Does FX Liquidity Influence the Relationship between Foreign Ownership and Stock Market Liquidity?

: Tobin Tax, Foreign Ownership and Stock Market Liquidity

Jieun Lee*

Bank of Korea

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Abstract

This paper investigates how foreign exchange (FX) market liquidity influences the relationship between foreign investors and stock market liquidity in an emerging market. First, I find that foreign investors improve stock market liquidity in Korea, which supports the trading hypothesis. This paper also investigates the possibility that decreases in FX market liquidity or the imposition of the Tobin Tax may limit foreign investments and thus reduce the local stock market liquidity; however, my empirical evidence shows that foreign investors still provide stock market liquidity even when FX market liquidity declines. Overall, these results indicate that foreign investors, as liquidity providers, play a positive role in emerging markets.

Keywords: Foreign institutional ownership; FX market liquidity; Stock market liquidity; Tobin Tax

JEL classification: G10; G18; G23

*Economist, Financial and Monetary Economics Team, Economic Research Institute, The Bank of Korea; telephone: +1-82-759-5470; Email: jelee@bok.or.kr. I gratefully acknowledge the helpful comments from seminar participants at the Bank of Korea. The views expressed herein represent those of the authors, and do not necessarily reflect the official view of the Bank of Korea.

1 Introduction

The Global Financial Crisis in 2008 sparked some controversy over the role of foreign investors in emerging markets. Despite their contribution to the growth of an emerging economy[1], foreign investors are criticized for creating huge volatility through their large foreign capital outflow during the crisis and for destabilizing the emerging economy.[2]To limit such excessive speculative trading of foreign investors, some emphasize the need for the imposition of the Tobin Tax, a tax on foreign exchange transactions (Stiglitz (1989) and Summers and Summers (1989)) as it can directly affect decreases in FX liquidity; however, there is also concern that the reduction of local financial market liquidity[3], caused by the Tobin Tax that may limit the foreign investors (Umluf (1993), Aliber et al. (2003), and Chou and Wang (2006)).

To better understand the role of foreign investors and the effect of the Tobin Tax in an emerging market, it is crucial to examine the linkage among FX liquidity, foreign investors and stock market liquidity. The Tobin Tax, which implies additional costs to foreign investors, may limit foreign investors and therefore reduce the inflow of foreign capital into the local stock markets; however, it is important to note that the effects of the Tobin Tax on the local stock market liquidity depend on the role of foreign investors. If foreign investors are liquidity providers in the local stock market, then the Tobin Tax will lead the stock market liquidity to be reduced. If foreign investors are speculative traders, then the Tobin Tax will cause the stock market liquidity to be increased.

In this paper, I first investigate the role of foreign investors associated with liquidity in an

[1]Traditionally, foreign equity investments are beneficial as they lower the costs of capital, which in turn lead to the improvement of firm valuation, economic growth and corporate governance in local financial markets (Bakaert and Havey (2000), (2001), Aggrawal, Eresl, Ferreira, and Matos (2011)).

[2]Dornbusch and Park (1995) argue that foreign investors pursue strategies that make stock priceoverreact to changes in fundamentals and more. Radelet and Sachs (1998) attribute the East Asian economic crisis to financial panic. Kaminsky, Lyons and Schumukler (2001) demonstrate that the Mexican, Asian, and Russian crises triggered withdrawals by mutual funds from other countries.

[3]Ulmarf(1993) finds that a transaction tax on trading, imposed in Sweden between 1984 and 1991 actually caused an increase in Volatility and a dramatic reduction in home market liquidity.

emerging market. There are two competing hypotheses about the relation between the level of institutional ownership and liquidity in the U.S markets that are applicable to this study: The adverse selection hypothesis suggests that when informed traders such as foreign traders possess superior information relative to other traders, information asymmetry increases, which in turn reduces liquidity (e.g., Grossman and Stiglitz, 1980; Glosten and Milgrom 1985; Easely and O'Hara, 1987). The trading hypothesis posits that when investors turnover their portfolio more frequently, transaction costs are reduced, which in turn improves liquidity (e.g., Demsetz, 1968; Merton, 1987; Schwartz and Shapiro, 1992). These two hypotheses point out an opposite direction in the relation between ownership level and liquidity. Previous empirical findings on emerging markets are also mixed. While Rhee and Wang (2009) suggest that foreign holdings have a negative effect on liquidity in the Jakarta Stock Exchange, Mingfa, Birger, and Sandy (2013) find that foreign investors promote liquidity in the Chinese stock market. Consequently, it is a purely empirical issue of how foreign investors affect stock market liquidity in Korea.

In addition, this paper examines how FX liquidity impacts the relationship between foreign ownership and stock market liquidity. To my knowledge, little has been said in the literature about such a relationship, which can indirectly test the effects of the Tobin Tax on an emerging market. Consistent with the limit of arbitrage, which indicates that high transaction costs and holding costs make arbitrage costly (Shliefer and Vishny (1997) and Pontiff (2006)), decreases in FX liquidity would limit foreign investors in local equity markets. If decreases in FX liquidity weaken the positive relationship between foreign investors and stock market liquidity, then foreign investors may not work as liquidity providers any longer and the local stock market liquidity may decline. If, however, decreases in FX liquidity are not enough to limit foreign investors, then a shock in FX market would not influence the relationship between foreign investors and stock market liquidity.

For my empirical analyses, I use Korean data, which have several peculiarities that link FX liquidity, foreign investors and stock market liquidity. First, among emerging markets, Korea is one that has developed enough to attract foreign investors. Second, Korea experienced financial market turmoil as a result of large foreign capital outflows during the Asian crisis in 1997 and the global financial crisis in 2008. Lastly, FX illiquidity relative to other currencies of the developed markets may work as a barrier to the entry of foreign investment in Korean equity markets.[4]

Using Korean data, I first measure liquidity[5]. Because no single measure can capture all the different aspects of liquidity (Kavajecz (1999)), I choose two that are widely used in the literature: spread (Corwin and Shultz (2012)) and price impact (Amihud (2002)). I then take a comprehensive approach by investigating the impact of foreign investors on different dimensions of liquidity including time-series and cross-sectional variation in liquidity. First, I find that as the level of foreign ownership increases, stock market liquidity improves over the sample period from January 2004 to December 2012. Our result is more supportive of the trading hypothesis than of the adverse selection hypothesis. This result is also consistent with prior literature that foreign investors are less informed than domestic investors. Choe, Kho, and Stulz (2005) and Hau (2001) show that foreign professional equity traders underperform their local counterparts in Korea and Germany. Furthermore, this result is also supported by studies of institutional investors in developed markets. Agarwal (2010) shows that liquidity increases with institutional holding but starts to decline once it reaches 40%. Therefore, 35% foreign ownership relative to total market capitalization in Korea would also suggest positive liquidity impacts on stock in the U.S.

[4]MSCI states that the limited convertibility of the Korean won keeps Korea as the status of emerging markets. For example, foreign investors are forced to trade the Korean Won during local business hours using Korean counterparties.

[5]Liquidity is generally defined as the ability to trade quickly as much as they want without price impact at a low cost.

Next, I test the linkage between FX liquidity and the relationship between foreign ownership and stock market liquidity in Korea. Our empirical evidence supports that as FX liquidity lowers, foreign ownership improves stock market liquidity. In other words, even if a negative shock in FX liquidity (e.g., the introduction of Tobin Tax) arises, foreign investors would continue providing liquidity in the Korean stock market, implying that they are not cross-market traders between FX and local financial markets for their every transaction. In sum, this result supports the idea that foreign investors play a positive role in improving stock market liquidity in Korea.

I perform a variety of robustness checks on my primary findings. I use firm-fixed effects to address the concern that foreign institutional ownership might be related to some unobserved firm characteristics that explain stock market liquidity. I also test the possibility of endogeneity and conduct the same analysis using the changes in variables and in the sub-sampe periods. My empirical results are robust to the alternative approaches.

This paper is organized as follows. Section 2 provides the background information about the Tobin Tax and Korean financial markets. Section 3 is dedicated to the description of data. In Section 4, I analyze the relation between foreign ownership and stock market liquidity and the linkage among FX liquidity, foreign ownership and stock market liquidity. Section 5 conducts a robustness check. Section 6 concludes the paper.

2 Background of the Tobin Tax and Korean Financial Markets

2.1 Tobin Tax and Liquidity

Since Tobin (1978) suggested the imposition of a tax on foreign exchange transactions, the Tobin Tax, as it is widely called, has been considered a potent yet unrealistic measure to decrease short-term speculative foreign exchange trades. As speculative foreign trades are blamed as one of the main causes of financial instability, especially in emerging market economies, the idea of taxation has been regarded as an ultimate tool to deal with external disturbances. It faded away from academic discourse, however, due to its lack of feasibility, difficulties in international co-ordinations and negative impacts on the efficiency of financial markets.

The Global Financial Crisis rekindled interest in the taxation among policy makers and commentators. Some argue that as the severity of the crisis and its fallout may outweigh any side effects, or any difficulties in the implementation of the tax, we need to take a second look at the idea of taxation. Indeed, as the global financial markets have been strongly integrated over the last few decades, financial disruptions in one country or region spread at an unprecedented speed. On the one hand, cross-border financial transactions help close saving-investment gaps in a country and thereby support its growth. By opening up the country's borders to foreign investors, availability of funding for investments to maintain its high growth significantly increased. On the other hand, the borders are no longer a fence against volatile, and sometimes vicious international capital movements. As some contend, the Tobin Tax may provide another tool to policy makers, in addition to the newly introduced macroprudential measures to guard against sudden changes in international

capital movements.

Generally speaking, taxes hamper transactions. This is even more true with the Tobin Tax since it is designed for the very purpose. While the intention is to discourage short term and speculative transactions, the effects may not be confined to it. Other long-term, and non-speculative transactions may well be affected as well. One of such unintended consequences is reduced market liquidity. The tax limits transactions, and low transaction volume, or low participation in the market, in turn deteriorates the liquidity.

In fact, it is not too hard to make a case that taxes, or in general transaction costs, lower the market liquidity. Umluf (1993), for example, finds that a transaction tax on stock trading, imposed in Sweden between 1984 and 1991 ended up increasing volatility and dramatically reducing liquidity of domestic markets as trading migrated to London and New York. Transaction costs in FX market are no different. Aliber (2003) find that the decline in transaction costs in FX market since the mid-1970s has been associated with a significant decline in volatility and an increase in trading volume. Chou (2006) find similar results for the futures market.

Since the countries which have implemented the Tobin Tax are at the early stage or the Tobin Tax is an ongoing debate among the other countries, data have not been sufficient for empirical analyses for the Tobin Tax. Under the premise that the imposition of the Tobin Tax leads to decreases in FX liquidity, this paper investigates the effects of Tobin Tax on the local stock market liquidity, focusing on the behavior of foreign investors.

First of all, the effects of theTobin Tax depend on the role of foreign investors in stock market liquidity. The reduced FX liquidity due to the Tobin Tax could limit foreign investors who try to invest in local stock market. If foreign investors are liquidity providers in the local stock market, then the Tobin Tax would reduce stock market liquidity. If they are speculative traders or liquidity takers, then the tax would improve stock market liquidity.

In addition to the role of foreign investors, it is important to figure out the extent to which the Tobin Tax limits foreign investors. There is a possibility that the Tobin Tax would not work as a constraint on such foreign investors, not influencing the behavior of foreign investors. If foreign investors are liquidity providers in the local stock market, they are likely to contrinue to provide liquidity despite a negative shock to FX market. It may be because they consider other factors more improtant than the Tobin Tax: foreign investors may prioritize global portfolio diversification or they may be long-term traders who are less sensitive to other exogenous shocks. In that case, they would have less incentive to cross borders for every stock trade. Consequently, it is crucial to examine how decreases in FX liquidity affect the relationship between foreign ownership and stock market liquidity.

2.2 Background of Korean Financial Market

In this section, I review the characteristics of Korean financial markets that can be regarded as a good example for analyzing the impacts of foreign investors on stock market liquidity in emerging markets.

Since the liberalization of foreign capital controls in 1992, foreign equity investments in Korea have gradually increased. Although Korea experienced large foreign capital outflows during the Asian currency crisis in 1997 and the global financial crisis in 2008, the foreign investors are still considered to be one of the influential groups, accounting for 35 percent of their ownership relative to total market capitalization.

Korea is still one of the attractive markets to foreign investors as the most developed financial markets among emerging markets. It stands out as the 15^{th} largest economy in terms of GDP, 13^{th} largest stock market in the world and the 3^{rd} largest in the Pacific Rim behind Japan and Australia and 9^{th} in terms of turnover value among member stock exchanges as of December 2012. Thus, the size and liquidity of Korea's equity market, together with

the scale of economic development is close to the developed market standards; however, according to MSCI, a leading provider of investment decision support tools worldwide, the limited convertibility of the Korean won keeps Korea at the status of an emerging market. For example, foreign investors are forced to trade the Korean won during local business hours using Korean counterparties. This aspect implies that FX illiquidity due to the limited convertibility of the Korean won, relative to other currencies such as the yen or Euro dollars, may restrain foreign investors from investing in Korean stock markets, relative to other countries. Foreign investors may therefore be reluctant to invest in Korean equity markets as FX liquidity further declines due to the imposition of the Tobin Tax. These peculiarities of Korean financial markets make this study important as it suggests the strong linkage of FX liquidity, foreign investors and stock market liquidity.

3 Data, Variable Construction, and Summary Statistics

In this section I discuss the estimation of data sources and summary statistics of the key variables used in the study.

3.1 Data

The sample includes all stocks listed on the Korean Stock Exchange between January 2004 and December 2012. I obtain stock market related data from FN Guide, such as foreign ownership, highs, lows, closing prices, stock returns, volume, and the total number of shares outstanding. Foreign exchange market data, such as highs, lows and closing prices are collected from the Bank of Korea's Economic Statistics System (ECOS) and volume data are obtained from the Bondweb.

3.2 Liquidity Measures

A stock is liquid to the extent that an investor can trade significant quantities of securities quickly, at or near the current market price and at low transaction costs. Because of the elusive nature of liquidity, researchers have suggested many alternative measures in different dimensions. Among those liquidity measures, this paper focuses on two that are widely used in literature - spread (Corwin and Shultz (2012)) and price impact (Amihud (2002)). Due to the limitation of FX market data, I do not construct alternative liquidity proxies such as the Pastor and Stambaugh (2003) measure and the Lesmond, Ogden, and Trizinca (1999) measure.

Referring to Corwin and Schultz (2012), I first calculate liquidity in the dimension of spread using daily highs, lows and closing prices in the foreign exchange and stock markets, respectively. Based on the intuition that daily highs are buyer-initiated and daily lows are seller-initiated, Corwin and Shultz first derive the relation where the ratio of high-to-low price is composed of fundamental Volatility of stock and its bid-ask spread, then rearrange this relation over two consecutive single days and one two-day period, respectively, and calculate spread. They confirm that the above measure accurately estimates liquidity benchmarks (effective spread) based on transaction level or high frequency data. Their measure also outperforms others such as the Roll (1984) measure, LOT measure (Lesmond, Ogden, and Trzcinka (1999) and effective tick spread (Holden (2009), Goyenko, Holden, and Trzconka (2009)) in the U.S market over the period 1993-2006. Furthermore, the Corwin and Schultz measure has the advantage of simple calculation based on easily accessible data such as daily highs, lows, and closing prices. Because of the data availability and their high correlations with liquidity benchmarks, the Corwin and Schultz measure is considered to be one of the appropriate methods for this study.

As another alternative measure, I construct the Ami measure, referring to Amihud (2002),

which emphasizes the price impact dimension of liquidity, i.e., the daily price response associated with one dollar of trading volume:

$$Amihud = \frac{|Return_{it}|}{Volume_{it}} \cdot 10^9$$

, where Return_{it} is the stock i's returns on day t and Volume_{it} is the stock i's won volume on day t. The average is calculated over all positive-volume days, since the ratio is undefined for zero volume days. Goyenko et al. (2009) show that in the dimension of the price impact, the Amihud (2002) dominates other measures against the benchmark constructed by high-frequency data.

3.3 Monthly Variables and Summary Statistics

I measure stock i's foreign ownership in month t-1 ($FOWN_{i,t-1}$) by the ratio of the number of shares held by foreign investors to the total number of shares outstanding. This measure implies that an increase in the number of stocks held by foreign institutional investors leads to a decrease in the average number of shares held by local investors and, thereby reducing the potential size of a trade and its accompanying liquidity-induced impact (e.g., Merton (1987)). In addition, I calculate the following variables (for firm i in month t) as control variables for my regression analyses: the standard deviation of daily returns ($Volatility_{i,t}$), quintile ranking of market capitalization ($Size_{i,t-1}$), and the ratio of trading volume to the total number of shares outstanding ($Turnover_{i,t}$).

Table 1 shows descriptive statistics on liquidity, foreign institutional ownership and other stock characteristics for my study sample. The mean value of stock market liquidity in the dimension of spread is 1.3%, and the value of foreign exchange market liquidity is 0.2%. Similarly, the mean value of stock market liquidity in the dimension of price impact is 0.1,

while the value of foreign exchange market liquidity is 0.01. These imply that the foreign exchange market is more liquid than the stock market, which is consistent with the idea that FX market is commonly regarded as extremely liquid because of their size and the dealership structure of the market. Our final sample consists of 1,727 firms and 151,676 stock-month observations.

Figure 1 shows the time-series of the KOSPI index, the Won/USD exchange rate, and two measures of foreign ownership coverage – namely, the number of firms with foreign ownership (FOWN) and the fraction of market capitalization held by foreign institutions for firms with coverage (FCAP) over the period from January 2004 to December 2012. The time-series of the KOSPI index and the Won/USD exchange rate also represent economic conditions. During the global financial crisis in 2008, the dollar values of the Korean shares dramatically dropped because both the KOSPI index and the dollar price of the won dropped. This figure also reports that foreign ownership variables also suddenly fell during the crisis. FOWN increased from 7.8 to 8.7 percent over the years 2004 through 2007, but has declined since the 2008 global financial crisis and reached 6.6 percent by the end of 2012. FCAP also shows a similar pattern as FOWN, falling from around 38 to 30 percent due to the impact of the global financial crisis. However, on average, the fraction of the number of shares held by institutional investors in each stock (FOWN) is around 7.4 percent and that of market capitalization held by foreign institutions (FCAP) is around 30 percent. These high percentages of foreign ownership suggest that foreign institutional investors would play an important role in the Korean financial market.

4 Basic Empirical Results

4.1 Impact of foreign ownership on stock market liquidity

In this section, I investigate whether foreign institutional investors provide or take stock market liquidity in Korea. Prior literature has studied the relationship between foreign institutional investors and stock market liquidity in emerging markets but to date, the role of foreign institutional investors in emerging markets remains ambiguous. Therefore, it totally depends on empirical results regarding the impacts of foreign institutional investors on stock market liquidity in Korea.

To figure out the relation between foreign ownership and stock market liquidity, I first regress individual stock liquidity on foreign ownership and a number of control variables using the panel data.

$$LIQ_{i,t} = \beta_0 + \beta_1 FOWN_{i,t-1} + \beta_2 Size_{i,t-1} + \beta_3 Turnover_{i,t} + \beta_4 Volatility_{i,t} + \varepsilon_{i,t} \qquad (1)$$

,where $LIQ_{i,t}$ is a daily average of stock i's liquidity that is measured by Corwin and Schultz (2012) and Amihud (2002) in the month t, $FOWN_{i,t-1}$ is the stock i's foreign ownership in month t-1 measured by the ratio of the number of shares held by foreign investors to the total number of shares outstanding. Note that both the liquidity estimates measure illiquidity. If foreign investors provide liquidity to the Korean stock market, the sign of β_1 should be negative.

Prior studies show that a significant portion of cross-sectional and time-series variations in liquidity can be explained by several stock attributes, including market capitalization, volatility, trading volume, and stock price (e.g., Bennet, Sias and Starks (2003), Rhee and Wang (2009)). To isolate the effect of foreign ownership on liquidity I include the following con-

trol variables: $Size_{i,t-1}$ is i stock's quintile rankings of market capitalization, $Turnover_{i,t}$is i stock's total number of shares outstanding at the end of the month t, $Volatility_{i,t}$is i stock's standard deviation of daily returns over a month t, and $\varepsilon_{i,t}$ is an error term. To assess the sensitivity of my results, I use Pooled OLS with industry and time dummy variables (Columns (1) and (3) in Table 3), firm-fixed effect (Columns (2) and (4) in Table 3). I use a firm-fixed effects regression model to control for omitted variables that differ across firms but do not change over time, and rely on time-series variations in variables to identify the relation between foreign institutional ownership and stock market liquidity. I calculate t-statistics using clustered standard errors for Columns (1) through (4). Petersen (2009) shows that the clustered standard errors correctly account for the dependence on the panel data set and produce unbiased estimates.

Regardless of models (1) through (4) and alternative measures of liquidity, the results of Table 3 show that the coefficients of foreign institutional ownership (β_1) are negative and statistically significant. This indicates that foreign institutional investors are liquidity providers, in that increases in foreign institutional ownership decrease spread, and thus improve liquidity. The negative relation between foreign institutional ownership and spread in the Korean stock market remains intact even after using different regression schemes.

Consistent with previous studies on the determinants of liquidity, size and turnover improve liquidity, volatility decreases liquidity. After controlling for size, volatility and turnover, I find that the relation between foreign institutional ownership and stock market liquidity is economically significant: a 10% increase in foreign ownership results in a 6.6 basis point (bp) decrease in spread (Column (2)). Consistent with the trading hypothesis, this result supports that foreign investors provide stock market liquidity in an emerging market.

4.2 The impact of FX liquidity on the relationship between foreign ownership and stock market liquidity

The previous section confirms that foreign investors improve liquidity in the local stock market. In this section, we test whether a negative shock in FX market such as the Tobin Tax that affect decreases in FX liquidity lead to the changes in the relation between the foreign ownership and stock market liquidity. If decreases in FX liquidity limit foreign investors, then foreign equity investment may declines and thus foreign investors may not work as the liquidity providers any more in the local market. As a result, stock market liquidity may decline.

To check the possibility, I estimate the following regression model.

$$\begin{aligned} LIQ_{i,t} &= \beta_0 + \beta_1 FOWN_{i,t-1} + \beta_2 Volatility_{i,t} + \beta_3 Turnover_{i,t} + \beta_4 Size_{i,t-1} \\ &\quad + \beta_5 LIQ_{fxt-1} + \beta_6 LIQ_{fxt-1} * FOWN_{i,t-1} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

,where all variables are the same as defined in equation (1). LIQ_{fxt} is the foreign exchange market liquidity, estimated by the method of Corwin and Schultz (2012) and Amihud (2002). Regardless of liquidity measures and alternative regression methods, I find that the coefficients of foreign institutional ownership (β_1) are negative after controlling for FX liquidity in addition to other variables. Additionally, I check whether FX liquidity influences the relationship between foreign institutional ownership and stock market liquidity. If FX liquidity weakens the role of foreign investors as liquidity providers in the local stock market, I expect the coefficients of interaction terms (β_6) to be positive. Otherwise, if FX liquidity does not influence the trading behavior of foreign investors as liquidity providers, the coefficient of interaction terms would be negative. The results in Table 4 show that the coefficients of interaction terms are significant and negative. I interpret this as evidence that although

the FX liquidity decreases, foreign investors continuously provide liquidity in the local stock market.

5 Robustness and Additional Tests

5.1 Endogeneity

A crucial concern is whether foreign ownership improves stock market liquidity or the reverse. Previous studies have reported that, ceteris paribus, foreign investors prefer to hold liquid stocks. To determine whether foreign investors drive improvements in liquidity, or whether the improvements in the liquidity attract foreign institutional investments, I conduct the analysis in the reverse direction using stock liquidity and lagged stock liquidity variables as the explanatory variables and foreign institutional ownership as the dependent variable. Two lags of the dependent variables are included to control for persistence in foreign ownership. I also control for the other control variables that are used for the previous analyses.The results for the level of foreign ownership are reported in Table 5, which shows that the coefficient on the liquidity is statistically insignificant or even negative in some cases. Thus, the evidence is consistent with foreign institutional ownership affecting liquidity, but not with liquidity attracting foreign institutional ownership.

5.2 Regression results based on changes in variables

Regression analyses using changes in variables are less likely to show spurious relations than those using level variables. Hence, I examine whether month-to-month changes in stock market liquidity can be explained by the changes in foreign institutional ownership in year t-1. Table 6 shows that changes in illiquidity,measured by Corwin and Schultz (2012), are negatively related to changes in foreign institutional ownership in all columns, (1)-(3), which

indicate that foreign investors are liquidity provider in the local stock market. I also confirm whether FX liquidity affect the relationship between foreign ownership and stock market liquidity. I find that as FX liquidity decreases (spread increases), foreign investors increases stock market liquidity (β_6<0). This result about changes in variables is consistent with my previous results.

5.3 Sub-period Analysis

Table 7 reports the sub-period analysis. I divide the sample into two periods: 2004-2007 and 2008-2012. Regardless of the sample periods, the results are in line with those for the whole period. The coefficients of $\text{FOWN}_{i,t-1}(\beta_1)$ for both sub-periods are negative. Additionally, negative coefficients of interaction terms (β_6) show that decreases in FX liquidity strengthen the positive relation between foreign investors and stock market liquidity. These results imply that foreign investors provide liquidity even when FX liquidity decreases. In sum, my results are robust with respect to sub-samples.

5.4 Level of Foreign Ownership: High-Foreign Ownership vs. Low-Foreign Ownership

This section investigates the impact of varying sizes of foreign ownership on stock market liquidity. Agarwal (2010) show that when institutional ownership levels are greater than 35 percent, any additional increase in instituional ownership leads to a decrease in stock liquidity while the lower level of instituional ownership improve stock market liquidity in the U.S market. This paper disaggregate foreign ownership into low and high ownership levels using 20% as a cutoff. Table 8 show that foreign investors provide liquidity even when the level of foreign ownership is high, but their significance is low. I also find that as FX

liquidity decreases, foreign investors continuously provide liquidity ($\beta_6<0$). This tendency is stronger when the level of foreign ownership is lower. Therefore, this result implies that foreign investors would provide stock market liquidity when FX liquidity shocks such as the Tobin Tax would occur.

6 Conclusion and Implications

The purpose of this paper is to test the effects of FX illiquidity or the Tobin Tax on the local stock liquidity by focusing on the behavior of foreign investors. Since the Tobin Tax is additional cost to foreign investors, it would limit trading activities of foreign investors in the local stock markets. However, the effects of the Tobin Tax depend on the behavior of foreign investors in the local financial markets: If foreign investors are liquidity providers, then stock market liquidity would decrease. If foreign investors are speculative traders, then the stock market liquidity would improve. This paper thus analyzes whether foreign ownership improves stock market liquidity in Korea. I find that as foreign ownership increases, stock market liquidity improves. This is consistent with the trading hypothesis that increases in investors' turnover lead to increases in liquidity by reducing transaction costs.

In addition to the role of foreign investors in the local financial markets, the extent to which FX illiquidity or the Tobin Tax limits foreign investors can affect the stock market liquidity. Provided that foreign investors are liquidity providers, there exists the possibility that transaction costs or illiquidity in FX market would limit the investment of foreign investors in the local financial markets because marginal costs become greater than marginal benefits and thus the increase in the transaction costs in FX market may lead to decreases in liquidity in the local equity market. On the contrary to this reasoning, my empirical result suggests that foreign investors continuously provide stock market liquidity as FX liquidity

declines. Based on these results, I conjecture that foreign investors would continuously provide stock market liquidity even when a negative shock in FX market such as the Tobin Tax arises. My analysis makes contributions to the literature. To my knowledge, it is the first to figure out the linkage among FX liquidity, foreign investors and stock market liquidity. Overall, my evidence supports that foreign investors play a positive role in improving stock market liquidity in emerging markets.

7 Appendix

Liquidity measure: Corwin and Schultz (2012)

Referring to Corwin and Shultz (2012), we estimate the spread. Their method is based on the following intuition: first, daily high prices are buyer-initiated while daily low prices are seller-initiated. The high-low price ratio for a day includes both the fundamental volatility of the stock and its bid-ask spread. Second, the volatility component of high-low price ratio proportionally increases with the length of the trading interval, while the spread component does not.

Under the assumption that true value of the stock price follows a diffusion process and there is a spread of $S\%$, which is constant over the two-day estimation period, they derive the high-low price ratio.

$$\left[ln(\frac{H_t^o}{L_t^o})\right]^2 = \left[ln(\frac{H_t^A(1+S/2)}{L_t^A(1+S/2)})\right] = \left[ln(\frac{H_t^A}{L_t^A})\right]^2 + 2\left[ln(\frac{H_t^A}{L_t^A})\right]\left[ln(\frac{2+S}{2-S})\right] + \left[ln(\frac{2+S}{2-S})\right]^2. \tag{3}$$

,where $H_t^A(L_t^A)$ is the actual high (low) stock price on day t and $H_t^o(L_t^o)$ is the observed high(low) stock price for day t.

Based on the assumptions that stock prices follow the usual geometric Brownian motion, and the prices are observed continuously,

$$E\left\{\frac{1}{T}\sum_{t=1}^{T}\left[ln(\frac{H_t}{L_t})\right]^2\right\} = k_1\sigma_{HL}^2 \tag{4}$$

,where $H_t(L_t)$ is the high (low) on day$t$ and $k_1 = 4ln(2)$.

Similarly, [parkinson1980extreme] shows that

$$E\left\{\frac{1}{T}\sum_{t=1}^{T}\left[ln(\frac{H_t}{L_t})\right]\right\} = k_2\sigma_{HL}. \tag{5}$$

,where $k_2 = \sqrt{\frac{8}{\pi}}$.

Substituting equations (4) and (5) into the expectation of equation (3),

$$E\left\{\left[ln(\frac{Ht^o}{Lt^o})\right]^2\right\} = k1\sigma HL^2 + 2k2\sigma HL^2 ln\left(\frac{2+S}{2-S}\right) + \left[ln\frac{(2+S)}{(2-S)}\right]^2 \tag{6}$$

The expectation of the sum of (6) over two consecutive single days is

$$E\left\{\sum_{j=0}^{1}\left[ln(\frac{H^o_{t+j}}{L^o_{t+j}})\right]^2\right\} = 2k_1\sigma^2_{HL} + 4k_2\sigma^2_{HL} ln\left(\frac{2+S}{2-S}\right) + 2\left[ln\frac{(2+S)}{(2-S)}\right]^2. \tag{7}$$

For simplicity, we define

$$A = ln(\frac{2+S}{2-S}), B = E\left\{\sum_{j=0}^{1}\left[ln(\frac{H^o_{t+j}}{L^o_{t+j}})\right]^2\right\} \tag{8}$$

Substituting equation (8) into (7),

$$2k_1\sigma^2_{HL} + 4k_2\sigma^2_{HL}A + 2A^2 - B = 0. \tag{9}$$

Here, A and $\sigma_{HL}$are unknowns.

The following equation represents the high-low price ratios over a two-day period

$$\left[ln(\frac{H^o_{t,t+1}}{L^o_{t,t+1}})\right]^2 = \left[ln(\frac{H^A_{t,t+1}}{L^A_{t,t+1}})\right]^2 + 2\left[ln(\frac{H^A_{t,t+1}}{L^A_{t,t+1}})\right]\left[ln(\frac{2+S}{2-S})\right] + \left[ln(\frac{2+S}{2-S})\right]^2. \tag{10}$$

where $H_{t,t+1}$ is the high price over the two days t and t+1 and $L_{t,t+1}$ is the low price over two days t andt+1.

To simplify notation, we define

$$C = \left[ln(\frac{H^o_{t,t+1}}{L^o_{t,t+1}}) \right]^2. \tag{11}$$

Taking expectations of equation (10) produces

$$2k_1\sigma^2_{HL} + 2\sqrt{2}k_2\sigma^2_{HL}A + 2A^2 - C = 0. \tag{12}$$

In equation (12), A and $\sigma_{HL}$are unknowns.

Based on the equation (9) and (12), we can obtain values, A and σ_{HL}.

$$\sigma_{HL} = \frac{\sqrt{\frac{B}{2}} - \sqrt{B}}{k_2(3-2\sqrt{2})} + \sqrt{\frac{C}{k_2(3-2\sqrt{2})}},\ A = \sqrt{B}(1+\sqrt{2}) - \sqrt{\frac{C}{3-2\sqrt{2}}}$$

Using the simple transformation of A in [eq:a6], the high-low spread estimate can be calculated.

$$S = \frac{2(\exp^A - 1)}{1 + \exp^A}$$

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Figure 1. Time-series Plots of Foreign Ownership

This figure presents the time-series of the monthly foreign ownership (FOWN), the monthly value-weighted foreign ownership (FCAP), the KOSPI monthly index (KOSPI), and the Won/USD monthly exchange rates (Exchange) for the period from February 2004 to December 2012.

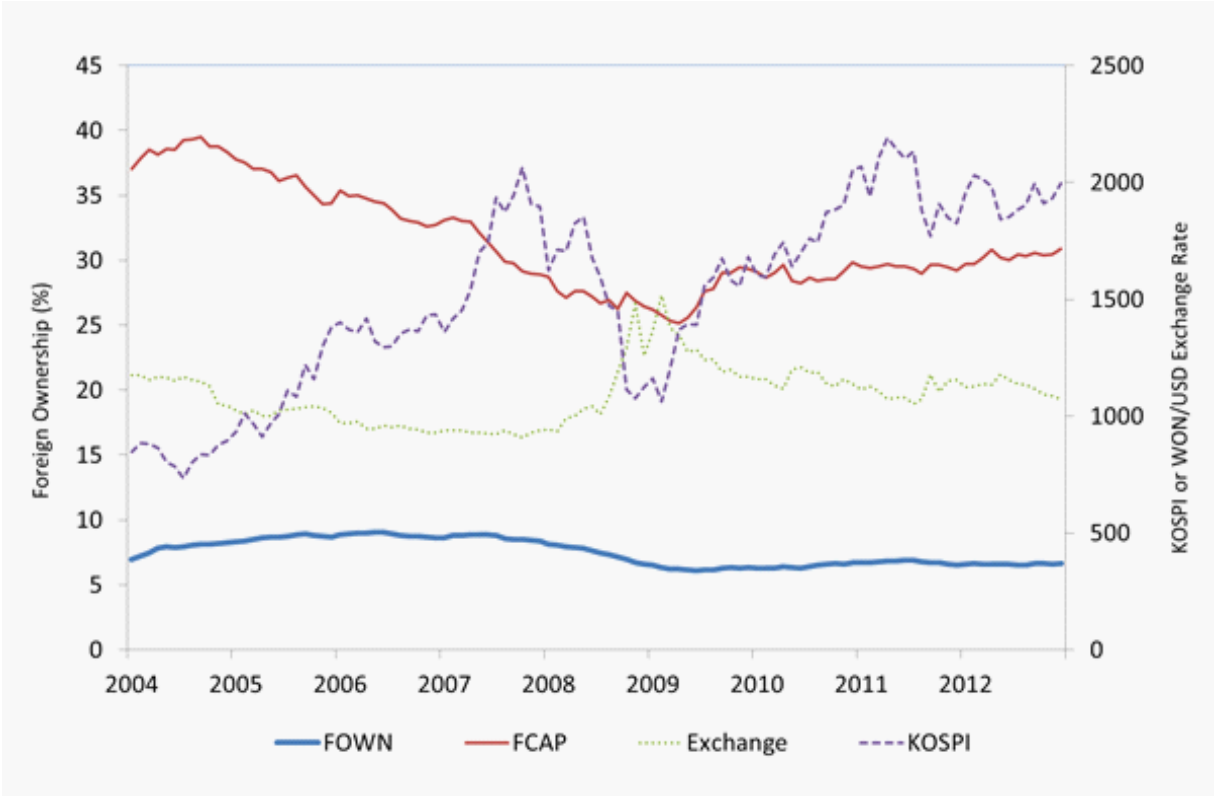

Table 1. Liquidity Measures on Korean Stock Exchange

This table reports statistics on FX and stock market liquidity variables over the sample period from January 2004 to December 2012. $SP_{i,t}$ is the individual stock i's monthly spread estimate, using Corwin (2012). $MKTSP_t$ ($FXSP_t$) is the mean of daily spread estimate (Corwin (2012) on the stock (foreign exchange) market in month t. AMI is the individual stock i's Amihud (2002) measure.$MKTAMI_t(FXAMI_t)$ is the mean of daily Amihud (2002) measure on the stock (foreign exchange) market liquidity in month t. Panel A shows the summary statistics of monthly variables. Panel B shows correlations among the variables.

Panel A. Descriptive statistics

Variables	Obs	Mean	Std. Dev.
$SP_{i,t}$	151603	0.013	0.007
$MKTSP_t$	151603	0.013	0.002
$FXSP_t$	151603	0.002	0.001
$AMI_{i,t}$	151598	0.096	0.573
$MKTAMI_t$	151603	0.096	0.180
$FXAMI_t$	151603	0.010	0.010

Panel B. Correlations

	$SP_{i,t}$	$MKTSP_t$	$FXSP_t$	$AMI_{i,t}$	$MKTAMI_t$	$FXAMI_t$
$SP_{i,t}$	1					
$MKTSP_t$	0.315	1				
$FXSP_t$	0.219	0.697	1			
$AMI_{i,t}$	0.049	0.056	-0.002	1		
$MKTAMI_t$	0.057	0.179	-0.007	0.313	1	
$FXAMI_t$	0.234	0.745	0.8	0.05	0.159	1

Table 2. Descriptive statistics

This table presents foreign ownership (FOWN) of stock i in month t-1, the quintile ranking of market capitalization (Size) of stock i in month t-1,monthly standard deviation of return (Volatility), monthly turnover ratio (Turnover) of stock i in month t. Panel A shows the summary statistics of monthly variables. Panel B shows correlations among the variables.

Panel A. Summary statistics

	Obs	Mean	Dev.	Min	Max
FOWN	151603	0.074	0.132	0.000	0.940
Size	151603	3.001	1.414	1.000	5.000
Volatility	151575	0.033	0.018	0.000	0.173
Turnover	151556	0.016	0.045	0.000	0.993

Panel B. Correlations

	FOWN	Size	Volatility	Turnover
FOWN	1			
Size	0.425	1		
Volatility	-0.144	-0.19	1	
Turnover	-0.087	-0.08	0.420	1

Table 3. Foreign ownership and stock market liquidity

Columns (1) through (6) show the results of the following regression model:
$LIQ_{i,t} = \beta_0 + \beta_1 FOWN_{i,t-1} + \beta_{2i,t} Size + \beta_3 Turnover_{i,t} + \beta_4 Volatility_{i,t} + \varepsilon_{i,t}$;where $LIQ_{i,t}$ is the measure of liquidity that is calculated by the method of Corwin (2012) or Amihud (2002), $FOWN_{i,t-1}$is stock i's number of shares held by foreign investors in the previous month, $Size_{i.t-1}$ is stock i's quintile ranking of the market capitalization at the end of the month t-1, $Turnover_{i,t}$is stock i's trade volume on the last day of the month divided by the number of share outstanding, $Volatility_{i,t}$ is stock i's standard deviation of daily return over a month. Column (1) and (3) show the pooled ordinary least squares (OLS) regression results; Column (2) and (4) report the regression results with firm fixed effects. Numbers in parenthesis are clustered standard errors at the firm level, following Petersen (2009).

	Corwin and Shultz(2012)		Amihud(2002)	
	(1)	(2)	(3)	(4)
Variables	Pooled OLS	Fixed Effect	Pooled OLS	Fixed Effect
$FOWN_{i,t-1}$	-0.027***	-0.066***	-0.011**	-0.051***
	(0.008)	(0.022)	(0.005)	(0.018)
$Size_{i,t-1}$	-0.071***	-0.051***	-0.012***	-0.007***
	(0.001)	(0.002)	(0.001)	(0.002)
$Turnover_{i,t}$	-0.569***	-0.428***	-0.146***	-0.093***
	(0.048)	(0.030)	(0.016)	(0.016)
$Volatility_{i,t}$	0.152***	0.150***	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
$LIQ_{i,t-1}$	0.348***	0.272***	0.754***	0.726***
	(0.004)	(0.002)	(0.022)	(0.015)
Constant	0.592***	0.631***	0.103***	0.358***
	(0.007)	(0.006)	(0.019)	(0.028)
Observations	149,649	149,649	149,641	149,641
Industry FE	YES	NO	YES	NO
Adj.R-squared	0.50	0.32	0.64	0.59
Number of firm		1,720		1,720

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. FX Liquidity, Foreign Ownership and Stock Market Liquidity

Columns (1) through (6) show the results of the following regression model: $LIQ_{i,t} = \beta_0 + \beta_1 FOWN_{i,t-1} + \beta_2 Size_{i,t-1} + \beta_3 Turnover_{i,t} + \beta_4 Volatility_{i,t} + \beta_5 LIQ_{fxt-1} + \beta_6 LIQ_{fxt-1} * FOWN_{i.t-1} + \varepsilon_{i,t}$; where $LIQ_{i,t}$ is the mean of daily spread measure over a month, estimated by the methd in Corwin (2012) or the mean of daily price impact, calculated by the method in Amihud (2002), $FOWN_{i,t-1}$is stock i's number of shares held by foreign investors in the previous month, $Size_{i,t-1}$ is stock i's quintile ranking of market capitalization at the end of the month t-1, $Turnover_{i,t}$ is stock i's trade volume on the last day of the month divided by the number of share outstanding, $Volatility_{i,t}$ is stock i's standard deviation of daily return over a month, LIQ_{fxt-1} is the mean of daily liquidity on the foreign exchange over a month, which equals spread, estimated by Corwin (2012) or price impact, measured by Amihud (2002). Numbers in parenthesis are clustered standard errors at the firm level, following Petersen (2009).

Panel A. Pooled OLS

	Corwin and Schultz(2012)		Amihud(2002)	
Variables	(1)	(2)	(3)	(4)
$FOWN_{i,t-1}$	-0.073***	-0.018	-0.010*	0.001
	(0.027)	(0.029)	(0.006)	(0.006)
$Size_{i,t-1}$	-0.116***	-0.116***	-0.011***	-0.011***
	(0.003)	(0.003)	(0.001)	(0.001)
$Turnover_{i,t}$	-0.384***	-0.384***	-0.206***	-0.206***
	(0.064)	(0.064)	(0.019)	(0.019)
$Volatility_{i,t}$	0.188***	0.188***	0.002**	0.002**
	(0.002)	(0.002)	(0.001)	(0.001)
LIQ_{fxt-1}	0.315***	0.342***	0.272***	0.355***
	(0.018)	(0.021)	(0.070)	(0.082)
$FOWN_{i,t-1}$*LIQ_{fxt-1}		-0.383***		-1.186***
		(0.120)		(0.336)
$LIQ_{i,t-1}$			0.749***	0.749***
			(0.013)	(0.013)
Constant	0.998***	0.994***	0.169***	0.168***
	(0.017)	(0.017)	(0.012)	(0.012)
Observations	149,649	149,649	149,641	149,641
Industry Dummy	YES	YES	YES	YES
Year Dummy	YES	YES	YES	YES
Adj.R-squared	0.43	0.43	0.63	0.63

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B. Firm Fixed Effect

	Corwin and Shultz(2012)		Amihud(2002)	
Variables	(1)	(2)	(3)	(4)
$FOWN_{i,t-1}$	-0.073*	-0.026	-0.049***	-0.035*
	(0.037)	(0.039)	(0.019)	(0.019)
$Size_{i,t-1}$	-0.057***	-0.057***	-0.007***	-0.007***
	(0.004)	(0.004)	(0.002)	(0.002)
$Turnover_{i,t}$	-0.164***	-0.163***	-0.153***	-0.153***
	(0.060)	(0.060)	(0.017)	(0.017)
$Volatility_{i,t}$	0.160***	0.160***	0.002***	0.002***
	(0.002)	(0.002)	(0.001)	(0.001)
LIQ_{fxt-1}	0.440***	0.467***	0.366***	0.476***
	(0.018)	(0.021)	(0.072)	(0.086)
$FOWN_{i,t-1}$*LIQ_{fxt-1}		-0.401***		-1.559***
		(0.117)		(0.358)
$LIQ_{i,t-1}$			0.720***	0.720***
			(0.014)	(0.015)
Constant	0.913***	0.910***	0.190***	0.189***
	(0.015)	(0.016)	(0.014)	(0.014)
Observations	149,649	149,649	149,641	149,641
Number of firm	1,720	1,720	1,720	1,720
Adj.R-squared	0.29	0.29	0.58	0.58

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Testing Reverse Causality: Determinants of Foreign Investors

This table presents the impact of liquidity on subsequent foreign ownership. Column (1) and (2) show the results of the following regression models:
$FOWN_{i,t} = \beta_0 + \beta_1 LIQ_{i,t-1} + \beta_2 LIQ_{i,t-2} + \beta_3 Size_{i,t-1} + \beta_4 Turnover_{i,t} + \beta_5 Volatility_{i,t} + \beta_6 FOWN_{i,t-1} + \beta_7 FOWN_{i,t-2} + \varepsilon_{i,t}$; where $LIQ_{i,t}$ is the mean of daily liquidity over a month, estimated by the method in Corwin (2012), and by the method in Amihud (2002), $FOWN_{i,t-1}$is stock i's number of shares held by foreign investors in the previous month, $Size_{i,t-1}$ is stock i's quintile ranking of market capitalization at the end of the month t-1, $Volatility_{i,t}$ is stock i's standard deviation of daily return over a month, $Turnover_{i,t}$ is stock i's trade volume on the last day of the month divided by the number of share outstanding. Numbers in parenthesis are clustered standard errors at the firm level.

Variables	Corwin and Shltz(2012) (1)	Amihud(2002) (2)
$LIQ_{i,t-1}$	0.011	0.002
	(0.007)	(0.002)
$LIQ_{i,t-2}$	-0.005	0.004
	(0.007)	(0.002)
$Size_{i,t-1}$	0.032***	0.032***
	(0.003)	(0.003)
$Turnover_{i,t}$	-0.091	-0.089
	(0.103)	(0.103)
$Volatility_{i,t}$	-0.014***	-0.013***
	(0.003)	(0.003)
$FOWN_{i,t-1}$	1.067***	1.067***
	(0.008)	(0.008)
$FOWN_{i,t-2}$	-0.075***	-0.075***
	(0.008)	(0.008)
Constant	-0.014	-0.008
	(0.017)	(0.012)
Observations	147,774	147,766
Industry FE	YES	YES
Adj.R-squared	0.99	0.99

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Changes in Variables

This table shows the results of the following regression model: $\Delta LIQ_{i,t} = \beta_0 + \beta_1 \Delta FOWN_{i,t-1} + \beta_2 \Delta Volatility_{i,t} + \beta_3 \Delta Turnover_{i,t} + \beta_4 \Delta Return_{i,t} + \beta_5 \Delta LIQ_{fxt-1} + \beta_6 \Delta LIQ_{fxt-1} * \Delta FOWN_{i.t-1} + \varepsilon_{i,t}$,where Δ denotes changes in variable, $LIQ_{i,t}$ is the mean of daily stock liquidity over a month, estimated by the method in Corwin (2012) and calculated by the method in Amihud (2002), $FOWN_{i,t-1}$is stock i's number of shares held by foreign investors in the previous month, $Size_{i,t-1}$ is stock i's quintile ranking of market capitalization month t-1, $Turnover_{i,t}$ is stock i's trade volume on the last day of the month divided by the number of share outstanding, $Volatility_{i,t}$ is stock i's standard deviation of daily return over a month, LIQ_{fxt} is the mean of daily liquidity on the foreign exchange over a month, which equals spread, estimated by Corwin (2012) or price impact, measured by Amihud (2002). Numbers in parenthesis are clustered standard errors at the firm level, following Petersen (2009).

Variables	(1)	(2)	(3)
ΔFOWN$_{i,t-1}$	-0.243**	-0.158	-0.156
	(0.101)	(0.101)	(0.101)
Size$_{i,t-1}$	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)
ΔVolatility$_{i,t-1}$	0.113***	0.113***	0.113***
	(0.002)	(0.002)	(0.002)
ΔTurnover$_{i,t-1}$	-0.822***	-0.824***	-0.824***
	(0.061)	(0.062)	(0.062)
ΔLIQ$_{fx_{t-1}}$		0.176***	0.175***
		(0.019)	(0.019)
ΔFOWN$_{i.t-1} * \Delta$LIQ$_{fx_{t-1}}$			-1.888*
			(1.086)
Constant	0.004***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)
Observations	149,578	147,710	147,710
Adj.R-squared	0.10	0.10	0.10

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Sub-period Analysis

For each sub-period, 2004-2008 and 2009-2012, I run the following regression model: $LIQ_{i,t} = \beta_0 + \beta_1 FOWN_{i,t-1} + \beta_2 Size_{i,t-1} + \beta_3 Turnover_{i,t} + \beta_4 Volatility_{i,t} + \beta_5 LIQ_{fxt-1} + \beta_6 LIQ_{fxt-1} * FOWN_{i.t-1} + \varepsilon_{i,t}$;where $LIQ_{i,t}$ is the mean of daily liquidity measure over a month, estimated by the methd in Corwin (2012) or the mean of daily price impact, calculated by the method in Amihud (2002), $FOWN_{i,t-1}$is stock i's number of shares held by foreign investors in the previous month, $Size_{i,t-1}$ is stock i's quintile ranking of market capitalization at the end of the month t-1, $Turnover_{i,t}$, is stock i's trade volume on the last day of the month divided by the number of share outstanding, $Volatility_{i,t}$ is stock i's standard deviation of daily return over a month, LIQ_{fxt} is the mean of daily liquidity on the foreign exchange over a month, which equals spread, estimated by Corwin (2012) and Amihud (2002). Numbers in parenthesis are clustered standard errors at the firm level, following Petersen (2009).

Sample Period	2004-2008			2009-2012		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	OLS	FE	FE	OLS	FE	FE
$FOWN_{i,t-1}$	-0.081***	-0.078**	-0.035	0.005	-0.135***	-0.057
	(0.019)	(0.037)	(0.038)	(0.024)	(0.050)	(0.054)
$Size_{i,t-1}$	-0.107***	-0.028***	-0.027***	-0.116***	-0.033***	-0.033***
	(0.002)	(0.003)	(0.003)	(0.001)	(0.003)	(0.003)
$Turnover_{i,t}$	-0.568***	-0.408***	-0.407***	-0.332***	0.047	0.048
	(0.070)	(0.046)	(0.046)	(0.070)	(0.042)	(0.042)
$Volatility_{i,t}$	0.187***	0.156***	0.156***	0.192***	0.158***	0.158***
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
LIQ_{fxt-1}	0.562***	0.667***	0.698***	0.339***	0.468***	0.498***
	(0.025)	(0.014)	(0.016)	(0.022)	(0.014)	(0.016)
$FOWN_{i,t-1}$*LIQ_{fxt-1}	-0.432***		-0.431***	-0.362***		-0.446***
	(0.132)		(0.106)	(0.130)		(0.112)
Constant	0.984***	0.824***	0.820***	1.025***	0.814***	0.807***
	(0.008)	(0.009)	(0.009)	(0.008)	(0.011)	(0.011)
Observations	73,740	73,740	73,740	75,909	75,909	75,909
Industry FE	YES	NO	NO	YES	NO	NO
Adj.R-squared	0.40	0.25	0.25	0.44	0.24	0.24
Number of firm		1,439	1,439		1,720	1,720

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8. Level of Foreign Ownership: High vs. Low-Foreign Ownership

This table shows the results of the following regression model: $LIQ_{i,t} = \beta_0 + \beta_1 FOWN_{i,t-1} + \beta_2 Size_{i,t-1} + \beta_3 Turnover_{i,t} + \beta_4 Volatility_{i,t-1} + \beta_5 LIQ_{fxt-1} + \beta_6 LIQ_{fxt-1} * FOWN_{i.t-1} + \varepsilon_{i,t}$; where $LIQ_{i,t}$ is the mean of daily liquidity measure over a month, estimated by the methd in Corwin (2012) or the mean of daily price impact, calculated by the method in Amihud (2002), $FOWN_{i,t-1} < 20\%(FOWN_{i,t-1} \geq 20\%)$ is stock i's number of shares held by foreign investors in the previous month if foreign ownership is less than (greater or equal to) 20% and zero otherwise. If $\text{FOWN}_{i,t-1}$ is less than (greater or equal to) 20% then it is indicated as Low(High). $Size_{i,t-1}$ is stock i's quintile ranking of market capitalization at the end of the month t-1, $Turnover_{i,t}$,tis stock i's trade volume on the last day of the month divided by the number of share outstanding, $Volatility_{i,t}$ is stock i's standard deviation of daily return over a month, LIQ_{fxt} is the mean of daily liquidity on the foreign exchange over a month, which equals spread, estimated by Corwin (2012) or price impact, measured by Amihud (2002). The sampe period is from 2004 to 2012.

Panel A. Liquidity measure: Corwin and Shultz (2012)

	(1)	(2)	(3)	(4)
Variables	High	Low	High	Low
$\text{FOWN}_{i,t-1}$	-0.038***	-0.303***	-0.017	-0.247***
	(0.008)	(0.025)	(0.012)	(0.039)
$\text{Size}_{i,t-1}$	-0.116***	-0.115***	-0.117***	-0.115***
	(0.001)	(0.001)	(0.001)	(0.001)
$\text{Turnover}_{i,t}$	-0.477***	-0.477***	-0.476***	-0.477***
	(0.049)	(0.049)	(0.049)	(0.049)
$\text{Volatility}_{i,t}$	0.192***	0.192***	0.192***	0.192***
	(0.001)	(0.001)	(0.001)	(0.001)
LIQ_{fxt-1}	0.428***	0.431***	0.432***	0.438***
	(0.014)	(0.014)	(0.014)	(0.015)
$\text{FOWN}_{i,t-1}$*LIQ_{fxt-1}			-0.280**	-2.513
			(0.140)	(1.555)
Constant	0.980***	0.981***	0.979***	0.979***
	(0.005)	(0.005)	(0.005)	(0.005)
Observations	149,649	149,649	149,649	149,649
Adj.R-squared	0.42	0.42	0.42	0.42

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(Table 8. Continued)

Panel B. Liquidity measure: Amihud (2002)

VARIABLES	(1) High	(2) Low	(3) High	(4) Low
$FOWN_{i,t-1}$	-0.008*	-0.011	-0.000	0.014
	(0.005)	(0.013)	(0.005)	(0.016)
$Size_{i,t-1}$	-0.012***	-0.012***	-0.012***	-0.012***
	(0.001)	(0.001)	(0.001)	(0.001)
$Turnover_{i,t}$	-0.206***	-0.205***	-0.206***	-0.205***
	(0.015)	(0.015)	(0.015)	(0.015)
$Volatility_{i,t}$	0.002***	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)
LIQ_{fxt-1}	0.270***	0.268***	0.302***	0.344***
	(0.098)	(0.098)	(0.106)	(0.119)
$FOWN_{i,t-1}$*LIQ_{fxt-1}			-0.797**	-2.648**
			(0.333)	(1.284)
$LIQ_{i,t-1}$	0.749***	0.749***	0.749***	0.749***
	(0.023)	(0.023)	(0.023)	(0.023)
Constant	0.169***	0.169***	0.169***	0.169***
	(0.011)	(0.011)	(0.011)	(0.011)
Observations	149,641	149,641	149,641	149,641
Adj.R-squared	0.63	0.63	0.63	0.63

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1