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Stock market liberalization, foreign institutional investors, and informational efficiency of stock prices: Evidence from an emerging market

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Abstract

This study investigates the effects of investments by qualified foreign institutional investors (QFIIs) on the informational efficiency of stock prices in Chinese A-share stock markets. Employing a large sample of listed firms from 2004 to 2012, we document a significant and positive relationship between stock price informativeness and stock ownership by foreign institutional investors. We also use the instrument-variable approach, propensity-score matching method, as well as an alternative measure of informational efficiency to ensure the robustness of our findings. We document that the effects of foreign ownership on informational efficiency is stronger for firms with lower levels of assets intangibility and in regions with less developed institutions. In addition, we document that the effects of foreign ownership on informational efficiency is more pronounced when QFIIs have better local information and more incentives to monitor.

KEYWORDS

China, foreign institutional investors, market liberalization, stock price efficiency

1 | INTRODUCTION

Stock market liberalization refers to a national government's decision to allow foreign investors to purchase shares in that country's stock market (Henry, 2000). The late 1980s and early 1990s witnessed waves of stock market liberalizations in emerging markets, which led to private investment booms and massive foreign capital inflows into emerging markets (Henry, 2000). The standard international asset pricing models posit that stock market liberalization may reduce the cost of equity in liberalizing countries due to the risk sharing between domestic and foreign investors (Henry, 2000). In addition

to the reduction of cost of capital, the scrutiny of foreign investors, especially those sophisticated institutional investors, can help to resolve information and agency problems. The increased openness to foreign institutional investors helps to improve the information environment (Piotroski & Wong, 2014), which facilitates the decision-making process of investors and managers regarding the resources allocation (Bae, Warren, & Mao, 2006; Bond, Edmans, & Goldstein, 2012; Chen, Goldstein, & Jiang, 2007; Goldman, 2004). Moreover, better informational environment promotes the production of firm-specific information (Morck, Yeung, & Yu, 2000), and the positive feedback trading of foreign investors can further

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increase stock price volatility (Bae, Chan, & Ng, 2004; Kim & Wei, 2002).

Despite the various motivations for liberalizing countries to open their markets, an important research question is whether and to what extent financial market liberalization helps to foster the efficiency of domestic capital markets (Cajueiro, Gogas, & Tabak, 2009). Foreign institutional investors (FIIs, thereafter) tend to have advanced skills and in-depth investment knowledge, and they are able to identify superior investment opportunities (Grinblatt & Keloharju, 2000). Furthermore, introducing FIIs may enhance market discipline and limit expropriation by controlling shareholders, resulting in better asset management and investment decisions (e.g., Doidge, Karolyi, & Stulz, 2004; Rajan & Zingales, 2003; Stulz, 1999). Therefore, uncovering the relation among market liberalization, foreign institutional investors and stock market efficiency is conducive to incorporating emerging markets into global asset allocations and management.

We recognize that, using various measures, existing studies in a cross-country setting has explored the effects of foreign ownership on the price informativeness of stocks in local markets, and generally documented a positive relation (e.g., Bae, Ozoguz, Tan, & Wirjanto, 2012; He, Li, Shen, & Zhang, 2013; Kacperczyk, Sundaresan, & Wang, 2018). Nonetheless, in this study, we explore our research question by focusing on China for two important reasons. First, data from the World Federation of Exchanges reveal that at the end of 2015, China has become the largest stock markets among emerging countries. Particularly, the Shanghai and Shenzhen stock exchanges were the fourth and the sixth largest exchanges in the world in terms of market capitalization, respectively. In 2002, China launched the Qualified Foreign Institutional Investor (QFII) program, which aimed at opening domestic financial markets to foreign institutional investors. The QFII program has witnessed rapid growth since its inception, with the combined quota of stock investment growing from \$10 billion U.S. dollars in 2002 to \$111 billion in 2019 managed by around 300 licensed QFIIs. Therefore, given the market capitalization of stock exchanges and the volume of equity investment by foreign investors, examining the effects of foreign ownership on stock price informativeness in China allows us to shed further lights on this important research question and generalize our findings to other emerging countries.

Second, according to MSCI, China represented around 28% of the MSCI Emerging Markets Index in 2017, and the weight increased to 33% of the index in 2019. It is plausible that the growing importance of China's equity market may transform the characteristics

of the emerging-market asset class and change its role in global portfolios. Therefore, it is of a high priority to develop a strategic approach in evaluating the assets allocation and the effects of the introduction of foreign investors to this equity segment.

Although quite a few studies advance our understanding regarding the economic consequences of QFII programs in China (Ding, Nilsson, & Suardi, 2017; Huang & Zhu, 2015; McGuinness, Vieito, & Wang, 2017), it remains unclear whether introducing QFIIs improves the informational efficiency of stock prices. In this study, focusing on Chinese A-share markets from 2004 to 2012, we empirically examine the relationship between the information efficiency of stock price and foreign institutional ownership. We believe that it is of critical importance for academia, practitioners, and policymakers to explore and understand the abovementioned relationship in an emerging country liberalizing its stock market. In a theoretical article, Goldman (2004) posits that the informativeness of stock price tends to affect managerial investment decisions and internal resource allocation. Empirical studies have shown that private information in stock price has a strong effect on the sensitivity of corporate investment to stock price (e.g., Chen et al., 2007). Therefore, such investigations help regulators oversee stock markets better and optimize the allocation of scarce resources through promoting an efficient information environment (Bond et al., 2012). Despite their large sizes, Chinese stock markets are particularly suitable for our research for the following reasons. First, as Morck et al. (2000) document, stock price movements are more synchronous in emerging markets than in developed markets. China has the second-highest synchronicity among 40 sample countries (Morck et al., 2000). Higher stock price synchronicity indicates that firm-specific private information is incorporated into the price-formation process less or at a lower speed. Second, according to the Opacity Index by the Milken Institute (2009), China ranks 38 out of 48 countries surveyed in terms of economic transparency.¹ Operating in a poor information environment tends to affect stock price informativeness negatively, which in turn deteriorates the efficiency of resource allocations.²

Using a sample of Chinese listed firms from 2004 to 2012, we document that high equity holdings by foreign institutional investors are associated with more informational efficiency. The relationship is both statistically and economically significant; it also holds after we control for other potential determinants of price efficiency, such as domestic institutional ownership, firm size, stock price, turnover, and liquidity. Our main results are robust to an alternative measure of price informational efficiency (i.e., stock price synchronicity), instrumental variable (IV)

estimation and propensity-score matching (PSM) for possible endogeneity concern. The evidence in this article strongly indicates that QFIIs improve stock price efficiency in the Chinese A-share markets. We further test two channels through which QFIIs can enhance stock price efficiency. Our evidence is more supportive to the notion that foreign institutional investors (FII) engage in monitoring and disciplining their portfolio companies thus improve the informational efficiency. In addition, we hand-collect data on whether QFIIs have local offices in China and report that the effect of QFII ownership on stock price informativeness is more pronounced when QFIIs have better access to local knowledge. Our evidence also reveals that the relationship is stronger for firms having higher QFII ownership and more visible QFIIs.

Our study contributes to the literature in the following ways. First, we add to the finance literature by showing that, even in a financial market partially open to foreigners, FIIs can enhance the information efficiency of local stocks. Moreover, focusing on a longitudinal dataset from a single developing country, we are able to implement the instrumental variable approach and propensity score matching method to address the potential endogeneity concern (He et al., 2013). Second, our study is one of the few, if not the first, to examine directly how QFIIs affect the informational efficiency of stock prices in the Chinese A-share markets; other related studies only examine stock price efficiency and domestic mutual fund (Ding et al., 2017), B-share, or H-share ownership (Gul, Kim, & Qiu, 2010) in China. Third, we explore some boundary conditions when the QFIIs are able to better enhance stock price informativeness. In addition, our finding shows that the relationship between stock price efficiency and foreign investments is more pronounced when FIIs have local offices. Chinese regulators could consider encouraging QFIIs to establish offices in China to obtain better information and hence enhance stock price efficiency.

2 | RELATED LITERATURE

Financial market efficiency has been a controversial topic since the efficient market hypothesis (EMH) by Fama (1970). The speed and magnitude at which financial markets absorb information reflect the market's efficiency in pricing stocks. As Fama (1965) argues, when the market is efficient, stock prices should follow a random walk if all relevant information is instantly incorporated. Since then, using stock return autocorrelation as a measure of weak-form market efficiency, a series of studies test the EMH hypothesis (Lim & Brooks, 2011) and

obtain supportive findings in different contexts (Patell & Wolfson, 1984).

One line of research focuses on factors that can explain the deviation of stock price from random walk. For example, Mech (1993) finds that transaction costs result in stock return autocorrelation, which impedes stock prices from adjusting in a timely manner. Other studies (Chordia, Roll, & Subrahmanyam, 2008; Hasbrouck, 1993) suggest that firm size and liquidity can be important determinates of stock price efficiency. Boudoukh, Richardson, and Whitelaw (1994) synthesize existing literature and categorize different options on this issue. In particular, their empirical tests support the notion that the markets are themselves efficient, but market frictions lead to return autocorrelations. More recent studies based on market microstructure theories yield some new insights to stock price efficiency. For instance, using detailed transactions data, Chordia, Roll, and Subrahmanyam (2005) discover that intraday price serial dependence disappears in 5–60 min, which indicates that informational efficiency of stock prices does exist over short time intervals but not in the long run. In addition, Boehmer and Wu (2013) find that intraday informational efficiency of prices improves with greater shorting flow, and stock prices are more accurate when short sellers are more active.

An emerging line of research focuses on institutional investors and their influence on the informativeness of stock prices. Institutional investors are believed to be sophisticated, with advanced investment knowledge and expertise. Therefore, their trading activities may facilitate an efficient incorporation of private information into stock prices because of the relative information advantage institutional investors have (Piotroski & Roulstone, 2004). Similarly, Boehmer and Kelley (2009) use a panel of NYSE-listed stocks between 1983 and 2004 and confirm that stocks with greater institutional ownership are priced more efficiently in the short term (Chordia et al., 2005).

Although there are many foreign institutional investors in the U.S. markets, the United States has one of the most developed financial markets in the world. FIIs in the United States are not necessarily more skilled than their domestic counterparts. Therefore, researchers conduct similar studies in other developed countries with domestic and foreign institutional investors. Among the relevant studies, Dahlquist and Robertsson (2001) investigate the holding preferences of foreign investors in Sweden and report that FIIs prefer to invest in stocks with large sizes, low dividends, large cash positions, and high liquidity. Using Finnish data, Grinblatt and Keloharju (2000) find that FIIs follow more sophisticated trading strategies and tend to engage in momentum

trading. Choe, Kho, and Stulz (1999) discover that FIIs in Korea engage in positive-feedback trading and herding, but their trading strategies do not seem to be detrimental to the stability of the Korean stock market. In fact, FIIs with little local information are more likely to use a positive-feedback strategy and engage in herding than FIIs that have more local knowledge about the Korean market (Kim & Wei, 2002).

The existing literature suggests two potential channels through which FIIs improve the efficiency of stock prices. First, FIIs can directly accelerate the process of incorporating value-relevant information into stock prices via informed trading (Bae et al., 2012). In addition, FIIs as sophisticated investors (Grinblatt & Keloharju, 2000) that can alleviate mispricing and assess the intrinsic value of stocks (Choe et al., 1999). Second, foreign investors could help improve stock price information efficiency indirectly via enhanced corporate governance. Specifically, FIIs can play an important disciplinary role of monitoring their portfolio companies in the presence of expropriation by large shareholders (Stulz, 1999). Bae et al. (2004) document that liberalizing emerging markets and increasing the openness to foreign investors are associated with increases in analyst coverage and decreases in earnings management. Furthermore, Gul et al. (2010) find that firms in China that cross-list their outstanding shares have lower stock price synchronicity (i.e., higher stock price information efficiency).

The Chinese stock markets are characterized as having weak institutional settings (Allen, Qian, & Qian, 2005) and poor investor protections (Gul et al., 2010). Moreover, listed firms in China tend to have concentrated ownership structures and insufficient corporate governance (Choi, Lee, & Williams, 2011; Gul et al., 2010; Xu & Wang, 1999). Huang and Zhu (2015) examine the QFII monitoring effects in the split share structure in China; they find that QFIIs promote minority investor interests. McGuinness et al. (2017) find that a firm's corporate social responsibility (CSR) increases with increases in foreign ownership, and the relationship is more pronounced in non-state-owned firms. Furthermore, Ding et al. (2017) find that foreign ownership helps enhance the liquidity of affected stocks by promoting trade activities and price discovery in China.

It is noteworthy that one recent study is close to ours. He et al. (2013) document a significant and positive relationship between large foreign ownership and stock price informativeness in 40 countries (including China) around the world. It is arguable that cross-country samples with 1-year data may fall short in controlling for the systematic differences among markedly different economies (Sekaran, 1983). In addition, their sample only includes

36 listed firms in China for the year of 2002. Since QFII scheme was just introduced to China's stock markets to allow qualified foreign institutional investors to trade A-shares in 2002, it is likely that He et al. (2013) adopt a sample of B-shares, which are exclusively invested by foreign investors. As a result, their findings related to stock price informativeness in Chinese stock markets are better interpreted as the effects of block ownership rather than foreign ownership. Our study focuses on foreign ownership by institutional investors and uses a comprehensive longitudinal data set in a single country. Therefore, the investigation of the relationship between stock price informativeness and foreign institutional ownership allows us to add new evidence to the existing literature, draw meaningful inferences, and provide further insights on QFIIs and their economic consequences in China.

3 | DATA

3.1 | Data and sample

Our sample consists of all listed firms in the Chinese A-share markets, including the Shanghai Stock Exchange and the Shenzhen Stock Exchange. Following the convention, we exclude financial firms (Chinese Securities Regulatory Commission industry code J) because they operate in a stringent regulatory environment and use different accounting standards. Our sample period ranges from the first quarter of 2004 to the second quarter of 2012. We rely on the RESSET database to collect firm-level accounting and pricing information. After excluding firms with missing information in RESSET, we obtain 48,007 firm-quarter observations for 2,365 unique listed nonfinancial firms. We collect QFII quarterly holding data from the Wind database. The records include the total volume, market valuation, and percentage of the tradable shares held by QFIIs at the end of that quarter. We find that for those stocks with a QFII presence, the average holding by QFIIs is 2.62%.

3.2 | Stock-level informational efficiency measure

Similar to Boehmer and Kelley (2009), we assume that informationally efficient stock prices tend to follow a random walk. Therefore, we measure stock price informational efficiency by gauging the discrepancy between the actual transaction price and the efficient price (fundamental value). Existing research widely adopts this measure (Boehmer, Jones, & Zhang, 2008; Chordia et al., 2008; Griffin, Kelly, & Nardari, 2010) in similar

settings. According to Chordia et al. (2005), intraday serial price dependence usually disappears in 5–60 min. Therefore, we focus on short-term aspects of informational efficiency of stock prices in Chinese A-share stock markets.

Specifically, we compute the return autocorrelation coefficients for each stock on a quarterly basis using the midpoints (the average of weighted average bid and ask quotes) of intraday stock quotes from the RESSET database with a 5-min interval instead of daily stock prices.³ The RESSET database contains information on five bids and five asks for each 5-min interval.⁴ The first step is to calculate the quote midpoint, which is the average of the weighted average bid and ask quotes. The second step is to compute the stock returns using the quote midpoints by simply calculating the changes in quote midpoints between every 5-min trading window. Following existing research (Boehmer et al., 2008; Chordia et al., 2005), we run an AR(1) model on a quarterly basis for each stock in our sample period. Random walk theory posits that past movement or trend of a stock price cannot be used to predict its future movement (e.g., return at time period t). Consequently, under the null hypothesis of a random walk, we estimate the first-order autocorrelation coefficients model as informational efficiency because returns lagged at one period best capture the collective information that the market receives at time period $t - 1$.

We expect the autocorrelation coefficients to be zero if stock prices follow a random walk.⁵ Because both plus and minus signs indicate a deviation from efficient prices, we are only interested in the absolute size of the quarterly return autocorrelation coefficients. We mainly derive our measure of stock price informativeness from the 5-min time interval. To ensure the robustness of our results, we also calculate an alternative measure of stock price informational efficiency using a 30-min trading window because Chordia et al. (2005) report that most information is incorporated into the stock prices with 30 min through investors' trading activities. Note that a larger value for the measures of stock price informational efficiency indicates that a particular stock price is less informationally efficient.

Existing studies (Boehmer & Kelley, 2009; Chordia et al., 2008; Griffin et al., 2010) also use variance ratio as an alternative measure of stock price informativeness. A random walk posits that the ratio of long-term to short-term return variances is close to unity. As suggested by Boehmer and Kelley (2009), autocorrelations are related to variance ratios in that variance ratios greater (less) than one indicate positive (negative) autocorrelations. Consistent with Boehmer and Kelley (2009), we perform robustness checks using variance ratios and find no

qualitative differences in untabulated results for both measures over comparable time intervals.

3.3 | Main explanatory variable

According to “Measures for the Administration of Securities Investment within the Borders of China by Qualified Foreign Institutional Investors (2006),” licensed QFIIs can exchange foreign currencies for Chinese Yuan (CNY) and trade CNY-denominated A-shares listed on both the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE). We calculate the foreign institutional ownership (FIO) by summing the percentage ownership of all QFIIs in a particular firm for a given quarter, using the following formula.

$$FIO_{i,t} = \sum_{m=1}^M \text{percentage of share holding by QFII}_m \text{ in firm } i \text{ in quarter } t. \quad (1)$$

Note that, for stock-quarter observations with no foreign institutional ownership, the FIO measure is zero.

3.4 | Control variables

In the regression analysis, we control for a set of variables that are important determinants of informational efficiency of stock prices. For example, Chordia et al. (2008) document that stock prices become more efficient with higher liquidity because lack of liquidity may deter arbitrage activity. Therefore, we use two measures—*Relative effective spread* and *Quoted spread* on a 5-min basis—to gauge the liquidity of a stock. Specifically, *Relative effective spread* is the ratio of effective spread (Chordia et al., 2008) to quote midpoint, and this information is readily available in the RESSET database. *Quoted spread* is the difference between bid and ask quotes. We take the quarterly average of these two measures for the common determinants of liquidity, such as market- and industry-wide liquidity (Chordia, Roll, & Subrahmanyam, 2000). Note that both measures are negatively correlated with liquidity. We also include *Quarterly turnover* to capture individual stock liquidity, which is the ratio of quarterly volume (the number of shares traded during a quarter) to the total number of shares outstanding. Moreover, following Boehmer and Kelley (2009) and Jain and Xue (2017), we include stock market capitalization, quarterly closing prices, domestic institutional ownership, and stock return volatility as additional controls.

TABLE 1 Descriptive statistics

	Mean	Median	SD	Mean (2004–2006)	Mean (2007–2009)	Mean (2010–2012)
<i>Measures of informational efficiency</i>						
AR5	0.179	0.078	0.191	0.082	0.248	0.190
AR30	0.181	0.075	0.195	0.103	0.239	0.187
<i>Foreign institutional ownership (%)</i>						
All stock-quarters	0.19	0	1.05	0.23	0.26	0.11
QFII holding-quarters	2.62	1.66	2.95	3.70	2.66	1.81
<i>Control variables</i>						
Relative effective spread (%)	3.49	0.41	10.67	2.78	6.90	0.96
Quoted spread (¥)	0.08	0.07	0.36	0.07	0.09	0.09
Market value (¥1,000)	8,862,696	2,590,658	56,480,252	2,983,621	11,968,410	10,402,780
Closing price (¥)	11.60	8.27	11.76	5.97	12.67	14.44
Quarterly turnover (%)	82.79	60.33	75.89	42.46	119.17	82.49
Domestic institutional ownership (%)	12.65	6.16	15.97	8.48	15.52	13.10
Volatility	0.075	0.066	0.042	0.079	0.098	0.057

Note: This table presents the descriptive statistics of the variables employed in this study. The sample includes 2,365 China's A-shares that were listed on SSE or SZSE between 2004Q3 and 2012Q2 and involves 72 active QFIIs that have ownership in China's A-shares. |AR5| and |AR30| are the absolute value of the quarterly 5- and 30-min return autocorrelation coefficient, which measure the informational efficiency of A-share prices. Foreign institutional ownership is the ratio of combined QFII holdings to stock's market capitalization. Relative effective spread and quoted spread estimate the liquidity of A-shares. Market value is the market capitalization of equity at the end of a quarter. Closing price is the quarterly closing price. Quarterly turnover is calculated as the number of shares traded within a quarter divided by the total number of shares outstanding; volatility is calculated as the standard deviations of the monthly stock returns over the previous year and domestic institutional ownership is the ratio of combined domestic institutional investors' holdings to stock's market capitalization. Quarterly mean, median, and standard deviation of these variables are computed and reported. Quarterly mean is also reported for each variable for three consecutive subperiods: before the recent financial crisis (2004–2006), during the crisis (2007–2009), and after the crisis (2010–2012). The descriptive statistics of the quarterly foreign institutional ownership are reported in two ways: (1) the whole sample and (2) the sample with foreign institutional ownership greater than 0.

Table 1 presents the summary statistics of our main variables. The mean of the quarterly 30-min return autocorrelations is 0.181, which is much higher than the stocks traded on the NYSE (0.070, see Boehmer & Kelley, 2009). This indicates that stocks traded on the Chinese A-share markets are less informationally efficient than those listed on the NYSE. When we look at different time intervals, it is not surprising that A-share prices are the least efficient during the financial crisis between 2007 and 2009, and they are more efficient before and after the financial crisis.

Table 1 shows that the both measures of liquidity follow a similar trend over time. According to *Relative effective spread*, the liquidity of A-shares falls significantly during the financial crisis but bounces back after 2010. *Quoted spread* shows the same pattern in the beginning, but the liquidity measure does not increase after the financial crisis. According to Table 1, market capitalization and stock prices experience dramatic surges after 2006. Quarterly turnover also surges during the financial

crisis, but it decreases after 2009. The large *Quarterly turnover* during the crisis reveals the reason for the worsening liquidity: investors might sell a lot of shares, but very few “astute traders” want to trade against them. *Volatility*, unsurprisingly, has the largest average value during the financial crisis period. Last but not least, we control for domestic institutional ownership to address the possibility that locals drive the relationship.

4 | EMPIRICAL RESULTS

4.1 | Conditional correlations among QFII ownership and other variables

Table 2 provides a brief overview of the relationships among QFII ownership and other variables. We partition our sample into four quartiles based on stock market capitalization at the end of each quarter, with Quartile 1 representing stocks with the largest market capitalizations

TABLE 2 Summary statistics by market value and foreign institutional ownership

	Foreign institutional ownership (FIO)		
	FIO = 0	0 < FIO < 10%	FIO ≥ 10%
<i>Size quartile 1</i>			
Foreign institutional ownership	0	1.92%	14.30%
AR5	0.177	0.163	0.125
AR30	0.172	0.159	0.134
Relative effective spread (%)	1.63	1.71	1.03
Closing price (¥)	17.55	18.22	15.02
Market value (000s)	28,144,464	31,290,356	45,121,920
Quarterly turnover (%)	66.75	68.39	34.13
Domestic institutional ownership (%)	16.67	16.05	5.15
Volatility	0.090	0.076	0.062
<i>N</i>	15,790	236	6
<i>Size quartile 2</i>			
Foreign institutional ownership	0	2.28%	12.00%
AR5	0.203	0.207	0.242
AR30	0.200	0.204	0.245
Relative effective spread (%)	2.62%	2.39%	1.70%
Closing price (¥)	12.60	14.14	18.29
Market value (000s)	3,742,470	4,252,303	4,528,579
Quarterly turnover (%)	96.11%	106.72%	61.67%
Domestic institutional ownership (%)	12.70%	12.50%	12.33%
Volatility	0.078	0.074	0.071
<i>N</i>	15,265	744	22
<i>Size quartile 3</i>			
Foreign institutional ownership	0	2.65%	12.42%
AR5	0.190	0.180	0.108
AR30	0.192	0.185	0.121
Relative effective spread (%)	3.69	2.57	1.65
Closing price (¥)	9.46	10.99	11.82
Market value (000s)	1,998,277	2,309,425	2,250,123
Quarterly turnover (%)	101.28	103.00	76.74
Domestic institutional ownership (%)	11.26	11.06	3.91
Volatility	0.072	0.072	0.070
<i>N</i>	14,719	1,275	38
<i>Size quartile 4</i>			
Foreign institutional ownership	0	2.75%	12.21%
AR5	0.142	0.140	0.040
AR30	0.156	0.150	0.043
Relative effective spread (%)	5.80	3.94	4.69
Closing price (¥)	5.28	8.07	8.18
Market value (000s)	833,161	1,263,789	1,485,990
Quarterly turnover (%)	69.87	94.87	66.83
Domestic institutional ownership (%)	9.68	11.55	1.26

(Continues)

TABLE 2 (Continued)

	Foreign institutional ownership (FIO)		
	FIO = 0	0 < FIO < 10%	FIO ≥ 10%
Volatility	0.063	0.061	0.056
N	13,532	2,383	116

Note: This table presents the summary statistics of the variables employed in this study by stock market value and foreign institutional ownership. The sample includes 2,365 China's A-shares, which were listed on SSE and SZSE between 2004Q3 and 2012Q2, and involves 72 active QFIIs' ownership in China's A-shares. Foreign institutional ownership is the ratio of combined QFII holdings to stock's market value. |AR5| and |AR30| are the absolute value of the quarterly 5- and 30-min return autocorrelation, which measure the informational efficiency of stock prices. Relative effective spread estimates stock liquidity, closing price is the quarterly closing price; market value is the market capitalization of equity at the end of a quarter; quarterly turnover is calculated as the number of shares traded within a quarter divided by the total number of shares outstanding; volatility is calculated as the standard deviations of the monthly stock returns over the previous year and domestic institutional ownership is the ratio of combined domestic institutional investors' holdings to stock's market capitalization. The sample is evenly divided into four groups based on stock market value. Within each size quartile, the subsample is split into three groups based on the size of foreign institutional ownership. Quarterly mean of all variables are computed and reported for each group.

TABLE 3 Pairwise correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10
1 AR5	1									
2 AR30	0.63	1								
3 FIO	-0.03	-0.021	1							
4 DIO	-0.005	-0.011	0.003	1						
5 RES	0.049	0.07	-0.022	0.067	1					
6 QS	0.127	0.154	0.007	0.004	-0.076	1				
7 MV	0.059	-0.021	0.123	0.164	-0.124	0.024	1			
8 P	0.199	0.146	0.087	0.147	-0.091	0.093	0.616	1		
9 QTO	0.203	0.041	-0.029	-0.026	0.063	-0.014	0.001	0.139	1	
10 VOL	0.056	0.044	-0.045	-0.049	0.322	-0.027	-0.249	-0.409	0.267	1

Note: This table presents the pairwise correlation matrix for variables used in the regression analysis. |AR5| and |AR30| are the absolute value of the quarterly 5- and 30-min return autocorrelation, which measure the informational efficiency of stock prices. FIO denotes foreign institutional ownership, which is the ratio of quarterly combined QFII holdings to stock's market value. DIO is domestic institutional ownership, which is calculated as the ratio of combined domestic institutional investors' holdings to stock's market capitalization. Both relative effective spread (RES) and quoted spread (QS) estimate stock liquidity. MV is the market capitalization of equity at the end of a quarter. P is quarterly closing price. QTO is quarterly turnover, which is calculated as the number of shares traded within a quarter divided by the total number of shares outstanding. VOL denotes volatility, which is calculated as the standard deviations of the monthly returns over the previous year. Numbers in bold indicate statistical significance at 1% level.

and Quarter 4 representing stocks with the smallest market capitalizations. Within each quartile, we divide the data into three groups based on the size of QFII ownership at the end of each quarter. For the sake of brevity, we only report the average of each variable.

The results reported in Table 2 reveal some general patterns among foreign institutional ownership and other variables. First, the two measures of relative informational efficiency decrease with QFII holdings except for size Quartile 2. Second, QFII holdings are negatively correlated to the relative effective spread (i.e., QFIIs have a preference for more liquid A-shares). Third, it appears that QFIIs tend to hold stocks with larger capitalizations,

which is in line with previous studies on stock preferences of foreign investors (Dahlquist & Robertsson, 2001; Kang & Stulz, 1997). Fourth, in all size quartiles, *Quarterly turnover* is significantly lower than that of the other groups when QFII holdings are larger than 10%. Last but not least, there seems to be no systematic relationship between foreign institutional ownership and quarterly trading volumes or stock return volatility.

In Table 3, we report the pairwise correlation matrix of the variables used in the regression analysis and indicate the significant level at 5% in bold. As expected, the measure of QFII ownership is significantly negatively correlated with our measures of informational efficiency.

We cautiously check whether high correlations exist among other independent variables to ensure multicollinearity is not a major concern for the regression analysis.

4.2 | Identification strategies

In order to examine the relationship between the informational efficiency of China's A-share prices and foreign institutional ownership, we regress the relative informational efficiency measure on the quarterly QFII holdings using the following model specification.

$$\text{RIE}_{i,t} = \alpha + \beta \text{FIO}_{i,t} + \sum_{k=1}^K \gamma_k X_{k,i,t-1} + \varepsilon_{i,t}. \quad (2)$$

This regression model in Equation (2) is modified according to the model in Boehmer and Kelley (2009). The dependent variable, $\text{RIE}_{i,t}$, measures the relative informational efficiency of firm i 's stock prices during quarter t . The independent variable, $\text{FIO}_{i,t}$, represents the total foreign institutional ownership in firm i at the end of quarter t , and $X_{k,i,t-1}$ denotes the k th control variable for firm i at the end of quarter $t - 1$. The control variables are stock liquidity, market capitalization, quarterly closing price, quarterly stock turnover, and domestic institutional ownership.

Following Boehmer and Kelley (2009), we lag our control variables, including market capitalization, relative effective spread, quoted spread, quarterly turnover, and quarterly closing price by one quarter to avoid possible contemporaneous correlations between the relative informational efficiency of prices and control variables. Nonetheless, in our model specification, we use QFII holdings at time t because unsophisticated Chinese investors can herd QFII investments in the following quarter, and such herding behaviour may distort the effects QFII holdings have on informational efficiency.

$$\text{RIE}_{i,t} = \alpha + \beta_1 \text{FIO}_{i,t} + \beta_2 \text{FIO}_{i,t-1} + \delta \text{RIE}_{i,t-1} + \sum_{k=1}^K \gamma_k X_{k,i,t-1} + \varepsilon_{i,t}. \quad (3)$$

We use the model specification in Equation 3 to control for the lagged dependent variable and the lagged QFII holdings to capture the dynamics in stock pricing and QFII investment. Including the lagged dependent variable ensures that the persistency of informational efficiency over time does not influence the conclusion derived from Equation 2. In addition, including the

lagged QFII holdings alters our interpretation in the sense that the coefficient of QFII holdings at time t captures the marginal effect of QFII holdings conditional on QFII holdings at time period $t - 1$. Note that in all model specifications, standard errors are clustered by firms to allow for time-series dependence of error terms for the same firm in the sample (Petersen, 2009).

4.3 | Baseline regression results

Table 4 reports the results based on the two regression models detailed in Section 4.2. Panels A and B of Table 4 report the results based on Equations (2) and (3), respectively. We use two dependent variables, namely, the natural logarithm of the absolute value of the quarterly 5-min and 30-min return autocorrelations, in our regression analyses.

For the 5-min return autocorrelation, we document a significantly negative relationship between QFII holdings and the measures of relative information efficiency ($p < .01$) in Panels A and B. For the 30-min return autocorrelation, we document similar results in Panel A, but in Panel B we find that including the lagged dependent variable and lagged QFII holdings takes away the significance of QFII holdings. There is no significant relationship between informational inefficiency and QFII ownership measures, possibly because the serial price dependence in A-shares is almost absorbed in the 30-min windows.⁶ In general, our findings reveal that QFII ownership increases stock price informativeness.

The effect of lagged QFII holdings on stock price informational efficiency is generally not significant. Our results are also robust to the control of stock liquidity measures such as relative effective spread and quoted spread. Moreover, the coefficients of the liquidity measures are positively associated with the informational efficiency measures (Chordia et al., 2008). In the balance of our analyses, we only report evidence using the relative effective spread to save space, though using quoted spread yields similar results.

With respect to other control variables, we report findings that are consistent with existing studies. For example, the positive coefficient of market capitalization indicates that larger firms tend to have more informative stock prices because they usually have more public exposure and hence their prices contain more efficient information. In addition, stock price is positively related to informational efficiency.

As noted in Section 4.2, we cluster standard errors by firms to control for the possible correlation of error terms over time for the same firms. Nonetheless, despite the panel data structure, we do not explicitly include quarter

TABLE 4 Baseline regression results relating stock price informativeness to QFII holdings

Independent variables	Dependent variables			
	Ln AR5	Ln AR30	Ln AR5	Ln AR30
<i>Panel A: Regression without lagged dependent variable</i>				
Foreign institutional ownership (FIO_t)	-4.371*** [-3.768]	-2.129* [-1.747]	-4.374*** [-3.766]	-2.136* [-1.748]
Domestic institutional ownership (DIO_{t-1})	0.176** [2.198]	0.064 [0.697]	0.202** [2.550]	0.103 [1.133]
Relative effective spread (RES_{t-1})	0.456*** [4.235]	0.685*** [5.942]		
Quoted spread (QS_{t-1})			-0.006 [-0.384]	0.007 [0.245]
Market value ($LnMV_{t-1}$)	0.013 [0.673]	-0.144*** [-6.665]	0.009 [0.474]	-0.150*** [-6.918]
Closing price (LnP_{t-1})	0.273*** [9.165]	0.326*** [10.646]	0.280*** [9.441]	0.337*** [10.971]
Quarterly turnover (QTO_{t-1})	0.359*** [23.238]	0.061*** [2.993]	0.361*** [23.419]	0.064*** [3.106]
Volatility (VOL_{t-1})	2.941*** [10.112]	2.479*** [8.133]	3.309*** [11.406]	3.045*** [10.003]
Intercept	-3.900*** [-15.398]	-1.448*** [-4.917]	-3.879*** [-15.312]	-1.418*** [-4.819]
<i>N</i>	48,007	48,007	47,990	47,990
Adjusted R^2	0.070	0.023	0.070	0.021
<i>Panel B: Regression with lagged dependent variable</i>				
Lagged dependent variable ($Ln AR _{t-1}$)	0.580*** [93.877]	0.569*** [84.649]	0.580*** [93.732]	0.568*** [84.201]
Foreign institutional ownership (FIO_t)	-2.151*** [-3.005]	0.085 [0.104]	-2.165*** [-3.021]	0.054 [0.066]
Lagged foreign institutional ownership (FIO_{t-1})	1.903** [2.467]	0.184 [0.228]	1.938** [2.516]	0.261 [0.325]
Domestic institutional ownership (DIO_{t-1})	0.192*** [4.817]	0.085* [1.814]	0.198*** [4.989]	0.088* [1.904]
Relative effective spread (RES_{t-1})	0.230*** [3.020]	0.358*** [4.305]		
Quoted spread (QS_{t-1})			0.557*** [3.487]	1.331*** [7.047]
Market value ($LnMV_{t-1}$)	0.012 [1.570]	-0.054*** [-5.617]	0.017** [2.097]	-0.041*** [-4.095]
Closing price (LnP_{t-1})	0.063*** [4.801]	0.072*** [5.057]	0.032** [2.119]	-0.004 [-0.249]
Quarterly turnover (QTO_{t-1})	0.154*** [20.272]	0.050*** [5.088]	0.165*** [21.279]	0.075*** [7.385]
Volatility (VOL_{t-1})	1.940*** [12.238]	1.072*** [6.088]	2.020*** [13.021]	1.113*** [6.510]

TABLE 4 (Continued)

Independent variables	Dependent variables			
	Ln AR5	Ln AR30	Ln AR5	Ln AR30
Intercept	-1.735*** [-15.956]	-0.662*** [-5.198]	-1.798*** [-15.777]	-0.822*** [-6.189]
<i>N</i>	47,973	47,973	47,973	47,973
Adjusted <i>R</i> ²	.382	.331	.382	.332

Note: This table reports the results of two multivariate pooled OLS regression models, in which the stock price efficiency measures are regressed on the foreign institutional holdings. The sample includes 2,365 China's A-shares, which were listed on SSE and SZSE between 2004Q3 and 2012Q2, and involves 72 active QFIIs' ownership in China's A-shares. |AR5| and |AR30| are the absolute value of the quarterly 5- and 30-min return autocorrelation, which measure the informational efficiency of stock prices. Foreign institutional ownership is the ratio of quarterly combined QFII holdings to stock's market value. Both relative effective spread and quoted spread estimate stock liquidity, and they are tested separately in both panels. Other control variables include previous quarter domestic institutional ownership, market value of equity at the end of the previous quarter, lagged quarterly closing price, previous quarterly stock turnover, and the standard deviations of the monthly stock returns over the previous year. Variables with Ln are converted to the natural logarithm of themselves. Panel A presents the results of a simple regression model, while Panel B provides the results of the model where lagged dependent variable and lagged foreign institutional ownership are controlled. Asterisks indicate the statistical significance at the 1% (***), 5% (**), and 10% (*) levels, and *t*-statistics adjusted for firm clustering-effects are reported in parentheses.

fixed effects and firm fixed effects. It is plausible that the inclusion of firm fixed effects aiming to control for time-invariant unobservables may lead to potential multicollinearity problem if QFII ownership has less variation for the same firms over time. In addition, we measure stock price informativeness on a quarterly basis. Adding quarter fixed effect may take away the explanatory power of other independent variables. Therefore, to ensure the robustness of our findings, we adopt the Fama–MacBeth approach (Fama & MacBeth, 1973) to estimate cross-sectional regression for each quarter and draw statistical inferences from the time series of estimate coefficients using Newey–West standard errors. As argued by Boehmer and Kelley (2009), although this approach is less powerful than a pooled estimation, it mitigates the problem of having cross-sectional correlations among the regression errors and yields almost identical results as a panel estimator with fixed effects. In untabulated results, we document a significant and negative relationship between QFII ownership and our measure of stock price informativeness.

4.4 | Addressing the endogeneity issue

Although we find consistent results using two measures of informational efficiency, endogeneity concern remains. Because information is costly to collect, investors, regardless of country origins, may prefer to hold and trade stocks with more informative or efficient prices. He et al. (2013) point out the possibility of reverse causality when they report that large foreign ownership can enhance stock price informativeness in 40 stock markets

globally. Therefore, it is plausible that QFIIs self-select into the strategy of holding stocks with higher levels of informational efficiency. It is also possible that unobservable factors drive both QFII holdings and stock price informativeness. We address the endogeneity concern and strive to obtain consistent estimations by performing regression analyses based on the instrumental-variable (IV) approach and propensity-score matching (PSM) approach (Rosenbaum & Rubin, 1983).

The State Administration of Foreign Exchange (SAFE) publishes information about historical and current QFII investment quotas. We argue that QFII investment quota is a valid instrument of QFII ownership for two reasons. First, the quota determines the maximum amount a QFII can invest in China's capital markets. Therefore, this variable is likely to have a positive relationship with the size of QFII ownership. Second, the QFII investment quota usually changes for exogenous reasons. For example, the total quota for QFIIs increased from USD 10 billion to USD 30 billion at the second China-U.S. Strategic Economic Dialogue (SED) meeting in Washington, DC in 2007.⁷ As such, it is highly unlikely that published quotas are directly associated with the measures of stock price informational efficiency.

Columns 1 and 2 of Table 6 report the regression results based on the instrumental-variable approach using QFII investment quota as an instrument for QFII ownership. The coefficient of the instrumented QFII ownership is negative and significant. We also perform postestimation diagnostic tests to assess the appropriateness of IV estimation. The Hausman tests for endogeneity suggest that it is appropriate to treat QFII ownership as endogenous. The weak-instrument tests indicate that

TABLE 5 Univariate tests for PSM-matched treatment group and control group

Variables	Treatment group (firms with QFII investments: $N = 4,242$)	Control group (firms without QFII investments: $N = 4,242$)	Difference in means
Domestic institutional ownership (DIO_{t-1})	0.143	0.142	0.001
Relative effective spread (RES_{t-1})	0.021	0.023	-0.002
Market value ($\ln MV_{t-1}$)	15.552	15.561	-0.009
Closing price ($\ln P_{t-1}$)	2.474	2.434	0.040**
Quarterly turnover (QTO_{t-1})	0.902	0.874	0.028
Volatility (VOL_{t-1})	0.067	0.068	-0.001

Note: In this table, we perform tests for group means of key variables for the two subsamples (i.e., treatment group and control group) obtained from the propensity score matching method. Asterisks indicate the statistical significance at the 1% (***) , 5% (**), and 10% (*) levels.

QFII quota is a strong instrument for QFII ownership (Stock & Yogo, 2005).

We also adopt the PSM approach to address the endogeneity issue. In observational studies, researchers are oftentimes forced to compare treatment and non-treatment groups with drastically different characteristics. The PSM technique estimates the conditional probability (i.e., propensity score) of group membership based on a set of observed characteristics (Aggarwal, Erel, Stulz, & Williamson, 2009; Bharath, Dahiya, Saunders, & Srinivasan, 2011; Evans & Fahlenbrach, 2012). In our case, firms with QFII ownership (i.e., the treatment group) or without QFII ownership (i.e., the nontreatment group or control group) may be quite different. Therefore, we employ a probit model to estimate the propensity score of having QFII investments on a set of observable characteristics. In the first stage of the analysis, we calculate each firm's propensity score, which is equal to the probability that QFII(s) will invest in the firm in the next quarter. In the second stage of the analysis, we match firms with QFII investments to firms that have the closest propensity scores but no QFII ownership. Thus, our aim is to ensure that the treatment group and the control group differ only in their presence of QFII investments.

The coefficients for the first-stage probit regression are given in Equation (4). We find that firms with low liquidity, large size, and high stock prices attract QFII investments. The first-stage probit model has a log-likelihood of -13,352.9 and a McFadden's pseudo-R-squared of .06. Furthermore, in our sample, 12% of all observations have QFII ownership. Following Veall (1996), we compare the prediction accuracy of our model (0.91) with a blind guess ($1 - 0.12 = 0.88$) by calculating $\lambda' = (0.91 - 0.88)/(1 - 0.88) = 0.25$, which reveals a significant 25% improvement (Hoetker, 2007).

$$\begin{aligned} \text{Prob}(Y = 1) = & -9.447^{***} + 0.073 \times DIO_{t-1} - 0.586^{**} \\ & \times RES_{t-1} + 0.492^{***} \times \ln MV_{t-1} - 0.004 \times \ln CP_{t-1} \\ & + 0.055^{***} \times QTO_{t-1} - 4.373^{***} \times VOL_{t-1} \end{aligned} \quad (4)$$

Our PSM-procedure yields a sample of 8,484 observations including both the treatment group and control group. Following Evans and Fahlenbrach (2012), we perform group mean tests for variables in both subgroups. As shown in Table 5, most variables are not statistically different for two subgroups, which is in line with our expectation. Thus, we construct a sample with two subgroups of firms that are almost identical except for their QFII investments.

Using a PS-matched sample, we report consistent results in Columns 3 and 4 of Table 6. Nonetheless, hidden bias exists due to unobservable factors and challenges our results based on the PSM approach if the hidden bias is sufficiently large (Rosenbaum, 2002). To address the problem, we follow Bharath et al. (2011) and conduct a Rosenbaum bounds-sensitivity analysis to gauge the hidden bias that may invalidate our findings. We experiment with a factor starting from 1 and increase by 0.1 for each sensitivity test. A factor of 1 means that the hidden bias has no effect on the treatment group and the control group. The factor (1.1 in our case) in the experiment reflects the magnitude of hidden bias when it results in the confidence interval of regression coefficients of QFII investment containing a positive value. Furthermore, we translate this factor using standard deviations of the variables used in the regression analysis. For example, we find that the magnitude of the hidden bias is equivalent to 106.2 standard deviations of closing price ($\ln CP$) and 206.1 standard deviations of quarterly turnover (QTO). Therefore, it is unlikely that hidden bias will challenge our results.

TABLE 6 Addressing the endogeneity issue: IV approach and PSM approach

Independent variables	Dependent variables			
	IV regression		PSM	
	Ln AR5	Ln AR30	Ln AR5	Ln AR30
	(1)	(2)	(3)	(4)
Foreign institutional ownership (FIO _t , instrumented)	-5.968*** [-3.860]	-2.300* [-1.433]	-4.435*** [1.132]	-2.256* [1.225]
Domestic institutional ownership (DIO _{t-1})	0.209*** [2.596]	0.064 [0.694]	-0.122 [1.157]	0.039 [0.174]
Relative effective spread (RES _{t-1})	0.581*** [5.489]	0.703*** [6.159]	0.758** [0.303]	0.615* [0.362]
Market value (LnMV _{t-1})	0.021 [1.132]	-0.145*** [-6.705]	0.009 [0.027]	-0.137*** [0.033]
Closing price (LnP _{t-1})	0.266*** [8.922]	0.331*** [10.842]	0.284*** [0.049]	0.292*** [0.048]
Quarterly turnover (QTO _{t-1})	0.375*** [24.505]	0.044** [2.166]	0.365*** [0.028]	0.061* [0.033]
Volatility (VOL _{t-1})	2.068*** [6.929]	2.460*** [7.811]	5.307*** [0.757]	3.259*** [0.868]
Intercept	-3.970*** [-15.636]	-1.431*** [-4.869]	-3.993*** [0.413]	-1.519*** [0.487]
Hausman test for overidentification	3.368*	0.056	-	-
Weak IV test	16.64***	3.14	-	-
N	48,007	48,007	8,484	8,484
Adjusted R ²	0.072	0.022	0.082	0.023

Note: This table reports the results of two-stage least squares test, in which combined QFII investment quota serves as an instrument for foreign institutional ownership and the propensity score matching test, in which we perform first stage probit model as Equation (3) and report the second stage estimation in Columns 3 and 4. The sample includes 2,365 China's A-shares, which were listed on SSE and SZSE between 2004Q3 and 2012Q2, and involves 72 active QFIIs' ownership in China's A-shares. |AR5| and |AR30| are the absolute value of the quarterly 5- and 30-min return autocorrelation, which measure the informational efficiency of stock prices. Foreign institutional ownership is the ratio of quarterly combined QFII holdings to stock's market value. Control variables include previous quarter domestic institutional ownership, lagged relative effective spread, market value of equity at the end of the previous quarter, lagged quarterly closing price, lagged quarterly turnover and the standard deviations of the monthly stock returns over the previous year. Variables with Ln are converted to the natural logarithm of themselves. Asterisks indicate the statistical significance at the 1% (***), 5% (**), and 10% (*) levels, and *t*-statistics adjusted for firm clustering-effects are reported in parentheses.

Furthermore, focusing on the 5-min return autocorrelation, we gauge the economic significance of our findings. Using information from Column 1 in Panel A of Table 4, we find that a one-standard deviation increase in QFII ownership translates into a 26% decrease in our measure of stock price informativeness. Similarly, using information from Column 1 in Panel B of Table 4 and Columns 1 and 3 of Table 6, we report that a one-standard deviation increase in QFII ownership translates into 9%, 35% and 26% increases in our measure of stock price informativeness, respectively. Note that the result (i.e.,

9%) reported in Column 1 in Panel B of Table 4 is conditional on the inclusion of stock price informativeness and foreign ownership in previous quarter as additional controls. Therefore, 9% is a very conservative number in terms of economic significance because the lagged dependent variable and lagged main explanatory variable may have explained a significant portion of variation in the stock price informativeness. Taken as a whole, the results reported in Tables 4 and 6 indicate that our findings are significant and robust and are unlikely to be driven by endogeneity issues.

4.5 | Channels linking QFII ownership to stock price informational efficiency

The existing literature suggests two channels through which QFIIs may help improve stock price informativeness. Specifically, QFIIs can better process and incorporate information in the stock price through informed trading (i.e., direct channel). QFIIs may also play an important monitoring and disciplinary role to enhance corporate governance of their portfolio companies, which lead to improved stock price informativeness. Although

direct data on informed trading and shareholder activism are not readily available, in this section, we attempt to test these two channels indirectly, and report the results in Table 7.

In Columns 1 to 4 of Table 7, we focus on the opaqueness of the listed firms, which is proxied by firm asset intangibility (i.e., firm intangible assets divided by total assets). As sophisticated investors, QFIIs may have better ability to process information and improve stock price informativeness through informed trading. If so, we expect to observe a stronger effect of QFII ownership on

TABLE 7 Institutional development index, firm opaqueness and the relation between foreign ownership and stock price efficiency

Independent variables	Dependent variables							
	High intangibility (above median)		Low intangibility (below median)		High institutional development index (above median)		Low institutional development index (below median)	
	Ln AR5	Ln AR30	Ln AR5	Ln AR30	Ln AR5	Ln AR30	Ln AR5	Ln AR30
	(5)	(6)	(1)	(2)	(1)	(2)	(7)	(8)
QFII ownership	-2.564 [-1.601]	-1.052 [-0.655]	-6.507*** [-4.415]	-3.516** [-2.301]	-3.742** [-2.290]	-1.431 [-0.839]	-5.354*** [-3.259]	-3.272* [-1.838]
Domestic institutional ownership (DIO _{t-1})	0.274*** [2.805]	0.136 [1.257]	0.023 [0.186]	-0.052 [-0.359]	0.079 [0.737]	-0.012 [-0.100]	0.303*** [2.623]	0.153 [1.157]
Relative effective spread (RES _{t-1})	0.556*** [4.209]	0.886*** [6.609]	0.271* [1.725]	0.325* [1.772]	0.789*** [3.868]	1.081*** [4.495]	0.304** [2.365]	0.457*** [3.474]
Market value (LnMV _{t-1})	-0.027 [-1.173]	-0.162*** [-6.213]	0.056** [2.078]	-0.128*** [-4.077]	-0.036* [-1.710]	-0.182*** [-7.303]	0.102*** [2.994]	-0.065 [-1.645]
Closing price (LnP _{t-1})	0.254*** [6.955]	0.310*** [8.396]	0.304*** [6.965]	0.353*** [7.841]	0.287*** [8.251]	0.340*** [9.405]	0.207*** [3.885]	0.270*** [4.870]
Quarterly turnover (QTO _{t-1})	0.363*** [19.994]	0.085*** [3.506]	0.355*** [14.690]	0.023 [0.722]	0.349*** [17.224]	0.053* [1.951]	0.355*** [15.996]	0.053* [1.811]
Volatility (Vol _{t-1})	2.473*** [6.848]	2.175*** [5.759]	3.498*** [7.464]	2.811*** [5.589]	2.950*** [7.490]	1.832*** [4.146]	2.509*** [5.823]	2.577*** [5.871]
Intercept	-3.283*** [-10.424]	-1.186*** [-3.323]	-4.591*** [-12.620]	-1.680*** [-3.951]	-3.233*** [-10.912]	-0.924*** [-2.645]	-5.004*** [-11.248]	-2.425*** [-4.756]
N	28,369	28,369	19,638	19,638	26,669	26,669	21,338	21,338
Adjusted R ²	0.072	0.026	0.073	0.020	0.064	0.028	0.080	0.015

Note: This table presents regression results examining whether the effects of QFII ownership on stock price efficiency are contingent on informational quality. The sample includes 2,365 China's A-shares, which were listed on SSE and SZSE between 2004Q1 and 2012Q2, and involves 72 active QFIIs' ownership in China's A-shares. Institutional development index is a broader index constructed by the National Economic Research Institute to capture provincial-level informational quality (Fan, Wang, & Zhang, 2011). We measure asset intangibility as intangible assets divided by total assets to capture firm opacity. |AR5| and |AR30| are the absolute value of the quarterly 5- and 30-min return autocorrelation, which measure the informational efficiency of stock prices. Foreign institutional ownership is the ratio of quarterly combined QFII holdings to stock's market value. Relative effective spread is used to proxy stock liquidity. Other control variables include previous quarter domestic institutional ownership, market value of equity at the end of the previous quarter, lagged quarterly closing price, previous quarterly stock turnover and the standard deviations of the monthly stock returns over the previous year. Variables with Ln are converted to the natural logarithm of themselves. Asterisks indicate the statistical significance at the 1% (***) , 5% (**), and 10% (*) levels, and *t*-statistics adjusted for firm clustering-effects are reported in parentheses.

informational efficiency of stocks for firms operating with higher levels of asset intangibility. We partition our sample using the median of assets intangibility as the cut-off value. Nonetheless, the findings in Columns 1 to 4 reveal that the relationship between QFII ownership and stock price informativeness is much stronger for firms with below-median asset intangibility. It appears that our findings are not supportive for the direct channel.

In Columns 5 to 8, we turn to examine the regional institutional development of our sample firms. Institutions, be they formal or informal, are critical in shaping various corporate governance mechanisms (Shleifer & Vishny, 1997). Well-developed institutions help improve corporate governance to facilitate efficient resource allocation and investment. In this sense, we argue that if QFIIs improve stock price informativeness through better monitoring and disciplining their portfolio companies, we expect that this effect to be stronger in regions with less-developed institutions. The National Economic Research Institute (NERI) publishes a series of indexes capturing various economic indicators, as well as indexes of formal and informal institutional development (Fan et al., 2011). We use a broader index to measure the overall institutional development at the provincial level and partition our sample using the median of the institutional development index as the cut-off value. We find that although QFII ownership improves stock price informativeness in both subsamples, the magnitude and significance of the effect are much stronger in regions with less institutional development. These results lend strong support for the indirect channel through improvement in corporate governance.

4.6 | Contingencies influencing the relationship between QFII ownership and stock price informational efficiency

In this section, we explore two possible contingencies that may affect the relationship between QFII ownership and stock price informativeness. First, we posit that QFIIs with better access to local information may be better able to perform their monitoring and disciplinary role to improve stock price informativeness. Research documents that having access to local information can help overcome informational asymmetry (Baik, Kang, & Kim, 2010; Dvorak, 2005). FIIs can obtain timely information by talking to firm representatives in person and even directly observing firm operations (Bae, Stulz, & Tan, 2008). Dvorak (2005) finds that the combination of global expertise and local information contributes to higher investment returns in Indonesia. Similarly, in an international study, Bae et al. (2008) find that analysts

residing in a country make more precise earnings forecasts for firms in that country because local analysts are better informed than foreign analysts. It is plausible that better local knowledge helps QFIIs understand the operations and business of their portfolio companies and increase the efficiency and effectiveness of their activism.

Note that some QFIIs have established branches in mainland China, and some have large Chinese shareholders sitting on their boards. To test our hypothesis, we hand-collect data using multiple sources of information including news reports, media disclosures, and annual prospectuses to identify QFIIs that have significant and direct connections to Chinese financial markets.⁸ In Columns 1 and 2 of Table 8, we report our regression results using two separate measures to capture foreign ownership, which is represented by QFIIs with direct access to local information and QFIIs without direct access to local information. We also control for the presence of local institutional investors to allow for “learning by observing” by those QFIIs. Strikingly, we find that the effects of QFII ownership on informational efficiency are more pronounced for QFIIs with local information. In addition, we replicate our analyses after excluding those observations without QFII ownership, and report our results in Columns 3 and 4 of Table 8. The results indicate that, conditional on having QFII ownership, QFIIs having access to local information play a more important role in improving stock price informativeness.

In addition, we examine when QFIIs have stronger incentives to monitor their portfolio companies hence improve their stock price informativeness and report our results in Table 9. Chen, Harford, and Li (2007) document that institutional investors with concentrated ownership are likely to monitor and improve the information efficiency (Gul et al., 2010). Therefore, we use the median value of QFII ownership to create two indicators, namely, QFIIs with high ownership (low ownership), when QFIIs have above (below) median value. We posit that the effect of QFII ownership on stock price informativeness to be stronger for those firms with high level QFII ownership.

In addition, institutional investors tend to have low visibility when they have a loose connection (i.e., smaller block ownership) with their portfolio companies (Coffee, 1991). On learning adverse information, these investors are able to liquidate their position without altering the market. Therefore, we argue that QFIIs with low visibility have less incentives to monitor and discipline their portfolio companies. Similar to Johnson (2008), who finds a positive relationship between visibility and web searches, we use search engine volume to proxy for the visibility of a particular QFII. In particular, we search a QFIIs' Chinese names on Baidu and Google and collect the numbers of generated results.⁹ We then partition our

TABLE 8 Do QFIIs with local information enhance informational efficiency?

Independent variables	Dependent variables			
	Full sample		Subsample: with QFII ownership	
	Ln AR5	Ln AR30	Ln AR5	Ln AR30
	(1)	(2)	(3)	(4)
Foreign institutional ownership with local information (FIO_WL _{<i>t</i>})	−4.635*** [−3.447]	−1.995 [−1.512]	−4.148*** [−3.150]	−1.720 [−1.260]
Foreign institutional ownership without local information (FIO_NL _{<i>t</i>})	−3.235 [−1.136]	−2.704 [−0.822]	−2.432 [−0.848]	−2.143 [−0.631]
Domestic institutional ownership (DIO _{<i>t−1</i>})	0.176** [2.197]	0.064 [0.698]	−0.152 [−0.634]	−0.067 [−0.249]
Relative effective spread (RES _{<i>t−1</i>})	0.456*** [4.238]	0.684*** [5.941]	0.624* [1.893]	0.571 [1.270]
Market value (LnMV _{<i>t−1</i>})	0.013 [0.678]	−0.144*** [−6.663]	0.009 [0.228]	−0.124*** [−2.780]
Closing price (LnP _{<i>t−1</i>})	0.273*** [9.160]	0.326*** [10.647]	0.275*** [3.568]	0.249*** [3.487]
Quarterly turnover (QTO _{<i>t−1</i>})	0.359*** [23.235]	0.061*** [2.992]	0.385*** [9.466]	0.114** [2.360]
Volatility (Vol _{<i>t−1</i>})	2.942*** [10.115]	2.479*** [8.133]	6.752*** [6.032]	3.929*** [3.241]
Intercept	−3.901*** [−15.394]	−1.447*** [−4.911]	−4.110*** [−6.665]	−1.703** [−2.519]
<i>N</i>	48,007	48,007	4,242	4,242
Adjusted <i>R</i> ²	0.070	0.023	0.088	0.026

Note: This table reports the results whether QFIIs have local information that can better enhance informational efficiency. The sample includes 2,365 China's A-shares, which were listed on SSE and SZSE between 2004Q3 and 2012Q2, and involves 72 active QFIIs' ownership in China's A-shares. |AR5| and |AR30| are the absolute value of the quarterly 5- and 30-min return autocorrelation, which measure the informational efficiency of stock prices. We measure QFII ownership separately for QFIIs with or without local information. Control variables include previous quarter domestic institutional ownership, lagged relative effective spread, market value of equity at the end of the previous quarter, lagged quarterly closing price, lagged quarterly turnover and the standard deviations of the monthly stock returns over the previous year. Variables with Ln are converted to the natural logarithm of themselves. Asterisks indicate the statistical significance at the 1% (***), 5% (**), and 10% (*) levels, and *t*-statistics adjusted for firm clustering-effects are reported in parentheses.

sample QFIIs into two subgroups according to median value of the hits as the cut-off value.

We report our results in Table 9. Columns 1 and 2 focus QFII ownership and Columns 3 and 4 use QFII visibility as an alternative proxy to capture the incentives for QFIIs to monitor. Our results confirm our conjecture that QFIIs having strong incentives to monitor also have a stronger effect on the stock price informativeness.

4.7 | Robustness checks

In this section, we report the results from a host of tests to ensure the robustness of our findings. For example, we

use stock price synchronicity as an alternative measure to proxy informational efficiency of stock prices. Morck et al. (2000) first propose that stock price synchronicity, defined as the R^2 from regressions based on a single-factor market model for stock returns, can measure the relative amount of firm-specific information reflected in stock returns. Durnev, Morck, Yeung, and Zarowin (2003) confirm that R^2 is associated with the informativeness of U.S. stock prices. Higher values of R^2 (greater stock price synchronicity) in the return regressions reflect more market-wide information and less firm-specific information. Thus, stock price synchronicity is inversely related to stock price informativeness. As evidenced in Table 10, using stock price synchronicity to capture stock price

TABLE 9 The effects of QFII visibility on the relationship between QFII ownership and stock informational efficiency

Independent variables	Dependent variables			
	Ln AR5	Ln AR30	Ln AR5	Ln AR30
QFIIs with high ownership	-5.202*** [-3.563]	-1.443 [-1.001]		
QFIIs with low ownership	-1.995 [-0.735]	-4.090 [-1.374]		
QFIIs with high visibility			-4.934*** [-3.363]	-1.282 [-0.886]
QFIIs with low visibility			-2.721 [-0.992]	-4.613 [-1.528]
Domestic institutional ownership (DIO _{t-1})	0.176** [2.198]	0.064 [0.697]	0.176** [2.197]	0.064 [0.698]
Relative effective spread (RES _{t-1})	0.457*** [4.246]	0.684*** [5.936]	0.456*** [4.244]	0.683*** [5.933]
Market value (LnMV _{t-1})	0.013 [0.699]	-0.145*** [-6.687]	0.013 [0.691]	-0.145*** [-6.692]
Closing price (LnP _{t-1})	0.272*** [9.148]	0.327*** [10.670]	0.272*** [9.155]	0.327*** [10.672]
Quarterly turnover (QTO _{t-1})	0.359*** [23.241]	0.062*** [3.002]	0.359*** [23.244]	0.062*** [3.005]
Volatility (VOL _{t-1})	2.944*** [10.125]	2.477*** [8.126]	2.943*** [10.121]	2.476*** [8.123]
Intercept	-3.907*** [-15.420]	-1.442*** [-4.900]	0.176** [2.197]	0.064 [0.698]
N	48,007	48,007	48,007	48,007
Adjusted R ²	.070	.023	.070	.023

Note: This table reports the results of QFII visibility on the relationship between QFII ownership and stock informational efficiency. The sample includes 2,365 China's A-shares, which were listed on SSE and SZSE between 2004Q3 and 2012Q2, and involves 72 active QFIIs' ownership in China's A-shares. |AR5| and |AR30| are the absolute value of the quarterly 5- and 30-min return autocorrelation, which measure the informational efficiency of stock prices. We sort and partition QFIIs into two groups, namely, QFIIs with high ownership and QFIIs with low ownership, according to the median value of QFII ownership, and report the results in Columns 1 and 2. We also sort and partition QFIIs into two groups, namely, QFIIs with high visibility and QFIIs with low visibility, according to the median value of hits in internet search by Google and Baidu, and report the results in Columns 3 and 4. Control variables include previous quarter domestic institutional ownership, lagged relative effective spread, market value of equity at the end of the previous quarter, lagged quarterly closing price, lagged quarterly turnover and the standard deviations of the monthly stock returns over the previous year. Variables with Ln are converted to the natural logarithm of themselves. Asterisks indicate the statistical significance at the 1% (***), 5% (**), and 10% (*) levels, and *t*-statistics adjusted for firm clustering-effects are reported in parentheses.

informativeness does not change our results in a material way. In line with our main findings, we document a significant and negative relationship between QFII ownership and stock price synchronicity.

We conduct a series of additional test as robustness checks, and we do not report the results for the sake of brevity. We summarize the results to offer some extra insights.¹⁰ First, we redo our analyses using stock price

synchronicity as an alternative measure, and the new model specification does not change our results in a material way. Second, we generate a dummy variable (precrisis dummy), which takes the value of one if the year is before 2007, and zero otherwise. We also generate a dummy variable (postcrisis dummy), which takes the value of 1 if the year is after 2009, and zero otherwise. We interact these two dummy variables with our main

TABLE 10 Stock price synchronicity as another measure of stock price informational efficiency

Independent variables	Dependent variable: synch	
	(1)	(2)
Last period's dependent variable (SYNCH _{t-1})		0.376*** [73.410]
Foreign institutional ownership (FIO _t)	-0.474*** [-4.107]	-0.501*** [-4.709]
Last period's foreign institutional ownership (FIO _{t-1})		0.278** [2.455]
Domestic institutional ownership (DIO _{t-1})	0.041*** [5.001]	0.051*** [8.488]
Relative effective spread (RES _{t-1})	-0.216*** [-19.017]	-0.112*** [-10.985]
Market value (LnMV _{t-1})	0.030*** [16.629]	0.022*** [18.226]
Closing price (LnP _{t-1})	-0.047*** [-16.974]	-0.022*** [-11.264]
Quarterly turnover (QTO _{t-1})	0.015*** [9.798]	0.015*** [13.880]
Volatility (VOL _{t-1})	-0.433*** [-12.917]	-0.257*** [-10.622]
Intercept	0.090*** [3.568]	-0.018 [-1.095]
N	48,007	48,007
Adjusted R ²	.052	.182

Note: This table reports the results when we use stock price synchronicity as the dependent variable to proxy informational efficiency. The sample includes 2,365 China's A-shares, which were listed on SSE and SZSE between 2004Q3 and 2012Q2, and involves 72 active QFIIs' ownership in China's A-shares. Synch denotes stock price synchronicity, which is calculated as R^2 from asset pricing model. Foreign institutional ownership is the ratio of quarterly combined QFII holdings to stock's market value. Control variables include previous quarter domestic institutional ownership, lagged relative effective spread, market value of equity at the end of the previous quarter, lagged quarterly closing price, lagged quarterly turnover and the standard deviations of the monthly stock returns over the previous year. Variables with Ln are converted to the natural logarithm of themselves. Asterisks indicate the statistical significance at the 1% (***), 5% (**), and 10% (*) levels, and *t*-statistics adjusted for firm clustering-effects are reported in parentheses.

explanatory variable (QFII ownership) and include other controls in our model specifications. We find that the first-order effect of QFII ownership is significant and negative, but the interaction terms of QFII ownership with pre- and postcrisis dummies are generally not significant.

Third, given the close connection between Hong Kong and mainland China, we perform our analyses after excluding QFIIs from Hong Kong and obtain consistent results. Fourth, to deal with potential outlier problem, we winsorize all continuous variables at 1 and 99 percentiles (or 5 and 95 percentiles) and find consistent results.

5 | SUMMARY AND CONCLUSION

The past few decades witnessed a significant reduction in barriers to investing in international financial markets through market liberalization. Since its establishment in 2002, the Qualified Foreign Institutional Investor (QFII) program in China has received a lot of attention from both practitioners and academics. It allows licensed foreign institutional investors to buy and sell in the Chinese A-share markets. The QFII program not only provides opportunities for sophisticated foreign institutional investors to participate in an emerging market but also allows listed local firms to have foreign ownership. Therefore, an important yet underexplored question remains as to what the real effects of FIIs are in the local market, particularly when it comes to processing and utilizing information related to intrinsic values and pricing.

Using the relative informational efficiency measure proposed by Boehmer and Kelley (2009) and quarterly QFII holding data from 2004 Q3 to 2012 Q2, we find strong evidence of a significantly positive relationship between QFII ownership and stock price informativeness. In other words, QFIIs help improve stock price informational efficiency for the stocks they hold. Our findings are robust to the inclusion of controls for local institutional ownership, stock liquidity, market size, stock price, and turnover. To make causal inferences, we adopt the IV approach and the PSM approach to ensure that endogeneity concerns do not drive our results. We also use stock price synchronicity as an alternative measure for informational efficiency as a robustness check. Furthermore, we find that the effect of QFII ownership on stock price informativeness is stronger for firms with lower levels of assets intangibility and in regions with less developed institutions. These findings provide indirect evidence that QFIIs influence the stock price informativeness through their monitoring and disciplinary role. In addition, we find that QFIIs are better able to perform their role in improving the corporate governance of their portfolio companies when they have better access to local information and have more incentives to monitor. This article naturally complements the existing literature by highlighting the role of QFIIs (Ding et al., 2017; Gul et al., 2010). More important, this study provides direct evidence of the relationship between foreign institutional

investors and stock price informativeness, which is important to policymakers and academics seeking to understand the consequences of opening markets to foreign capital and investors.

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ENDNOTES

- ¹ <http://www.milkeninstitute.org/publications/view/384>
- ² Note that in the remaining context, we use *informational efficiency* and *informativeness* interchangeably.
- ³ This is because using quote midpoints could avoid bid-ask bounce, which could intertwine the price changes caused by trade reversal with price changes caused by new information.
- ⁴ When there are more than five bids (asks) at the end of a time interval, we recode the five bids (asks) with the largest volume quoted.
- ⁵ Assume the AR(1) model $y_t = c + \varphi y_{t-1} + \varepsilon_t$ describes the movement pattern of a stock's prices, which happen to follow a random walk. The autocorrelation coefficient of this stock's prices with one lag (φ) should be 1. The residual, which is the stock return in this context, should then be white noise, meaning that $\text{cov}(\varepsilon_t, \varepsilon_{t-s}) = \text{cov}(\varepsilon_{t-j}, \varepsilon_{t-j-s}) = 0 \forall j, s$. In other words, stock returns should be independent of one another over time. We expect the return autocorrelation coefficients of stock returns to be zero if stock prices follow a random walk.
- ⁶ The coefficients reported in Panel A support this conjecture, as the absolute value of the coefficients of *QFII holdings* is much smaller when the dependent variable is the quarterly 30-min return autocorrelation. This confirms that pricing inefficiency rises in the 5-min interval than in the 30-min interval.
- ⁷ http://news.xinhuanet.com/world/2007-05/26/content_6152819.htm
- ⁸ We obtain financial news mainly from Wind and Finance Sina and prospectus from <http://www.cninfo.com.cn/cninfo-new/index>.
- ⁹ Baidu is the largest Chinese-language search engine. According to umeng (www.umeng.com), the most influential and credible institution that analyzes web traffic in China, Baidu ranked first at the end of April 2014 in China. Baidu accounts for 60.03% of webpage views generated via search engines, and 58.06% of Chinese search engine users use Baidu.
- ¹⁰ Results from the additional tests are not reported but are available upon request.

DATA AVAILABILITY STATEMENT

I confirm that my article contains a Data Availability Statement even if no data is available (list of sample

statements) unless my article type does not require one. I confirm that I have included a citation for available data in my references section, unless my article type is exempt.

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APPENDIX A.: Variable definitions

Variables	Definitions
AR5	The absolute value of the quarterly 5-min return autocorrelation, which measure the informational efficiency of stock prices.
AR30	The absolute value of the quarterly 30-min return autocorrelation, which measure the informational efficiency of stock prices.
FIO	Foreign institutional ownership, which is calculated as the ratio of combined QFII holdings to stock's market value.
DIO	Domestic institutional ownership, which is calculated as the ratio of combined domestic institutional investors' holdings to stock's market capitalization.
RES	Relative effective spread estimates stock liquidity.
QS	Quoted spread estimates stock liquidity.
MV	Market value is the market capitalization of equity at the end of a quarter.
P	Quarterly closing price.
QTO	Quarterly turnover, which is calculated as the number of shares traded within a quarter divided by the total number of shares outstanding
VOL	Stock return volatility estimated as the standard deviation of monthly returns over the previous year.