The Causal Relationship between Foreign Ownership and Stock Volatility in Indonesia

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Abstract

Using daily foreign holdings of Indonesian stocks from January 1996 to December 2000, we find that foreign investors prefer to hold stocks with low historical volatility. However this preference weakened over the sample period. More importantly, we show that even though gross foreign trading is positively correlated with contemporaneous volatility, foreign holdings at the end of the current month (quarter) have a negative, calming effect on the volatility in the next month (quarter). This calming effect is independent of gross and net foreign trading, and was present before, during, and after the Asian financial crisis. The calming effect increases with the level of foreign holdings. The finding suggests the presence of different economic mechanisms leading to opposite volatility impact from foreign ownership and foreign trading.

Keywords: emerging markets, foreign ownership, foreign trading, volatility, Granger causality, Asian financial crisis
JEL Codes: F32, F36, G12, G15

I. Introduction

A key feature of emerging equity markets is the high volatility compared to developed markets. High volatility increases the cost of capital, deters investments, and impedes long-run stock market development. Understanding the determinants of emerging market volatility is important for investors and policymakers. The financial crises in the 1990s have led to many studies on the volatility impact of foreign institutional investors. Early studies examine foreign impact on emerging market volatility by comparing volatility surrounding the events of market opening in late 1980s and early 1990s. Most of them, e.g. De Santis and İmrohoroğlu (1997), Bekaert and Harvey (1995, 1997, 1998, 2000), Henry (2000), and Kim and Singal (2000), find market opening to be associated with stable or lower volatility. However, Roll (1995) was the first to document a surge in volatility following market opening in Indonesia in late 1988. Levine and Zervos (1998) present evidence of greater volatility associated with market opening in 16 countries. More recently Bae, et al. (2004) investigates whether restrictions on foreign ownership affect stock volatility in emerging markets. They report a robust positive relationship between a stock's accessibility to foreign investors and its volatility. Based on daily trading activities of foreign investors in six Asian emerging markets, Richards (2005) finds much greater price impact from foreign trading than previously reported. Wang (2007) shows that even though foreign selling accounted for only 15% of daily trading volume in Indonesia, it had a dominant impact on the volatility of the Jakarta Composite Index.

This study explores the causal relationship between foreign ownership and stock volatility in Indonesia: whether foreign investors prefer stocks with low volatility in the past, and more importantly, whether and how foreign ownership affects future volatility. This causality is important for understanding the volatility

dynamics and for assessing the benefits of foreign participation for emerging equity markets and companies. If foreign participation leads to greater risk sharing, enhanced liquidity, and improved corporate governance and disclosure, these benefits should result in lower future volatility for stocks with greater foreign ownership. If, ceteris paribus, greater foreign ownership is associated with greater future volatility, it would lend support to the speculative nature of foreign ownership and challenge the perceived benefits of market opening and foreign participation. This causal relationship has not been examined in the existent literature due to data limitations.

A key feature of this study is that we separate the volatility impact of foreign ownership from that of foreign trading. Theory[1] and empirical studies have shown that trading in general, and foreign trading in particular, leads to higher volatility. On the other hand, foreign ownership of an emerging market stock may lead to lower volatility for several reasons. First, foreign ownership increases the investor base, leading to greater risk sharing and higher returns (Merton, 1987). A simple extension of Merton's model shows that greater investor base also reduces volatility (Wang, 2007). Second, evidence suggests that foreign ownership is viewed favourably in emerging markets, which are generally characterised by poor disclosure and greater information asymmetry among investors. Foreign institutions are better monitors of corporate management than local institutions (Khanna and Palepu, 1999) and foreign analysts produce more timely and accurate forecasts than local analysts (Bacmann and Bolliger, 2001). As such greater foreign ownership may reduce the degree of information asymmetry surrounding a stock. In addition, Huang and Shiu (2005) reports a "foreign ownership premium" among stocks in Taiwan: ceteris paribus, stocks with greater foreign ownership have better returns. Therefore greater foreign

[1] The mixture of distribution hypothesis in market microstructure literature provides a theoretical link between trading activity and price volatility. See Andersen (1996) and references therein.

ownership may induce greater investor confidence on a stock which should translate to lower volatility. Finally, there is a large body of literature showing the positive impact of foreign institutional investors on corporate governance, disclosure, and operational profits, which again leads to better returns and lower volatility. Foreign institutional ownership tends to improve corporate governance and profitability (D'Souza, et al., 2005, Mitton, 2006), and help firms to recover from financial stress (Blalock, et al., 2005). When faced with agency conflicts, foreign institutions are more likely to raise objection (Gillan and Stark, 2003), therefore have a deterrence effect on managerial expropriation (Johnson, et al., 2000)[2]. Taken together, the evidence suggests that foreign ownership should have a calming effect on volatility, opposite to that of foreign trading activity. The findings of a positive relationship between a stock's investibility and its volatility (Bae, et al., 2004) may reflect the impact of foreign trading, as oppose to foreign ownership restrictions. By separating the volatility impact of foreign ownership and foreign trading, we provide a more complete picture on the impact of market opening and foreign participation.

Indonesia opened its equity market to foreign investors relatively early in December 1988 and has played an important role in the collective understanding of various aspects of emerging financial markets[3]. By 1996, foreign investors have become a significant, if not the dominant player in Indonesia, holding over 27% of the total market capitalization and participating in 80% of daily trading value on the Jakarta Stock Exchange (Wang, 2007, Figure 2). They do not show preference for large stocks or high turnover stocks, and hold large, medium, and small stocks in

[2] Gillan and Starks (2003) provides a detailed discussion on direct and indirect influences of foreign institutional investment on corporate governance. They report that some large US pension funds have directly sought to improve corporate governance in their overseas holdings.
[3] A partial list of studies focusing on the Indonesian equity market includes Roll (1995), Chang, et al. (1995), Bonser-Neal, et al. (1999, 2002), Bowe and Domuta (2004), Hanafi and Rhee (2004), Blalock, et al. (2005), Dvorak (2005), and Wang (2007).

proportions similar to the market portfolio. Our analysis shows that foreign investors have a significant preference for stocks with low past volatility, but the preference weakened over the sample period.

To identify the impact of foreign ownership on future volatility, we examine the cross-sectional relationship between a stock's volatility in a month (or quarter) and foreign ownership in the previous month (or quarter), while controlling for a range of contemporaneous and lagged variables. Consistent with Wang (2007), there is a positive contemporaneous relationship between foreign trading and individual stock volatility. More importantly, we show that the level of foreign ownership is negatively related to subsequent volatility. This result is independent of the gross and net trading by foreign investors: if two stocks have the same amount of foreign trading in the same direction, the one with the higher foreign ownership has lower volatility. Furthermore, the relationship between volatility and foreign ownership is nonlinear: the stabilizing effect increases with the level of foreign ownership. These findings hold for the full sample and all sub-periods before, during, and after the Asian financial crisis. They show that the impact of foreign participation is not one-sided, and there are different economic mechanisms leading to opposite effects from foreign ownership and foreign trading. Our finding is in contrast to those of Sias (1996) and Xu and Malkiel (2003), who show that greater institutional ownership in the U.S. increase future volatility. However both studies did not control for the positive effect of institutional trading.

The paper is organized as follows. Section II explains the data and features of foreign ownership in Indonesia. Foreign preference for stocks with different historical volatilities is investigated in section III. Section IV explores the causality from foreign ownership to future stock volatility. The paper concludes in section V.

II. Data and Preliminary Analysis

The Jakarta Stock Exchange (JSX) maintains and publishes daily foreign holdings of individual stocks. Our data include stock code, daily high, low, and closing prices, daily trading volume, rupiah value, and the number of transactions, shares outstanding, and end-of-day foreign share holding in each stock. The sample period is from 1 January 1996 to 22 December 2000 and has 1212 trading days. After removing records with obvious errors, e.g. missing price (price=0), duplicate records (same stock with two trading records on the same day), daily high being less than daily low, etc, our initial sample has 329,393 stock-day records.

Our sample covers the Asian financial crisis period. Given the severity of the crisis, it is sensible to divide the full sample into three sub-periods: before, during, and after the Asian crisis. Figure 1 depicts the Jakarta Composite Index (JCI) and the IDR/USD exchange rate. The stock market in Indonesia had a bull run in 1996 and the first half of 1997. The crisis hit Indonesia in early August 1997. The stock market crashed after August 5, and the Rupiah was floated on August 14. The crisis deepened through the rest of 1997 and early 1998. In May 1998, Suharto resigned as the Indonesian President and a new rescue package was signed with the International Monetary Fund. The JCI began a strong and sustained recovery after October 6, 1998. The rupiah also experienced a substantial surge against US dollar in the second week of October. We take August 5, 1997, as the start of the crisis period for Indonesia, and October 7, 1998, as the start of the recovery. These dates are the same as in Wang (2007). Using alternative dates for the Asian crisis, e.g. July 1997 to August 1998 as in Johnson and Mitton (2003) and Lemmon and Lins (2003), does not alter the main results.

Table 1 provides a brief summary of the JSX. Despite of the Asian crisis, the number of stocks listed increased from 271 to 289 by the end of the crisis period. The market was highly concentrated: the top 10 stocks accounted for over 50% of the total market capitalization, and the concentration increased over the sample period. Although trading activity increased substantially, the average transaction size decreased after the start of the Asian crisis. Over 35% of listed stocks were not traded on an average trading day. Our later analyses are based on active stocks, defined as those being traded more than 5 days in a month. Overall only 136 of the 289 stocks are considered being active. The JCI was up almost 40% from early 1996 to mid-1997. The crisis period saw the JCI losing over 63% of its value and is accompanied by a surge in volatility.

Figure 2 and Panel A of Table 1 depict the aggregate foreign ownership over the sample period. The percentage foreign holdings, by shares and rupiah value, were relatively stable except at the end of the sample period when they had several large drops in the second half of 2000. Overall there was no evidence of massive capital outflows from Indonesia's equity market during the Asian crisis. Foreign holding in rupiah value decreased by only 3.2% compared to the decline in the JCI by 63.4% over the same period. The difference is most likely the result of additional capital injections. Indeed foreign shareholding increased by 5.5 billion over the crisis period, even though the percentage shareholding dropped by 4.9% because of the increase in the total shares outstanding from the 18 newly listed stocks. It appears that foreign investors took advantage of the low share prices and low rupiah value and increased their share holding in Indonesia during the crisis period. Other studies[4] also report capital inflows to equity markets in Korea and Thailand. After the crisis, there was a

[4] Kim and Wei (1999) report that foreign holdings in Korea increased from 7.06 to 8.58 trillion won between November 1997 and June 1998. Wang (2007) reports that foreign investors were net buyers of 64 billion baht of Thai stocks during the crisis.

surge in the total shares outstanding and foreign shareholding in early April 1999.[5] The percentage foreign holding increased only slightly. Foreign percentage holdings began to decrease in the second half of 2000.

Panels B and C of Table 2 report foreign ownership by market capitalization and by daily turnover. Foreign investors in Indonesia do not favor large stocks and high turnover stocks as suggested in previous studies. For the full sample, the largest 50 stocks accounted for 78.3% of the total market capitalization in Indonesia and 79.3% of the total foreign holding in Indonesia. On average foreign investors hold 27.6% of the top 50 stocks. The market weight for the next 100 stocks is 16%, while their weight in the aggregate foreign portfolio is 15.9%. The market weights and foreign portfolio weights are very similar across different market capitalization groups in all three sub-periods. Foreign investors do not favor stocks with the highest turnover, except during the Asian crisis. Despite the higher volatility and greater trading activities during the crisis, the turnover ratio is actually lower. This is consistent with smaller transaction size and more stocks not being traded during the crisis (Table 1). Panel D of Table 2 shows foreign ownership distribution across active stocks, those traded more than 5 days in a month. The distribution shifted towards the lower end of percentage holdings during the Asian crisis.

III. Foreign Preference for Historical Volatility

In this section we examine whether foreign investors prefer to hold stocks with low historical volatility. Understanding foreign preferences for stocks in emerging markets is important for investors as foreign holdings affect future returns (Huang and Shiu, 2005). It is also important for policymakers and regulators. Investor preferences

[5] Between March 30 and April 6, 1999, the total shares outstanding on the JSX increased from 154 billion to 472 billion. Three banks, Bank Danamon (BDMN), Bank International Indonesia (BNII), and Bank Tiara Asia (BNTA), increased shares outstanding by about 320 billion, while prices of these banks remained steady. Foreign shareholding increased from 36.2 billion to 118 billion.

in developed markets have been examined in several studies[6]. Falkenstein (1996) and Gompers and Metrick (2001) report that U.S. mutual funds prefer stocks with higher volatility, while Covrig, et al. (2006) shows that funds in 11 developed markets prefer stocks with lower volatility. Evidence from emerging markets remains limited. Based on surveys conducted in 1994 and 1997, Edison and Warnock (2004) shows that U.S. investors prefer stocks with lower volatility in Asia, but show no such preference in Latin America[7]. Our analysis is based on actual foreign holdings therefore provides direct evidence on foreign preference.

Foreign preference in relation to stock volatility is analyzed at monthly intervals. Foreign holdings of individual stocks are highly persistent. Tests indicate the presence of a unit root in monthly foreign holdings. We examine the changes in monthly foreign holdings using the following model:

$$(1) \qquad \Delta FH_{i,t} = \beta_0 + \beta_1 FH_{i,t-1} + \beta_2 \ln(\sigma_{i,t}) + \beta_3 \ln(MCAP_{i,t}) + \beta_4 TOVER_{i,t} + \beta_5 r_{i,t} + \beta_6 r_{i,t-1} + \varepsilon_{i,t}$$

where $FH_{i,t}$ is the percentage foreign holding of stock i at the end of month t, $\sigma_{i,t}$ is the daily standard deviation in month t, $MCAP_{i,t}$ is the market capitalization at the start of month t, $TOVER_{i,t}$ is turnover, and $r_{i,t}$ is return in month t.

The model is estimated cross-sectionally for every month in the sample. Only active stocks, those traded more than 5 days in a month, are used in order to obtain reasonable estimates for volatility and foreign holdings. The average coefficients are reported in Table 3. The modified Fama-MacBeth t-statistics is calculated with the standard error given by $\frac{\text{St. Dev.}(\beta)}{\sqrt{T}}\left(\frac{1+\rho(1)}{1-\rho(1)}\right)$, where "St. Dev." is the standard deviation across all months, $\rho(1)$ is the first-order autocorrelation of the estimated coefficients,

[6] See for example Falkenstein (1996), Kang and Stulz (1997), Gompers and Metrick (2001), Dahlquist and Robertsson (2001), Covrig, et al. (2006).

[7] Aggarwal, et al. (2005) examines the holding preferences of U.S. mutual funds in emerging markets, but not in terms of stock volatility. Gelos and Wei (2005) shows that emerging market funds prefer companies with greater transparency.

and T is the number of month (Cochrane, 2001). The full-sample results show foreign holdings increase with current and past returns, decrease with current volatility and past levels of foreign holdings. The strong positive impact of current and lagged returns is consistent with momentum trading by foreign investors documented in previous studies. Ceteris paribus, foreign investors show aversion to stocks with high volatility. Consistent with Panels B and C of Table 2, market capitalization and turnover do not affect foreign holdings. There are significant variations across sup-periods before, during, and after the Asian crisis. Foreign investors show significant preference for large stocks before the crisis, but sold them during the crisis period. Many of the large stocks had political or business connections with the Soharto family, and fell out of favour during the crisis. After the crisis, changes in foreign holdings appear to be entirely driven by returns, particularly current returns. Overall the evidence suggests that foreign investors did show preference for low volatility stocks, but the preference becomes weaker over time.

IV. Foreign Ownership and Future Volatility

In this section we examine the relationship between foreign holding and future volatility, while controlling for a range of other contemporaneous and lagged variables that may affect future volatility. Specifically foreign impact on future volatility is examined using the following model:

$$(2) \qquad \ln(\sigma_{i,t}) = \beta_0+\beta_1\ln(\sigma_{i,t-1})+\beta_2\ln(\sigma_{i,t-2})+\beta_3\ln(MCAP_{i,t-1})+\beta_4 r_{i,t-1} +\beta_5 TOVER_{i,t}+\beta_6 r_{i,t}+\beta_7 FT_{i,t}+\beta_8 \Delta FH_{i,t}+\beta_9 FH_{i,t-1}+\varepsilon_{i,t}$$

Most of the variables are the same as in Equation (1). The only new variable is $FT_{i,t}$ which is defined as the sum of the absolute changes of daily foreign holdings for stock i during month t, and is used as an proxy for foreign trading. Because foreign investors do not trade in the same direction, the absolute changes of foreign holdings

underestimate foreign trading volume. To the extend that $FT_{i,t}$ is positively correlated with $FH_{i,t-1}$, this leads to an overestimation of β_9. Since the estimated $\beta_9<0$, the true β_9 < the estimated β_9, therefore the inverse relationship between $\sigma_{i,t}$ and $FH_{i,t-1}$ should be stronger than reported.

Again only active stocks are used for the analysis. The full-sample results at monthly intervals are reported in Panel A of Table 4. Model (1) includes only lagged variables. Model (2) includes contemporaneous return and turnover. Model (3) includes contemporaneous foreign gross and net trading. In all three specifications, volatility is negatively related to past foreign holdings. Since $FT_{i,t}$ is positively correlated with $FH_{i,t-1}$, omitting $FT_{i,t}$ leads to an overestimation of β_9. Indeed β_9 in models (1) and (2) are larger than in model (3). Adding $FT_{i,t}$ in model (3) strengthens the negative relationship between foreign holdings and future volatility. Volatility is inversely related to lagged returns, reflecting the leverage effect, but is unaffected by market capitalization or current returns. Panel B reports the results for quarterly estimations of model (3). Foreign net purchase, $\Delta FH_{i,t}$, is no longer significant. But foreign holdings in the previous quarter still have a negative impact on current volatility.

Panel C of Table 4 reports monthly sub-period estimations for model (3). Foreign holdings had a calming effect on future volatility in all three sub-periods. Before the crisis, large stocks had lower volatility. The Indonesian market had a bull run, and volatility becomes higher as the prices moved higher ($\beta_6>0$). During the crisis period, volatility appeared to be unrelated to trading activities. Turnover (TOVER), gross foreign trading (FT), and net foreign trading (ΔFH) were all unrelated to volatility. It is likely that volatility was driven by severe currency depreciations and the overall macro uncertainty related to leadership changes and IMF

programs. Interestingly the calming effect of foreign holdings was strongest during the crisis period. After the crisis the calming effect of foreign ownership became weaker but remained significant.

Panel D of Table 4 explores possible nonlinear relationships between volatility and foreign holdings: the impact of foreign holdings may be a function of the level of foreign holdings. We separate stocks into groups with foreign holdings below 15%, between 15-30%, between 30-45%, and above 45%. The average numbers of stocks in these groups are reported in Panel D of Table 2. The full-sample results show that as foreign holding increases, the coefficients become more negative with greater statistical significance. Across sub-periods, the statistical significance of different foreign holding groups varies. During the crisis, only foreign holdings above 45% had a significant calming effect on future volatility. After the crisis, foreign holdings above 15% contributed to lower future volatility.

V. Conclusion

Recent studies, e.g. Bae, et al. (2004) and Wang (2007), link foreign participation to greater volatility in emerging markets. This study shows that after controlling for gross and net foreign trading, foreign ownership has a calming effect on future stock volatility. The effect is robust to alternative specifications, presence of gross and net foreign trading variables, and sub-period analyses. There are several economic mechanisms that may potentially explain the calming effect of foreign ownership on future volatility: increased risk sharing and higher return, positive signaling and greater investor confidence, and positive impact on corporate governance, disclosure, and operational profits. An important future research topic is to investigate the economic mechanisms that lead to our findings.

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Table 1: JSX Summary

This table provides a summary of listing and trading on the JSX. "Number of stocks listed" is at the end of the period. "JCI return" is the JCI index return over the period. All other numbers are daily averages for the period. "Top 10" is the market capitalization of the top 10 largest stocks relative to the total. "No trading" is the percentage of stocks not traded on a trading day. "Active stocks" is the average number of stocks traded more than 5 days in a month.

	Full Sample 1996/1/1 – 2000/12/22	Before Crisis 1996/1/1 – 1997/8/5	During Crisis 1997/8/7 – 1998/10/6	After Crisis 1998/10/7 – 2000/12/22
Stocks listed	289	271	289	289
Market Cap. (tri. rupiah)	245	201	182	312
Top 10 (%)	56	53	55	60
Volume (million shares)	333	117	298	510
Value (billion rupiah)	348	238	329	438
Number of transactions	13642	8382	13339	17655
Transaction Size (mil. rupiah)	25.5	28.4	24.7	24.8
No trading (%)	36.7	37.2	38.0	35.5
Active stocks	136	132	145	137
JCI return (%)	-18.8	39.3	-63.4	59.4
JCI volatility (%)	2.19	1.04	3.33	2.41

Table 2: Foreign Ownership in Indonesia

Panel A: Foreign Ownership over Time

	Before Crisis 1996/1/1 – 1997/8/5		During Crisis 1997/8/7 – 1998/10/6		After Crisis 1998/10/7 – 2000/12/22	
Shares	(billion)	(%)*	(billion)	(%)*	(billion)	(%)*
Average	18.4	26.8	34.4	25.3	133.6	20.3
High	30.4	28.7	36.4	28.5	179.1	28.8
Low	11.5	25.0	29.8	23.4	35.4	11.7
Change	18.9	3.4	5.5	-4.9	127.1	-9.7
Rupiah Value	(trillion)	(%)**	(trillion)	(%)**	(trillion)	(%)**
Average	54.8	27.2	47.3	25.9	80.8	25.8
High	74.7	28.7	71.5	28.4	135.4	30.3
Low	40.4	26.0	27.5	22.9	27.0	20.9
Change	33.3	1.9	-43.6	-3.2	26.5	-4.2

* Percentage of the total shares outstanding.

** Percentage of the total market capitalization.

Table 2 – *Continued*

Panel B: Foreign Ownership by Market Capitalization

	Top 50	Medium 100	Remaining Stocks
Full Sample			
% of Market Capitalization	78.3	16.0	5.7
% of Foreign Holding	79.3	15.9	4.8
Average Foreign Holding (%)	27.6	24.8	21.6
Before Crisis			
% of Market Capitalization	78.2	17.7	4.0
% of Foreign Holding	78.2	18.3	3.5
Average Foreign Holding (%)	31.3	27.1	24.1
During Crisis			
% of Market Capitalization	80.9	14.8	4.3
% of Foreign Holding	80.2	16.1	3.7
Average Foreign Holding (%)	27.0	25.9	21.5
After Crisis			
% of Market Capitalization	84.0	12.1	3.9
% of Foreign Holding	84.8	11.7	3.5
Average Foreign Holding (%)	24.8	25.1	22.8

Panel C: Foreign Ownership by Daily Turnover

	Top 50	Medium 100	Remaining Stocks
Full Sample			
Average Turnover (%)	0.98	0.28	0.07
Average Foreign Holding (%)	21.7	27.2	22.0
Before Crisis			
Average Turnover (%)	1.46	0.26	0.04
Average Foreign Holding (%)	22.5	28.0	27.1
During Crisis			
Average Turnover (%)	0.77	0.18	0.02
Average Foreign Holding (%)	25.9	24.6	22.7
After Crisis			
Average Turnover (%)	1.04	0.26	0.04
Average Foreign Holding (%)	25.6	26.0	21.9

Panel D: Foreign Ownership of Active Stocks*

	Number of	Foreign Ownership Distribution			
	Active Stocks	<15%	(15%,30%]	(30%,45%]	>45%
Full Sample	136	37	42	37	20
Before Crisis	132	27	40	44	21
During Crisis	145	43	49	39	14
After Crisis	137	42	41	32	22

*Stocks traded more than 5 days in a month.

Table 3: Impact of Volatility on Foreign Holdings

This table reports the following cross-sectional regression:

$$\Delta FH_{i,t} = \beta_0 + \beta_1 FH_{i,t-1} + \beta_2 \ln(\sigma_{i,t}) + \beta_3 \ln(MCAP_{i,t}) + \beta_4 TOVER_{i,t} + \beta_5 r_{i,t} + \beta_6 r_{i,t-1} + \varepsilon_{i,t}$$

where $FH_{i,t}$ is the percentage foreign holding of stock i at the end of month t, $MCAP_{i,t}$ and $TOVER_{i,t}$ are market capitalization and turnover ratio respectively, $r_{i,t}$ is the monthly return, and $\sigma_{i,t}$ is the monthly return volatility. The coefficients are averaged across monthly estimations. "St. Dev." is the standard deviation across all months, $\rho(1)$ is the first-order autocorrelation of the estimated coefficients, "F-M t-stat" is the modified Fama-MacBeth t-statistics with the standard error given by $\frac{\text{St. Dev.}(\beta)}{\sqrt{T}}\left(\frac{1+\rho(1)}{1-\rho(1)}\right)$ where T = number of months. The asterisks *, **, and *** denote one-sided significance at 10%, 5%, and 1% respectively.

	β_0	β_1	β_2	β_3	β_4	β_5	β_6	R^2
Full Sample								
Coefficients	0.066	-0.012	-0.135	0.023	-0.403	2.097	0.519	0.136
St. Dev.	1.579	0.018	0.459	0.202	6.351	2.456	2.088	
$\rho(1)$	0.043	0.138	0.074	0.001	-0.034	0.245	0.001	
F-M t-stat	0.30	-4.02***	-1.98**	0.89	-0.53	4.04***	1.94*	
Before Crisis								
Coefficients	-0.538	-0.02	-0.133	0.144	-0.865	1.533	0.026	0.138
St. Dev.	1.129	0.014	0.362	0.167	6.934	2.471	1.567	
$\rho(1)$	-0.142	-0.29	-0.428	-0.192	-0.087	0.148	-0.021	
F-M t-stat	-2.84***	-11.9***	-4.11***	5.70***	-0.66	2.06**	0.08	
During Crisis								
Coefficients	0.39	-0.012	-0.334	-0.059	-0.529	1.646	0.447	0.097
St. Dev.	1.034	0.02	0.463	0.122	5.692	1.764	1.336	
$\rho(1)$	0.039	0.047	0.199	-0.313	0.085	-0.022	-0.342	
F-M t-stat	1.35	-2.19**	-1.87*	-3.60***	-0.30	3.78***	2.64***	
After Crisis								
Coefficients	0.325	-0.007	-0.018	-0.015	-0.334	2.814	0.91	0.154
St. Dev.	2.005	0.02	0.503	0.23	6.035	2.709	2.691	
$\rho(1)$	-0.007	0.205	0.005	-0.137	-0.091	0.275	0.013	
F-M t-stat	0.87	-1.25	-0.19	-0.45	-0.35	3.13***	1.74*	

Table 4: Impact of Foreign Holdings on Volatility

This table reports the following cross-sectional regression:

$$\ln(\sigma_{i,t}) = \beta_0+\beta_1\ln(\sigma_{i,t-1})+\beta_2\ln(\sigma_{i,t-2})+\beta_3\ln(MCAP_{i,t-1})+\beta_4 r_{i,t-1}+\beta_5 TOVER_{i,t}+\beta_6 r_{i,t}+\beta_7 FT_{i,t}+\beta_8 \Delta FH_{i,t}+\beta_9 FH_{i,t-1}+\varepsilon_{i,t}$$

where $\sigma_{i,t}$ is the return volatility of stock i in month t; $MCAP_{i,t}$ is the median market capitalization; $r_{i,t}$ is the monthly return; $FH_{i,t}$ is the percentage foreign holding at the end of the month; $TOVER_{i,t}$ is turnover in month t; $FT_{i,t}$ is the sum of the absolute changes in daily foreign holding of stock i in month t and is a proxy for foreign trading volume; and $\Delta FH_{i,t}=FH_{i,t}-FH_{i,t-1}$. The coefficients are averaged across monthly estimations. "St. Dev." is the standard deviation across all months, $\rho(1)$ is the first-order autocorrelation of the estimated coefficients, "F-M t-stat" is the modified Fama-MacBeth t-statistics with the standard error given by $\frac{\text{St. Dev.}(\beta)}{\sqrt{T}}\left(\frac{1+\rho(1)}{1-\rho(1)}\right)$ with T being the number of months. The asterisks *, **, and *** denote one-sided significance at 10%, 5%, and 1% respectively.

Panel A: Full Sample – Monthly Estimation

	β_0	$\ln(\sigma_{i,t-1})$	$\ln(\sigma_{i,t-2})$	$\ln(MCAP_{i,t-1})$	$r_{i,t-1}$	$TOVER_{i,t}$	$r_{i,t}$	$FT_{i,t}$	$\Delta FH_{i,t}$	$FH_{i,t-1}$	R^2
Model (1)											
Coefficients	-0.437	0.433	0.213	-9.874	-0.19					-0.136	0.341
St. Dev.	0.574	0.115	0.099	49.41	0.285					0.261	
$\rho(1)$	0.155	0.212	0.142	0.091	0.231					-0.181	
F-M t-stat	-4.35***	19.1***	12.6***	-1.30	-3.25***					-5.89***	
Model (2)											
Coefficients	-0.832	0.39	0.19	4.794	-0.193	1.226	0.172			-0.161	0.418
St. Dev.	0.571	0.116	0.104	38.9	0.289	0.715	0.502			0.256	
$\rho(1)$	0.367	0.279	0.145	0.052	0.149	0.412	0.365			-0.088	
F-M t-stat	-5.27***	14.8***	10.7***	0.87	-3.87***	5.58***	1.25			-5.85***	
Model (3)											
Coefficients	-0.769	0.385	0.185	-2.195	-0.181	1.201	0.206	2.056	-0.67	-0.169	0.428
St. Dev.	0.585	0.116	0.104	40.9	0.293	0.702	0.504	2.95	1.593	0.267	
$\rho(1)$	0.378	0.27	0.14	0.103	0.096	0.371	0.412	0.376	-0.001	-0.074	
F-M t-stat	-4.64***	14.9***	10.5***	-0.34	-3.98***	6.13***	1.33	2.47***	-3.29***	-5.75***	

Table 4 – *Continued*

Panel B: Full Sample – Quarterly Estimation

	β_0	$\ln(\sigma_{i,t-1})$	$\ln(\sigma_{i,t-2})$	$\ln(MCAP_{i,t-1})$	$r_{i,t-1}$	$TOVER_{i,t}$	$r_{i,t}$	$FT_{i,t}$	$\Delta FH_{i,t}$	$FH_{i,t-1}$	R^2
Coefficients	-0.595	0.42	0.179	0.013	-0.205	0.316	-0.037	0.157	-0.165	-0.112	0.522
St. Dev.	0.323	0.18	0.114	0.054	0.137	0.186	0.216	0.423	0.634	0.249	
$\rho(1)$	0.296	-0.245	0.11	-0.021	0.38	-0.122	-0.201	-0.605	-0.077	-0.281	
F-M t-stat	-4.58***	17.66***	5.78***	1.16	-3.08***	9.94***	-1.17	6.89***	-1.39	-3.68***	

Panel C: Sub-periods – Monthly Estimation

	β_0	$\ln(\sigma_{i,t-1})$	$\ln(\sigma_{i,t-2})$	$\ln(MCAP_{i,t-1})$	$r_{i,t-1}$	$TOVER_{i,t}$	$r_{i,t}$	$FT_{i,t}$	$\Delta FH_{i,t}$	$FH_{i,t-1}$	R^2
Before Crisis											
Coefficients	-1.075	0.334	0.133	-8.097	-0.321	1.279	0.552	3.02	-1.222	-0.193	0.380
St. Dev.	0.503	0.107	0.09	37.9	0.424	0.464	0.485	3.14	1.43	0.249	
$\rho(1)$	-0.352	0.073	0.112	-0.56	-0.121	-0.019	0.117	-0.105	-0.41	0.211	
F-M t-stat	-19.9***	12.1***	5.25***	-3.38***	-4.32***	12.8***	4.02***	5.31***	-9.15***	-2.26**	
During Crisis											
Coefficients	-0.401	0.412	0.182	-9.254	-0.186	1.247	-0.1	3.354	-0.511	-0.249	0.400
St. Dev.	0.564	0.121	0.106	52.6	0.134	1.01	0.382	3.93	1.19	0.313	
$\rho(1)$	0.585	0.715	-0.113	0.405	0.51	0.692	0.254	0.598	0.162	-0.305	
F-M t-stat	-0.72	2.19**	8.38***	-0.29	-1.74**	0.87	-0.60	0.83	-1.20	-5.80***	
After Crisis											
Coefficients	-0.75	0.41	0.219	4.781	-0.09	1.015	0.161	0.999	-0.153	-0.106	0.464
St. Dev.	0.522	0.111	0.097	37.6	0.215	0.672	0.428	2.00	1.65	0.205	
$\rho(1)$	0.234	0.305	0.282	0.073	0.227	0.055	0.339	0.04	-0.191	0.013	
F-M t-stat	-4.64***	10.2***	6.55***	0.57	-1.37	7.03***	0.97	2.40***	-0.71	-2.63***	

Table 4 – *Continued*

Panel D: Foreign Holding Thresholds – Monthly Estimation

	$\ln(MCAP_{i,t-1})$	$r_{i,t-1}$	$TOVER_{i,t}$	$r_{i,t}$	$FT_{i,t}$	$\Delta FH_{i,t}$	$FH_{i,t-1}$ <15%	$FH_{i,t-1}$ (15%,30%]	$FH_{i,t-1}$ (30%,45%]	$FH_{i,t-1}$ >45%	R^2
Full Sample											
Coefficients	-0.017	-0.216	0.864	0.151	1.548	-0.677	-0.137	-0.073	-0.09	-0.113	0.573
St. Dev.	0.043	0.229	0.658	0.407	2.421	2.234	1.322	0.507	0.372	0.307	
ρ(1)	0.05	0.117	0.204	0.319	0.273	-0.062	-0.129	-0.276	-0.281	-0.159	
F-M t-stat	-2.59***	-6.41***	6.70***	1.41	2.92***	-2.56***	-1.50	-2.14**	-3.85***	-4.50***	
Before Crisis											
Coefficients	-0.023	-0.378	1.055	0.311	2.194	-1.134	-0.173	-0.047	-0.088	-0.055	0.475
St. Dev.	0.045	0.265	0.44	0.435	2.821	1.227	1.475	0.553	0.456	0.427	
ρ(1)	-0.061	-0.286	0.015	0.167	-0.109	-0.119	-0.255	-0.084	-0.252	-0.188	
F-M t-stat	-2.26**	-15.22***	10.03***	2.08**	4.68***	-4.90***	-2.08**	-0.64	-2.14**	-1.44	
During Crisis											
Coefficients	-0.029	-0.15	0.708	-0.043	2.713	-0.721	0.051	-0.04	-0.091	-0.242	0.558
St. Dev.	0.037	0.151	0.643	0.436	2.826	1.508	1.319	0.353	0.269	0.243	
ρ(1)	0.119	-0.35	0.459	0.274	0.465	0.401	-0.166	-0.263	-0.122	-0.146	
F-M t-stat	-2.73***	-7.29***	1.47	-0.01	1.42	-0.97	0.57	-0.19	-1.32	-5.62***	
After Crisis											
Coefficients	-0.005	-0.141	0.731	0.157	0.783	-0.087	-0.098	-0.127	-0.078	-0.096	0.629
St. Dev.	0.045	0.196	0.765	0.333	1.758	3.027	1.365	0.574	0.361	0.207	
ρ(1)	0.069	0.069	0.052	0.371	-0.014	-0.296	-0.092	-0.404	-0.39	-0.44	
F-M t-stat	-0.80	-3.14***	5.17***	1.05	2.46***	0.30	-0.34	-2.17**	-1.95*	-6.15***	

Figure 1: The Jakarta Composite Index and IDR/USD Exchange Rate

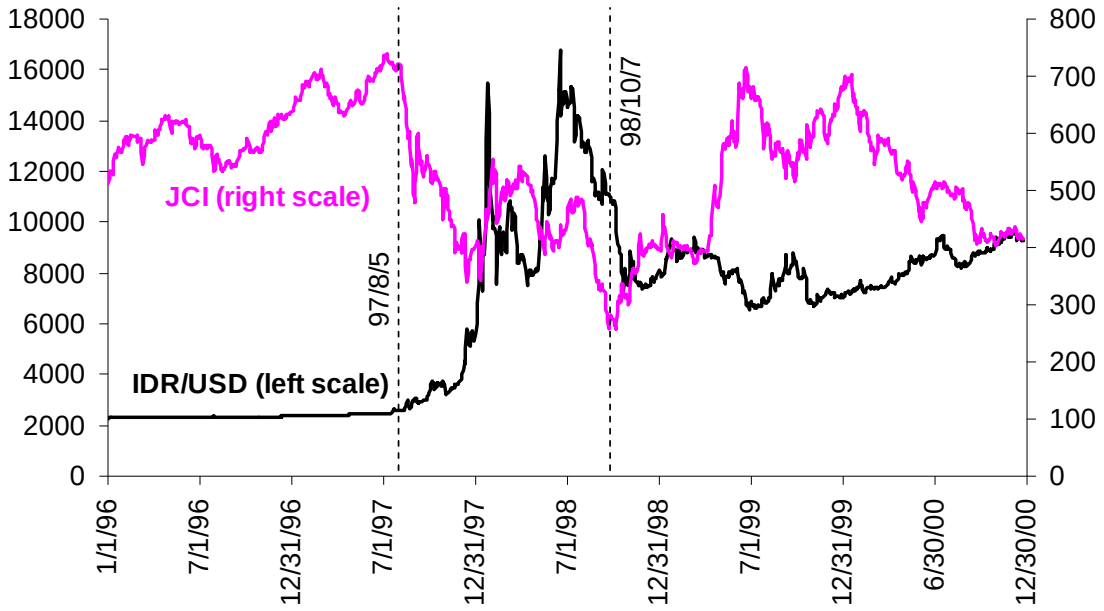

Figure 2: Foreign Ownership in Indonesia