	0.3952
	(-0.53)	(1.26)	(3.16)	(-1.30)	YES		
Turkey	-0.0544***	0.0034	0.0055	0.0311	YES	15733	0.5411
	(-3.79)	(0.37)	(0.44)	(1.28)	YES		
Panel B3: L-America							
Brazil	-0.0426***	0.0275***	-0.0126	0.0275	YES	5779	0.4282
	(-4.88)	(2.77)	(-0.83)	(1.33)	YES		
Chile							
Mexico	-0.0279*	-0.0023	0.0021	-0.0129	YES	2035	0.4064
	(-1.77)	(-0.21)	(0.30)	(-1.32)	YES		
Peru							

Table 12

Impact of HFT.

This table presents the regression results according to Equation (9) over the pre- and post-periods of the Chi-X introduction. Standard errors are clustered by country and time. *t*-Statistics are in parentheses. * = significance at the 0.10 level; ** = significance at the 0.05 level; *** = significance at the 0.01 level.

Panel A: *AMISHOCK*

	VOLASHOCK	*AMISHOCK*	*VOLASHOCK* × *AMISHOCK*	*VOLASHOCK* × *AMISHOCK* × *CHIX*	Controls	Obs	R^2
Australia	0.0234	0.1918***	-0.0554	0.1730*	YES	25062	0.3121
	(0.52)	(10.77)	(-0.94)	(1.76)	YES		
Austria	-0.0115*	-0.0057	0.0201	-0.0306	YES	1154	0.4261
	(-1.74)	(-0.45)	(0.68)	(-0.86)	YES		
Belgium	-0.0168	0.0500***	-0.0146	0.0767**	YES	2069	0.3838
	(-1.49)	(4.63)	(-0.58)	(2.27)	YES		
Denmark	-0.0267**	0.0208**	-0.0098	0.0595***	YES	2992	0.3476
	(-2.43)	(2.05)	(-0.53)	(2.76)	YES		
Finland	-0.0291***	0.0381***	-0.024	0.1240***	YES	2666	0.4543
	(-2.77)	(3.40)	(-1.55)	(3.05)	YES		
France	-0.0297***	0.0379**	0.0064	0.0213	YES	11411	0.3539
	(-3.13)	(2.18)	(0.23)	(1.02)	YES		
Germany	-0.0215*	0.0172	-0.0097	0.1194	YES	11320	0.2866
	(-1.96)	(1.11)	(-0.48)	(1.26)	YES		
Japan	-0.0134**	0.0293***	0.0211*	-0.0171	YES	54985	0.2202
	(-2.54)	(7.56)	(1.75)	(-1.29)	YES		
Netherlands	-0.0113	0.0188*	-0.0320***	0.0528*	YES	2287	0.3929
	(-1.33)	(1.86)	(-3.14)	(1.94)	YES		
Norway	-0.0235**	0.0344***	-0.0412***	0.0711***	YES	3303	0.3563
	(-2.04)	(2.59)	(-3.64)	(5.44)	YES		
Portugal	-0.0312**	0.0076	0.0125	-0.0149	YES	815	0.5531
	(-2.06)	(0.86)	(0.48)	(-0.61)	YES		
Spain	-0.0382***	0.0233***	0.0395	-0.0361	YES	2494	0.5298
	(-2.67)	(3.08)	(1.39)	(-1.25)	YES		
Sweden	-0.0195***	0.0636***	-0.0340**	-0.0138	YES	7595	0.2733
	(-3.45)	(4.55)	(-2.36)	(-0.50)	YES		
Switzerland	-0.0167*	0.0636***	-0.0069	-0.0598	YES	4297	0.3042
	(-1.88)	(8.68)	(-0.44)	(-1.60)	YES		
United Kingdom	-0.0307**	0.0886***	-0.0042	0.0243	YES	25542	0.1991
	(-2.02)	(9.70)	(-0.23)	(1.09)	YES		

Panel B: *SPRSHOCK*

	VOLASHOCK	*SPRSHOCK*	*VOLASHOCK* × *SPRSHOCK*	*VOLASHOCK* × *SPRSHOCK* × *CHIX*	Controls	Obs	R^2
Australia	0.0119	0.0649***	-0.0031	0.0332	YES	17659	0.3194
	(0.45)	(9.27)	(-0.10)	(0.70)	YES		
Austria	-0.0214**	-0.0031	0.0022	0.0482	YES	1028	0.4410
	(-2.91)	(-0.19)	(0.09)	(1.11)	YES		
Belgium	-0.0195	0.0578***	-0.0251**	0.0486**	YES	2057	0.4008
	(-1.32)	(6.16)	(-2.04)	(2.47)	YES		
Denmark	-0.0160*	0.0122	0.0173	-0.0424	YES	2841	0.3546
	(-1.79)	(1.01)	(0.86)	(-1.07)	YES		
Finland	-0.0314***	0.0247***	-0.0196	0.0390	YES	2633	0.4522
	(-2.84)	(3.08)	(-1.43)	(1.44)	YES		
France	-0.0324***	0.0277***	0.0064	0.0231*	YES	11337	0.3691
	(-3.62)	(3.12)	(0.61)	(1.84)	YES		
Germany	-0.0197**	0.0227***	-0.0115	0.0258	YES	10936	0.2739
	(-2.05)	(2.79)	(-1.41)	(0.45)	YES		

Japan	-0.0241**	0.0180***	0.0115	-0.0165	YES	54736	0.2151
	(-2.47)	(3.36)	(0.60)	(-0.72)	YES		
Netherlands	-0.0175**	0.0163***	-0.0160	0.0280*	YES	2298	0.3932
	(-2.18)	(4.59)	(-1.32)	(1.70)	YES		
Norway	-0.0294*	0.0061	-0.0311***	-0.0195	YES	3311	0.3635
	(-1.77)	(0.58)	(-2.70)	(-0.96)	YES		
Portugal	-0.0170	0.0058	-0.0109	0.0360	YES	815	0.5394
	(-1.16)	(0.59)	(-0.42)	(1.43)	YES		
Spain	-0.0334***	0.0262***	0.0180	-0.0205	YES	2529	0.5309
	(-3.72)	(3.35)	(1.21)	(-1.40)	YES		
Sweden	-0.0206**	0.0270***	-0.0011	-0.0027	YES	7370	0.2734
	(-2.18)	(4.05)	(-0.09)	(-0.16)	YES		
Switzerland	-0.0241**	-0.004	0.0178	-0.0382**	YES	4302	0.3800
	(-2.14)	(-0.45)	(1.30)	(-2.11)	YES		
United Kingdom	-0.0300***	0.0445***	-0.0014	0.0211*	YES	22304	0.1927
	(-2.61)	(11.96)	(-0.22)	(1.67)	YES		

Appendix 1

Variable definitions and data sources.

This table describes our explanatory variables.

Variable	Description
Panel A: Effects of Volatility and Liquidity Shocks on Stock Returns	
IVOSHOCK	Stock idiosyncratic volatility shock, computed as $IVOSHOCK_{i,t} = (IVO_{i,t} - AVGIVO_{i\|t-12,t-1})/AVGIVO_{i\|t-12,t-1}$, where $IVO_{i,t}$ is the idiosyncratic volatility, estimated from the market model in Bali and Cakici (2008), of stock *i* in month *t* and $AVGIVO_{i\|t-12,t-1}$ is the average of *IVO* for stock *i* from months *t* - 12 to *t* - 1. Source: Datastream.
DVOLSHOCK	Stock dollar volume shock, computed as $DVOLSHOCK_{i,t} = (DVOL_{i,t} - AVGDVOL_{i\|t-12,t-1})/AVGDVOL_{i\|t-12,t-1}$, where $DVOL_{i,t}$ is the dollar trading value of stock *i* in month *t* and $AVGDVOL_{i\|t-12,t-1}$ is the average of *DVOL* for stock *i* from month *t* - 12 to *t* - 1. Source: Datastream.
MKTRET	Value-weighted average of stock returns within a market in a given month. Source: Datastream.
MKTAMISHOCK	Monthly market *AMISHOCK*, computed as $MKTAMISHOCK_t = -(MKTILLIQ_t - AVGMKTILLIQ_{t-12,t-1})/AVGMKTILLIQ_{t-12,t-1}$, where $MKTILLIQ_t$ is the value-weighted average of stock log-transformed Amihud values in month *t* and $AVGMKTILLIQ_{t-12,t-1}$ is the average of $MKTILLIQ_t$ from months *t* - 12 to *t* - 1. Source: Datastream.
MKTSPRSHOCK	Monthly market *SPRSHOCK*, computed as $MKTSPRSHOCK_t = -(MKTSPREAD_t - AVGMKTSPR_{t-12,t-1})/AVGMKTSPR_{t-12,t-1}$, where $MKTSPREAD_t$ is the value-weighted average of stock closing spreads in month *t* and $AVGMKTSPR_{t-12,t-1}$ is the average of $MKTSPREAD_t$ from months *t* - 12 to *t* - 1. Source: Datastream.
BETA	Historical beta of stock *i* in month *t*. Source: Datastream.
SMKTCAP	Market capitalization of stock *i* in month *t*. Source: Datastream.
MAXRET	Maximum daily return of stock *i* in month *t* - 1. Source: Datastream.
REVISE	Return of stock *i* in month *t* - 1. Source: Datastream.
MOMENT	Cumulative return of stock *i* over months *t* - 12 to *t* - 2. Datastream.
STDTO	Standard deviation of monthly turnover over the past 12 months for stock *i* in month *t*. Monthly turnover is calculated as the share volume divided by the number of shares outstanding. Source: Datastream.
BVTOPRI	Ratio of the book value to price for stock *i* in month *t*. Source: Datastream.
Panel B: Market Attributes and the Role of Liquidity Providers	
MKTVOLA	Standard deviation of daily value-weighted market returns in month t. Source: Datastream.
MKTDVOL	Total trading value in a market in month *t*. Source: Datastream.
MKTCAP	Market capitalization of firms listed in a market in month *t*. Source: Datastream.
GOVERNANCE	Average of the six components of the Worldwide Governance Indicators in a given year. Source: World Bank.
GDP_PER_CAP	Gross domestic product (GDP) per capita in the previous year. Source: World Bank, World Economic Outlook.
DEVELOPMENT	An annual stock market development index is constructed based on the ratio of market capitalization to the GDP, the ratio of the stock traded value to the GDP, the turnover ratio, the number of listed firms, and the concentration ratio (ratio of the market capitalization of the 10 largest stocks to total market capitalization). Source: World Bank, Datastream.
OPENNESS	A proxy for market openness, computed as (Export + Import)/GDP in the current year. Source: World Bank.
SEGMENTATION	A monthly equity market segmentation measure is constructed for each market as per Bekaert, Harvey, Lundblad, and Siegel (2011). Source: Datastream.
SHORT_SELLING	A time-varying dummy variable set to one if short selling is prohibited and zero otherwise. Source: Jain, Jain, McInish, and McKenzie (2013), Charoenrook and Daouk (2005).
MKTMAKER	A time-varying dummy variable set to one for markets in the presence of market makers and zero otherwise. We surveyed the main stock exchange(s) when we are unsure of their trading mechanism. Source: Survey answers from main exchanges and exchange webpages.

Appendix 2

Correlation matrix.

This table shows the correlation matrices of the independent variables of Equation (7).

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[2] *MKT_DVOL*	-0.0405								
[3] *MKT_CAP*	-0.1666	0.8043							
[4] *GOVERNANCE*	-0.2303	0.5796	0.4749						
[5] *GDP_PER_CAP*	-0.2467	0.6760	0.6453	0.8774					
[6] *DEVELOPMENT*	-0.1555	0.3469	0.5151	0.1405	0.1088				
[7] *OPENNESS*	-0.1178	0.1039	0.0916	0.2508	0.2077	0.2666			
[8] *SEGMENTATION*	0.1024	-0.3888	-0.4366	-0.3642	-0.3139	-0.2845	-0.1195		
[9] *SHORT_SELLING*	0.1458	-0.5645	-0.5318	-0.5653	-0.6755	-0.0948	-0.1303	0.3549	
[10] *MKT_MAKER*	-0.2188	0.3858	0.2479	0.3952	0.4284	-0.1977	-0.1755	-0.2380	-0.3143

Appendix 3

Market attributes and the role of liquidity providers: Multivariate analysis.

This table presents our regression results for multivariate analysis. Standard errors are clustered by country and time. The variable MKTDVOL and MKTCAP are logarithmically scaled.

Panel A: Dependent variable - $(\beta_2 + \beta_3 VOLASHOCK_{50})(AMISHOCK_{75} - AMISHOCK_{25})$

	[1]	[2]	[3]	[4]
MKTVOLA	0.6375*	0.4391**	0.4316*	0.0098
	(1.73)	(2.04)	(1.73)	(0.07)
MKTDVOL	-0.0025*			
	(-1.83)			
MKTCAP		-0.0016		
		(-1.17)		
GOVERNANCE		0.0023		
		(0.99)		
GDP_PER_CAP				-0.0009
				(-0.62)
DEVELOPMENT	0.0016	0.0007	-0.0012	
	(0.36)	(0.19)	(-0.36)	
OPENNESS	0.0013		0.0022*	0.0015
	(1.01)		(1.89)	(1.02)
SEGMENTATION	-0.0477		-0.0665	0.0083
	(-0.73)		(-0.69)	(0.11)
SHORT_SELLING			0.0168	
			(1.05)	
MKT_MAKER				-0.0008
				(-0.20)
Constant	0.0481***	0.0471*	0.0172***	0.0299***
	(3.25)	(1.89)	(3.19)	(2.69)
Obs	182	156	182	135
R^2	0.0182	0.0522	0.0280	0.0180

Panel B: Dependent variable - $(\beta_2 + \beta_3 VOLASHOCK_{50})(SPRSHOCK_{75} - SPRSHOCK_{25})$

	[1]	[2]	[3]	[4]
MKTVOLA	-0.4991	0.0294	-0.4721	-0.4482
	(-1.50)	(0.15)	(-1.65)	(-1.55)
MKTDVOL	0.0008			
	(1.51)			
MKTCAP		-0.0011		
		(-1.28)		
GOVERNANCE		0.0058***		
		(3.88)		
GDP_PER_CAP				0.0012
				(1.03)
DEVELOPMENT	0.0021	0.0023	0.0031	
	(0.90)	(1.23)	(1.44)	
OPENNESS	-0.0009		-0.0014	-0.0009
	(-0.93)		(-1.32)	(-0.80)
SEGMENTATION	0.1366		0.1493	-0.0224
	(0.87)		(1.01)	(-0.27)
SHORT_SELLING			-0.0067**	
			(-2.24)	
MKT_MAKER				0.0006
				(0.27)
Constant	0.0043	0.0268	0.0145***	0.0067
	(0.99)	(1.58)	(2.79)	(0.54)
Obs	128	130	128	102
R^2	0.0505	0.1651	0.0770	0.0669

Appendix 4

Impact of market maker services.

Following the approach of Chung and Chuwonganant (2017), we test whether the influence of market makers on the impact of the liquidity channel is more time series based in seven markets, by adding the interaction term *VOLASHOCK* × *AMISHOCK* × *MMS* to Equation (6), where *MMS* is a dummy variable set to one over a one-year period following the introduction of market maker services in a given country and zero for a one-year pre-period. According to our survey answers, exchange websites, and the literature, nine of the 41 sample countries introduced market maker programs during our sample period; however, France and Italy do not have sufficient data over the one-year pre- and/or post-event windows.

Panel A: *AMISHOCK*

	VOLASHOCK	*AMISHOCK*	*VOLASHOCK* × *AMISHOCK*	*VOLASHOCK* × *AMISHOCK* × *MMS*	Controls	Obs	R^2
Singapore	-0.0160*	0.0500***	-0.0219	0.0515	YES	8067	0.2592
	(-1.76)	(4.34)	(-0.71)	(1.35)	YES		
South Korea	0.0147	0.0112*	0.0291	0.0073	YES	26872	0.2732
	(0.31)	(1.79)	(0.88)	(0.19)	YES		
Austria	-0.0256***	0.0385***	-0.0227	0.0274	YES	1340	0.2418
	(-3.13)	(3.24)	(-0.55)	(0.62)	YES		
Israel	0.0106	0.0831***	0.0770*	-0.0501	YES	4721	0.3236
	(1.03)	(4.27)	(1.73)	(-0.91)	YES		
Norway	-0.0252	0.1109***	0.2590***	-0.2953**	YES	2346	0.2584
	(-1.20)	(5.00)	(2.66)	(-2.37)	YES		
Sweden	0.0426	0.1423***	-0.0358	-0.0538	YES	6312	0.2560
	(1.43)	(8.21)	(-0.82)	(-0.74)	YES		
Turkey	-0.0427***	0.0454***	0.1206	-0.1541*	YES	6294	0.4650
	(-3.13)	(2.84)	(1.60)	(-1.76)	YES		

Panel B: *SPRSHOCK*

	VOLASHOCK	*AMISHOCK*	*VOLASHOCK* × *SPRSHOCK*	*VOLASHOCK* × *SPRSHOCK* × *MMS*	Controls	Obs	R^2
Singapore	-0.0131*	0.0216**	-0.0072	0.0503	YES	7053	0.2218
	(-1.67)	(2.32)	(-0.24)	(1.37)	YES		
South Korea	-0.0377	0.0009	0.2004**	-0.2101**	YES	26048	0.2683
	(-1.37)	(0.08)	(2.53)	(-2.35)	YES		
Austria							
Israel							
Norway	-0.0058	0.0700***	0.1012	-0.1374	YES	2273	0.2682
	(-0.24)	(5.26)	(1.28)	(-1.31)	YES		
Sweden	0.0279	0.0673***	-0.0519***	0.0185	YES	5253	0.2611
	(1.22)	(5.37)	(-2.58)	(0.51)	YES		
Turkey	-0.0403***	0.0066	0.1037*	-0.0803	YES	6442	0.4634
	(-3.57)	(0.62)	(1.66)	(-1.22)	YES		