

INSTITUTIONAL INVESTORS TRADING STRATEGY IN INDONESIA'S GOVERNMENT BOND MARKET DURING THE 2008 CRISIS

Isabelle Aranditha Gusdinar and Deddy Priatmodjo Koesrindartoto

*School of Business and Management,
Institut Teknologi Bandung, Bandung 40132, Indonesia*

*Corresponding author: isabelle@sbm-itb.ac.id

ABSTRACT

The importance of government bonds in covering shortages in a government's budget is inseparable from the market players' role in the government bond market. In this study, we examine whether institutional investors' behaviour had causal effects on the government bond market index from April 2008 to April 2009. Moreover, we also observe whether foreign, bank, non-bank and central bank investors exhibit similar strategies in their bond trading activities. Granger causality tests and a Vector Error Correction Model (VECM) methodology have indicated that foreign investors become market leaders and tend to hold long-tenor bonds during crises to maintain an optimal level of risk in their portfolio. This also shows that foreign investors tend to hold the fall of index. Another result shows that both foreign and non-bank investors become market leaders who influence the bond market index and have similar trading strategies in the after-crisis period. Meanwhile, the central banks become foreign investors' and non-bank investors' trade counterparts to provide liquidity and stabilise the bond price. Moreover, the results indicate that bank investors become the market makers in the bond market.

Keywords: institutional investors, behaviour, Granger causality, VECM, bond

INTRODUCTION

The government plays an important role in maintaining economic growth by issuing government bonds to cover cash shortages in general financing. The growth in the sales of government bonds can be analysed by considering the amount and frequency of such transactions each year. From the increase in transaction frequency and decrease in the amount of government bonds traded since 2007 shown in Figure 1, we can observe the government bond market phenomena from 2007 to 2009.

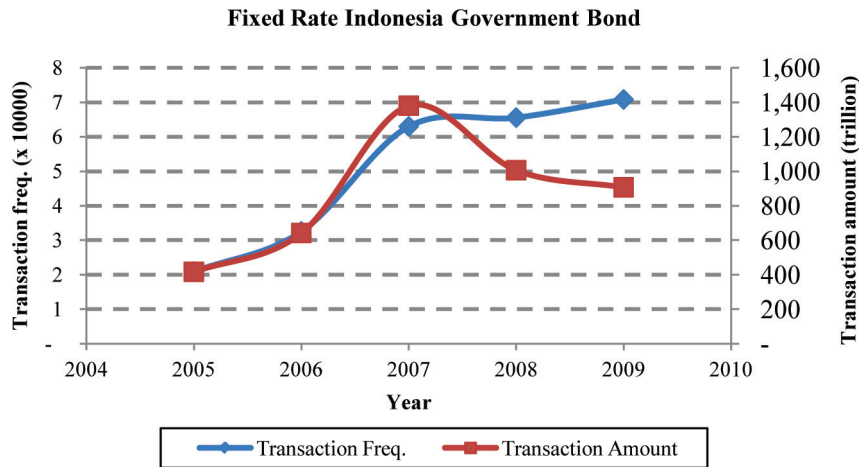


Figure 1. Government bond transactions from 2005 to 2009

There is a decreasing level of investor’s interest to own government bonds, whereas to bridge the gap in government funding, the government needs to assure that their bonds are bought by investors. The crisis period showed us that there is a decreasing amount of investment in the government bond market and an indication that decreasing bond prices trigger decreasing transaction amounts. Therefore, this research focuses on investor behaviour and strategy in a crisis period.

Transactions involving government bonds are conducted over the counter (OTC), so that the amount a government bond is traded for depends on the bid and ask process that occurs between the seller and buyer. Therefore, the movement of government bond transactions will still depend on the role of the involved market players. To control an efficient, active and liquid government bond secondary market, government requires the description of market players’ trading activities in the government bond market. The majority of market players in the bond market are institutional investors, who control approximately 90% of the shares in the bond market (Indonesia Bond Pricing Agency [IBPA], 2011). There are seven different types of institutional investors, including foreign investors, insurance companies, banks, securities, mutual funds, pension funds and charitable foundations. A variety of different characteristics in bond trading result from having these different types of investors (Ryan & Schneider, 2002). Therefore, the purpose of this study is to examine the impact of institutional investors’ behaviour in bond trading on the government bond market return and how the trading strategies vary among them. Through this analysis, it is expected that we will determine which investors become the market leader as well as the market maker in crisis and normal periods.

Based on the Indonesia Bond Market Directory of 2011, the outstanding amount of Indonesian government bonds held by foreign investors increased from 19.5% in January 2010 to 34% in June 2011 (IBPA, 2011). This increase may indicate that foreign investors' behaviour influences the bond market's return and domestic investors' trading activity. Therefore, this study will examine whether foreign investors and domestic investors exhibit different trading behaviour.

Based on several literature reviews, we found that studies of investor's behaviour on the government's bond market have not been conducted before. Although the number of intraday transactions and the bond prices are not as volatile as stock prices, performing a study of investor's behaviour towards government bonds will enhance the government's understanding of who played an important role in the government's bond trading. Data will be relevantly justified in time-series analysis by using bond daily transaction data.

In this study, secondary bond market data are used, and the seven types of investors are classified into four groups, namely, foreign investors, bank investors, non-bank investors and central bank investors. Granger causality tests will be used to examine whether institutional investors' buying and selling transactions have causal effects on the government bond market's return. A Vector Error Correction Model (VECM) methodology is also applied to identify any long-term relationship that might exist among institutional investors' transactions and which might offer insight into their trading strategies. Each group of investors can buy or sell bonds for each different bond tenor. If an investor buys a bond, then other investors can sell that bond. The same investor group (consisting of several companies) can trade bonds among themselves. Thus, we can find that there is an interaction between investors. By using the VECM test, we can find their buy and sell movement. For example, in medium to long tenor bonds in the crisis period, a non-bank investors' BUY was negatively related to a foreign investors' BUY. This finding indicates that their trading strategy movement is different. Through this research, we learn about the interaction between institutional investors in government bond trading, and thus the government can understand the dynamics in the government bond market.

The results indicate that foreign investors have become the market leader and are interested in holding long-tenor bonds during crisis periods to maintain an optimal level of risk in their portfolio. Contrary to the declining bond market index during the most recent financial crisis, foreign investors tend to affect the bond market index from the buying side, which indicates that foreign investors arrested the fall of the bond market index during the crisis. A second finding shows that in the pre-crisis, recovery from crisis and post-crisis periods, foreign and non-bank investors became the market leaders. These investors have similar

trading strategies during those periods. Meanwhile, central banks have become the counterpart traders against foreign investors for long- and medium- to short-tenor bonds and against the non-bank investors for long-tenor bonds in the post-crisis period. Moreover, the findings also indicate that bank investors became market makers for several tenors in all time periods.

Previous Studies

Several studies that explain the behaviours of both foreign and domestic investors in capital markets have been conducted. A differential reaction has been observed between foreign investors living in Korea who reacted positively during the Asian crisis from 1996 to 1998 and who reacted negatively before the crisis and foreign investors not living in Korea, who reacted positively before and during the crisis (Kim & Wei, 1999). Griffin, Nadari and Stulz (2004) found that the buying activities of foreign investors in smaller countries increase along with the return of investors in bigger countries. Some studies have focused on how information influences investors' trading decisions. Nam (2004) found that foreign traders in the Korean market between 1992 and 1998 traded based on the available information and not on market noise. Although there are different trading decisions made by foreign as opposed to domestic investors, Choe, Kho and Stulz (2005) found no evidence that foreign investors were better informed than were domestic institutions. Based on these findings, we can confidently assert that there are differences in the trading behaviours of different types of investors.

Investors' trading behaviours have also been analysed from an Indonesian market perspective. Kamesaka and Wang (2004), using vector autoregression (VAR) analysis, found that foreign investors buying from domestic investors had more positive feedback and realised superior returns than did domestic investors buying from foreign investors. Agarwal, Faircloth, Liu and Rhee (2009) found that foreign investors underperformed domestic investors in the Indonesia stock market. Rhee and Wang (2009) used a Granger causality test to examine foreign holdings and found that they had a negative impact on future liquidity in the Indonesian stock market from January 2002 to August 2007.

Furthermore, some investors were found to have had a strong influence in affecting the movement of the market return. According to Boyer and Zheng (2009), the net purchase of government bonds by foreign investors and mutual funds has had a significant positive effect on stock market return in the US market from 1952 to 2004. Sevil, Ozer and Kulah (2012) determined that stock indexes were influenced by foreign investors and there was a causal effect of their behaviour on the Istanbul Stock Exchange.

Previous studies have shown that foreign investors played an important role in the stock market, while there has also been evidence emphasising that foreign investors have not had an effect on the movement of stock markets, either during crises or during periods of normalcy. Kim, Landi and Yoo (2009) found that the net buying of foreign investors does not affect stock market return but that of domestic institutional investors does, at least in the Korean market. Patnaik, Shah and Singh (2012) examined foreign investors and found that they were not a vector of transmission during the crisis in the Indian stock market from 2009 to 2011.

Data and Methodology

This study uses government bond transaction data culled from secondary market data. The data collected spans April 2008 to April 2009. It is divided into four periods: pre-crisis (from 1 April 2008 to 31 July 2008), crisis (from 1 August 2008 to 28 October 2008), recovery (from October 29, 2008 to 22 December 2008) and post-crisis (from 23 December 2008 to 30 April 2009). The transaction data consists of 37,889 observations, and it is aggregated as 290 daily observations that span 1 April 2008 to 30 April 2009. The date point selection for each period is determined by descriptive analyses of the index data and supported by a Chow breakpoint test. This study uses a Chow test when there is an assumption that the date is known. This assumption is supported by the bond index data plot and event analysis.

The bond data are daily trading records of the Indonesian rupiah value, which is aggregated by each investor group. The transaction data consist of several variables, such as investor group, transaction date, the buy or sell of each investor and transaction amount. The bond market data consists of tenor and government bond market return as INDEX. Bond tenor is divided into four groups: long (above 10 years), medium to long (above 7 years to 10 years), medium to short (above 3 to 7 years) and short (fewer than 3 years). Investors are also divided into four groups: foreign investors, bank investors, non-bank investors and central bank. Foreign investors are investors such as insurance companies and commercial and investment banks that are not based in Indonesia. The bank investors group consists of domestic banks that include both commercial and investment banks. The non-bank investors group is comprised of domestic companies such as insurance companies, mutual funds, securities funds, pension funds and charitable foundations. Domestic investors are still becoming a majority in the government's bond market. Based on Indonesia Bond Pricing Agency data, the bond ownership of foreign investors was still approximately 17%–19% in 2007–2009. Therefore, to reveal the role of foreign investors as a whole in the bond market, these investors will not be further separated in the present study. Central bank investors only represent the domestic central bank.

In processing the time series, we needed to test stationarity and cointegration data to avoid spurious regression results. First, we tested the stationarity of all variables via the unit root test method. Second, if the variable exhibited stationarity, we then used a Granger causality test on the original data. However, when one of two variables did not exhibit stationarity, we conducted a cointegration test to determine whether the variables were cointegrated (Gujarati, 2004).

The empirical analysis starts by examining the stationary variables using the Augmented Dickey-Fuller (ADF) stationarity test. The ADF test is conducted by testing the hypothesis $H_0: \delta=0$ (there are unit root) in the following regression equation (Gujarati, 2004, p. 817):

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^m \alpha_i \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

where Y_t is stationary around a deterministic trend, $\beta_1, \beta_2, \delta, \alpha_i$ are coefficient, ε_t is a pure white noise error term, $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$ and $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$

H_0 is rejected when the ADF statistic value is less than the critical value, as noted in Table 1. All variables are stationary in the first difference.

We next tested the cointegration of variables using the Johansen cointegration test. To perform this test, the lag-length first had to be determined according to the Schwarz information criterion based on unrestricted VAR estimation. This method showed lag length to be 1. This study used the Maximum Eigenvalue test and the Trace test. Both tests indicated that there was cointegration between variables and therefore a long-term relationship between variables. The results are shown in Tables 2 and 3.

Table 1
Stationarity test by ADF test

Tenor	Variable	Pre-crisis		Crisis		Recovery from crisis		Post-crisis	
		Level	First difference	Level	First difference	Level	First difference	Level	First difference
		Prob.	Prob.	Prob.	Prob.	Prob.	Prob.	Prob.	Prob.
Long	Index	0.7416	0.0000*	0.9686	0.0000*	0.8451	0.0000*	0.0235*	0.0001*
	Buy_Bank	0.0000*	0.0001*	0.0000*	0.0000*	0.0148*	0.0000*	0.0000*	0.0000*
	Buy_Foreign	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0001*
	Buy_Non Bank	0.0006*	0.0000*	0.0000*	0.0000*	0.0227*	0.0000*	0.0000*	0.0000*
	Buy_Central Bank	<i>no transaction</i>		0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Bank	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Foreign	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Non Bank	0.0254*	0.0000*	0.0000*	0.0000*	0.0002*	0.0000*	0.0000*	0.0001*
	Sell_Central Bank	<i>no transaction</i>		0.0000*	0.0000*	<i>no transaction</i>		0.0000*	0.0000*
Medium to Long	Index	0.8089	0.0000*	0.9860	0.0000*	0.1263	0.0000*	0.1665	0.0001*
	Buy_Bank	0.0000*	0.0001*	0.0000*	0.0000*	0.0000*	0.0000*	0.0874	0.0001*
	Buy_Foreign	0.0000*	0.0000*	0.0000*	0.0000*	0.0081*	0.0000*	0.0200*	0.0001*
	Buy_Non Bank	0.1471	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0515	0.0000*
	Buy_Central Bank	<i>no transaction</i>		0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Bank	0.0000*	0.0000*	0.0000*	0.0000*	0.0006*	0.0000*	0.0000*	0.0000*
	Sell_Foreign	0.0000*	0.0000*	0.0000*	0.0000*	0.0002*	0.0000*	0.0000*	0.0000*
	Sell_Non Bank	0.0000*	0.0000*	0.0058*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Central Bank	<i>no transaction</i>		<i>no transaction</i>		<i>no transaction</i>		0.0000*	0.0001*
Medium to Short	Index	0.808	0.0000*	0.9999	0.1969	0.4135	0.0002*	0.0024*	0.0000*
	Buy_Bank	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Buy_Foreign	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Buy_Non Bank	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0004*	0.0000*
	Buy_Central Bank	<i>no transaction</i>		0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Bank	0.0000*	0.0000*	0.0000*	0.0000*	0.0027*	0.0000*	0.0000*	0.0000*
	Sell_Foreign	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Non Bank	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Central Bank	<i>no transaction</i>		0.0000*	0.0000*	<i>no transaction</i>		0.0000*	0.0000*

(continued on next page)

Table 1 (continued)

Short	Index	0.9424	0.0001*	0.9978	0.0000*	0.2863	0.0000*	0.0332*	0.0000*
	Buy_Bank	0.0000*	0.0000*	0.0203*	0.0000*	0.0000*	0.0016*	0.0000*	0.0000*
	Buy_Foreign	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Buy_Non Bank	0.0000*	0.0000*	0.4074	0.0000*	0.0176*	0.0000*	0.0000*	0.0000*
	Buy_Central Bank	<i>no transaction</i>		0.0297*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Bank	0.0000*	0.0000*	0.0014*	0.0000*	0.0033*	0.0000*	0.0000*	0.0000*
	Sell_Foreign	0.0000*	0.0001*	0.3347	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*
	Sell_Non Bank	0.0186*	0.0001*	0.0000*	0.0000*	0.5704	0.0000*	0.0000*	0.0000*
	Sell_Central Bank	<i>no transaction</i>		<i>no transaction</i>		<i>no transaction</i>		0.0001*	0.0000*

Table 2
Johansen co-integration for Granger causality test

Unrestricted Johansen Cointegration Rank Test for Granger Causality Test			Pre-crisis		Crisis		Recovery from crisis		Post-crisis	
Tenor	Variable	Hypothesised no. of CE(s)	Trace test Prob.**	Max Eigen value Prob.**	Trace test Prob.**	Max Eigen value Prob.**	Trace test Prob.**	Max Eigen value Prob.**	Trace test Prob.**	Max Eigen value Prob.**
Long	Index - Buy_Foreign - Sell_Foreign	None	0.0000*	0.0003*	0.0000*	0.0023*	0.0000*	0.0000*	0.0000*	0.0006*
		At most 1	0.0032*	0.0050*	0.0010*	0.0005*	0.0105*	0.0080*	0.0000*	0.0001*
		At most 2	0.1043	0.1043	0.9604	0.9604	0.3978	0.3978	0.0002*	0.0002*
	Index - Buy_Bank - Sell_Bank	None	0.0000*	0.0000*	0.0001*	0.0007*	0.0570	0.1231	0.0000*	0.0028*
		At most 1	0.0005*	0.0011*	0.0223*	0.0135*	0.2045	0.1763	0.0000*	0.0010*
		At most 2	0.0636	0.0636	0.8892	0.8892	0.4664	0.4664	0.0000*	0.0000*
	Index - Buy_Non Bank - Sell_Non Bank	None	0.0024*	0.0134*	0.0002*	0.0019*	0.0000*	0.0005*	0.0000*	0.0000*
		At most 1	0.0592	0.0943	0.0292*	0.0181*	0.0019*	0.0010*	0.0000*	0.0000*
		At most 2	0.1114	0.1114	0.8582	0.8582	0.7605	0.7605	0.0007*	0.0007*
	Index - Buy_Central Bank - Sell_Central Bank	None	–	–	0.0000*	0.0000*	–	–	0.0000*	0.0000*
		At most 1	–	–	0.0089*	0.0051*	–	–	0.0000*	0.0000*
		At most 2	–	–	0.8735	0.8735	–	–	0.0002*	0.0002*
Medium to Long	Index - Buy_Foreign - Sell_Foreign	None	0.0000*	0.0005*	0.0000*	0.0001*	0.0039*	0.0233*	0.0000*	0.0000*
		At most 1	0.0009*	0.0006*	0.0213*	0.0138*	0.0577	0.1785	0.0005*	0.0091*
		At most 2	0.3665	0.3665	0.6521	0.6521	0.0332*	0.0332*	0.0033*	0.0033*

(continued on next page)

Table 2 (continued)

		Unrestricted Johansen Cointegration Rank Test for Granger Causality Test								
Medium to Short	Index - Buy_Bank - Sell_Bank	None	0.0000*	0.0000*	0.0001*	0.0018*	0.0028*	0.0104*	0.0000*	0.0000*
		At most 1	0.0000*	0.0000*	0.0107*	0.0070*	0.0887	0.2513	0.0002*	0.0047*
		At most 2	0.4626	0.4626	0.5561	0.5561	0.0369*	0.0369*	0.0028*	0.0028*
	Index - Buy_Non Bank - Sell_Non Bank	None	0.0000*	0.0000*	0.0002*	0.0068*	0.0006*	0.0272*	0.0000	0.0000*
		At most 1	0.0001*	0.0000*	0.0084*	0.0052*	0.0066*	0.0139*	0.0015*	0.0239*
		At most 2	0.4758	0.4758	0.6273	0.6273	0.0662*	0.0662	0.0036*	0.0036*
	Index - Buy_Central Bank - Sell_Central Bank	None	–	–	0.0000*	0.0000*	–	–	0.0000*	0.0001*
		At most 1	–	–	0.0371*	0.0234*	–	–	0.0000*	0.0000*
		At most 2	–	–	0.8557	0.8557	–	–	0.0012*	0.0012*
	Index - Buy_Foreign - Sell_Foreign	None	0.0000*	0.0000*	0.0000*	0.0001*	0.0029*	0.0402	0.0000*	0.0000*
		At most 1	0.0069*	0.0045*	0.0029*	0.0041*	0.0240*	0.0569	0.0000*	0.0000*
		At most 2	0.5381	0.5381	0.1209	0.1209	0.0557	0.0557	0.0003*	0.0003*
	Index - Buy_Bank - Sell_Bank	None	0.0000*	0.0004*	0.0000*	0.0000	0.0023*	0.0711	0.0000*	0.0000*
		At most 1	0.0002*	0.0001*	0.0085*	0.0112*	0.0092*	0.0124*	0.0000*	0.0001*
		At most 2	0.5315	0.5315	0.1439	0.1439	0.1380	0.1380	0.0000*	0.0000*
	Index - Buy_Non Bank - Sell_Non Bank	None	0.0000*	0.0000*	0.0000*	0.0002*	0.0001*	0.0210*	0.0000*	0.0000*
		At most 1	0.0008*	0.0005*	0.0009*	0.0010*	0.0015*	0.0029*	0.0000*	0.0001*
		At most 2	0.4354	0.4354	0.1732	0.1732	0.0764	0.0764	0.0025*	0.0025*
Index - Buy_Central Bank - Sell_Central Bank	None	–	–	0.0001*	0.0008*	–	–	0.0000*	0.0000*	

(continued on next page)

Table 2 (continued)

		Unrestricted Johansen Cointegration Rank Test for Granger Causality Test								
Short		At most 1	-	-	0.0283*	0.0395*	-	-	0.0000*	0.0000*
		At most 2	-	-	0.1381	0.1381	-	-	0.0000*	0.0000*
	Index - Buy_Foreign - Sell_Foreign	None	0.0000*	0.0001*	0.0000*	0.0040*	0.0074*	0.1675	0.0000*	0.0000*
		At most 1	0.0006*	0.0003*	0.0013*	0.0017*	0.0125*	0.0238*	0.0000*	0.0001*
		At most 2	0.8926	0.8926	0.1355	0.1355	0.0798	0.0798	0.0020*	0.0020*
	Index - Buy_Bank - Sell_Bank	None	0.0000*	0.0001*	0.0002*	0.0002*	0.0060*	0.1490	0.0000*	0.0000*
		At most 1	0.0005*	0.0003*	0.2228	0.1917	0.0114*	0.0270*	0.0000*	0.0000*
		At most 2	0.8323	0.8323	0.4804	0.4804	0.0557	0.0557	0.0020*	0.0020*
	Index - Buy_Non Bank - Sell_Non Bank	None	0.0000*	0.0000*	0.0000*	0.0006*	0.0000*	0.0052*	0.0000*	0.0000*
		At most 1	0.0022*	0.0012*	0.0021*	0.0021*	0.0008*	0.0017*	0.0000*	0.0001*
		At most 2	0.9196	0.9196	0.2124	0.2124	0.0608	0.0608	0.0038*	0.0038*
	Index - Buy_Central Bank Sell_Central Bank	None	-	-	0.0000*	0.0000*	-	-	0.0000*	0.0000*
		At most 1	-	-	0.0299*	0.0467*	-	-	0.0000*	0.0000*
		At most 2	-	-	0.1132	0.1132	-	-	0.0026*	0.0026*

Notes: * denotes rejection of the hypothesis at the 0.05 level.

** MacKinnon-Haug-Michelis (1999) p-values.

Table 3
Johansen co-integration for VECM test

Tenor	Variable	Hypothesised no. of CE(s)	Pre-crisis		Crisis		Recovery from crisis		Post-crisis				
			Trace test Prob **	Max Eigen value Prob **	Trace test Prob **	Max Eigen value Prob **	Trace test Prob **	Max Eigen value Prob **	Trace test Prob **	Max Eigen value Prob **			
Long	Index - Buy_Bank - [Buy_CentralBank] - Buy_Foreign - Buy_NonBank	None	0.0000*	0.0035*	0.0000*	0.0007*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0003*	
		At most 1	0.0110*	0.0110*	0.0000*	0.0000*	0.0000*	0.0065*	0.0198*	0.0000*	0.0000*	0.0000*	0.0003*
		At most 2	0.0361*	0.0752	0.0071*	0.0636	0.2959	0.3646	0.3646	0.0000*	0.0000*	0.0000*	0.0020*
	Index - Sell_Bank - [Sell_CentralBank] - Sell_Foreign - Sell_NonBank	None	0.0689	0.0689	0.0392*	0.0253*	0.4610	0.3748	0.3748	0.0000*	0.0000*	0.0000*	0.0013*
		At most 1	0.0000*	0.0001*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0000*	0.0001*
		At most 2	0.0100*	0.0100*	0.0002*	0.0482*	0.0879	0.1928	0.1928	0.0000*	0.0000*	0.0000*	0.0014*
Medium to Long	Index - Buy_Bank - [Buy_CentralBank] - Buy_Foreign - Buy_NonBank	None	0.1710	0.1710	0.0458*	0.0303*	0.2107	0.1747	0.1747	0.0000*	0.0000*	0.0000*	0.0038*
		At most 1	0.0000*	0.0000*	0.0000*	0.0363*	0.5269	0.4340	0.4340	0.0000*	0.0000*	0.0000*	0.0023*
		At most 2	0.0001*	0.0001*	0.0001*	0.0150*	0.1913	0.1913	0.1913	0.0000*	0.0000*	0.0000*	0.0000*
	Index - Sell_Bank - [Sell_CentralBank] - Sell_Foreign - Sell_NonBank	None	0.0002*	0.0002*	0.0019*	0.0173*	0.0439*	0.0814	0.0814	0.0000*	0.0000*	0.0000*	0.0001*
		At most 1	0.4415	0.4415	0.0356*	0.0228*	0.2900	0.2812	0.2812	0.0073*	0.0073*	0.0073*	0.0561
		At most 2	0.0000*	0.0000*	0.0000*	0.0004*	0.0847	0.0847	0.0847	0.0000*	0.0000*	0.0000*	0.0000*
Medium to Short	Index - Buy_Bank - [Buy_CentralBank] - Buy_Foreign - Buy_NonBank	None	0.0000*	0.0002*	0.0001*	0.0134*	0.0265*	0.1046	0.1046	0.0000*	0.0000*	0.0000*	0.0015*
		At most 1	0.0011*	0.0007*	0.0049*	0.0538	0.1013	0.2213	0.2213	0.0001*	0.0001*	0.0001*	0.0123*
		At most 2	0.4869	0.4869	0.0312*	0.0207*	0.0603	0.0603	0.0603	0.0028*	0.0028*	0.0028*	0.0251*
	Index - Sell_Bank - [Sell_CentralBank] - Sell_Foreign - Sell_NonBank	None	0.0000*	0.0002*	0.0000*	0.0010*	0.0044*	0.1723	0.1723	0.0000*	0.0000*	0.0000*	0.0010*
		At most 1	0.0068*	0.0046*	0.0106*	0.0241*	0.0506	0.0506	0.0506	0.0000*	0.0000*	0.0000*	0.0005*
		At most 2	0.4889	0.4889	0.1610	0.1950	0.0919	0.1093	0.1093	0.0044*	0.0044*	0.0044*	0.0044*
Short	Index - Buy_Bank - [Buy_CentralBank] - Buy_Foreign - Buy_NonBank	None	0.0000*	0.0014*	0.0000*	0.0009*	0.0027*	0.0959	0.0959	0.0000*	0.0000*	0.0000*	0.0002*
		At most 1	0.0015	0.0010*	0.0001*	0.0048*	0.078*	0.0124*	0.0124*	0.0000*	0.0000*	0.0000*	0.0000*
		At most 2	0.4740	0.4740	0.0048*	0.0063*	0.1054	0.1054	0.1054	0.0000*	0.0000*	0.0000*	0.0003*
	Index - Sell_Bank - [Sell_CentralBank] - Sell_Foreign - Sell_NonBank	None	0.0000*	0.0006*	0.0001*	0.0129*	0.1036	0.1036	0.1036	0.0000*	0.0000*	0.0000*	0.0002*
		At most 1	0.0000*	0.0046*	0.0039*	0.0621	0.0677*	0.0977	0.0977	0.0000*	0.0000*	0.0000*	0.0001*
		At most 2	0.0020*	0.0010*	0.0320*	0.1154	0.0359*	0.1584	0.1584	0.0000*	0.0000*	0.0000*	0.0001*
Index - Sell_Bank - [Sell_CentralBank] - Sell_Foreign - Sell_NonBank	None	0.9328	0.9328	0.1136	0.1617	0.0908	0.1578	0.1578	0.0002*	0.0002*	0.0002*	0.0033*	
	At most 1	0.0000*	0.0002*	0.0000*	0.0002*	0.0013*	0.0013*	0.0013*	0.0000*	0.0000*	0.0000*	0.0000*	
	At most 2	0.0000*	0.0008*	0.0000*	0.0031*	0.0012*	0.0437*	0.0437*	0.0000*	0.0000*	0.0000*	0.0008*	
At most 3	0.8569	0.8569	0.016*	0.0656*	0.0823*	0.0823*	0.0823*	0.0000*	0.0000*	0.0000*	0.0004*		
At most 3	0.8569	0.8569	0.0763	0.0580	0.0423*	0.0423*	0.0423*	0.0000*	0.0000*	0.0000*	0.0010*		

Note: * denotes rejection of the hypothesis at the 0.05 level.
 ** MacKinnon-Haug-Michelis (1999) p-values.
 [] denotes CentralBank transactions are excluded on pre-crisis (both buy and sell), recovery from crisis (sell), for other periods, CentralBank transactions are included in VECM equation.

This study applied VECM instead of VAR to evaluate the long-term relationship that exists between investors' transactions. According to our decision to use the Schwarz information criterion as the lag-length selection test, the VECM test is examined by lag 1:

$$\Delta index_t = \alpha_0 + \alpha_1 \Delta bb_{t-1} + \alpha_2 \Delta bcb_{t-1} + \alpha_3 \Delta bf_{t-1} + \alpha_4 \Delta bnb_{t-1} + \alpha_5 u_{1,t-1} + \alpha_6 u_{2,t-1} + \alpha_7 u_{3,t-1} + \varepsilon_t \quad (2)$$

where Δ is the first difference operator, *index* denotes government bond index, *bb* denotes "buy transaction from bank", *bcb* is "buy transaction from central bank", *bf* is "buy transaction from foreign" and *bnb* is "buy transaction from non-bank"; Δ is the first difference operator, α_i is a coefficient and ε_t is a random error term. We suppose that there are 3 cointegrating variables, such that: $u_{1,t-1} = (\Delta index_{t-1} - \beta_1 - \beta_2 \Delta bnb_{t-1})$, $u_{2,t-1} = (\Delta bb_{t-1} - \beta_3 - \beta_4 \Delta bnb_{t-1})$, and $u_{3,t-1} = (\Delta bf_{t-1} - \beta_5 - \beta_6 \Delta bnb_{t-1})$.

For each VECM test, the variables for buying transactions and long-tenor bonds in the pre-crisis period are long-tenor index, foreign buy, bank buy, non-bank buy and central bank buy. This test is conducted for each transaction, bond tenor and period. Therefore, there are 32 (2 *transaction type* × 4 *bond tenor* × 4 *period*) instances of the VECM test. The results of these tests will be further explained on the analysis section of this paper.

The Granger causality method was used to determine whether there was a causal relationship between the buying and selling transactions to the bond index. The test involved estimating the following pair of regressions, for example:

$$index_t = \sum_{i=1}^m \alpha_i buy_{t-i} + \sum_{j=1}^m \beta_j index_{t-j} + u_{1t} \quad (3)$$

where *index* denotes government bond index, *buy* denotes amount of buying transaction, α_i and β_j are the coefficients, u_{1t} is an error term;

$$buy_t = \sum_{i=1}^m \lambda_i buy_{t-i} + \sum_{j=1}^m \delta_j index_{t-j} + u_{2t} \quad (4)$$

where *index* denotes government bond index, *buy* denotes amount of buying transaction, λ_i and δ_j are the coefficients, u_{2t} is an error term.

Those regression models will result in four possibilities (Gujarati, 2004, p. 697). First, when $\sum_{i=1}^m \alpha_i \neq 0$, the coefficients on the lagged buy are significantly different from zero as a group, and when $\sum_{j=1}^m \delta_j = 0$, the coefficients on the lagged index are not significantly different from zero. As such there is unidirectional causality from buy to index. Second, when $\sum_{i=1}^m \alpha_i = 0$ and $\sum_{j=1}^m \delta_j \neq 0$, then there is unidirectional causality from index to buy. Third, when $\sum_{i=1}^m \alpha_i = 0$ and $\sum_{j=1}^m \delta_j = 0$, which means both are significantly different from zero, then there is bilateral causality. Fourth, when $\sum_{i=1}^m \alpha_i \neq 0$ and $\sum_{j=1}^m \delta_j \neq 0$, meaning that both are not significantly different from zero, then there is no causality (independence).

The above example mentions the causality between index and buy. In this study, there are 64 instances ($4 \text{ investor group} \times 4 \text{ bond tenor} \times 4 \text{ period}$) of the Granger causality test. Based on the lag-length selection test mentioned earlier, the Granger causality test is examined by lag 1. The results are shown in Tables 4 and 5.

Table 4
Granger causality result

VEC Granger Causality/Block Exogeneity Wald Tests
Sample: 4/01/2008 4/31/2009

		Null Hypothesis	Chi-sq	df	Prob.	Conclusion
PRE-CRISIS	Bank	SELL_BANK_SHORT does not Granger Cause BUY_BANK_SHORT	4.180868	1	0.0409	H0 rejected
	Non-Bank	SELL_NONBANK_LONG does not Granger Cause BUY_NONBANK_LONG	5.638702	1	0.0176	H0 rejected
		BUY_NONBANK_LONG does not Granger Cause SELL_NONBANK_LONG	3.861809	1	0.0494	H0 rejected
CRISIS	Foreign	BUY_FOREIGN_LONG does not Granger Cause INDEX_LONG	8.993005	1	0.0027	H0 rejected
	Bank	SELL_BANK_SHORT does not Granger Cause BUY_BANK_SHORT	6.855734	1	0.0088	H0 rejected
	Central Bank	SELL_CENTRALBANK_LONG does not Granger Cause BUY_CENTRALBANK_LONG	7.982511	1	0.0047	H0 rejected
		SELL_CENTRALBANK_SHORT does not Granger Cause BUY_CENTRALBANK_SHORT	4.865286	1	0.0274	H0 rejected
RECOVERY CRISIS	Foreign	BUY_FOREIGN_LONG does not Granger Cause INDEX_LONG	3.911685	1	0.0480	H0 rejected
	Bank	SELL_BANK_MLONG does not Granger Cause BUY_BANK_MLONG	6.874415	1	0.0087	H0 rejected
	Non-Bank	BUY_BANK_MLONG does not Granger Cause SELL_BANK_MLONG	5.533227	1	0.0187	H0 rejected
		INDEX_LONG does not Granger Cause BUY_NONBANK_LONG	5.434835	1	0.0197	H0 rejected
		BUY_NONBANK_MLONG does not Granger Cause INDEX_MLONG	9.222880	1	0.0024	H0 rejected
		SELL_NONBANK_MLONG does not Granger Cause INDEX_MLONG	4.394895	1	0.0360	H0 rejected
POST CRISIS	Foreign	BUY_FOREIGN_LONG does not Granger Cause INDEX_LONG	4.381002	1	0.0363	H0 rejected
	Bank	BUY_FOREIGN_LONG does not Granger Cause INDEX_LONG	9.782566	1	0.0018	H0 rejected
	Non-Bank	SELL_FOREIGN_MLONG does not Granger Cause INDEX_MLONG	6.054449	1	0.0139	H0 rejected
		BUY_FOREIGN_MLONG does not Granger Cause SELL_FOREIGN_MLONG	5.329690	1	0.0210	H0 rejected
		BUY_FOREIGN_MSHORT does not Granger Cause INDEX_MSHORT	10.56766	1	0.0012	H0 rejected
		BUY_FOREIGN_MSHORT does not Granger Cause SELL_FOREIGN_MSHORT	4.200983	1	0.0404	H0 rejected
	Bank	SELL_FOREIGN_SHORT does not Granger Cause BUY_FOREIGN_SHORT	11.90851	1	0.0006	H0 rejected
	Non-Bank	SELL_BANK_MLONG does not Granger Cause BUY_BANK_MLONG	18.59111	1	0.0000	H0 rejected
		BUY_BANK_MSHORT does not Granger Cause SELL_BANK_MSHORT	4.923682	1	0.0265	H0 rejected
		BUY_NONBANK_LONG does not Granger Cause INDEX_LONG	4.280751	1	0.0385	H0 rejected
		BUY_NONBANK_LONG does not Granger Cause SELL_NONBANK_LONG	5.017021	1	0.0251	H0 rejected
	Central Bank	SELL_NONBANK_MLONG does not Granger Cause INDEX_MLONG	4.756393	1	0.0292	H0 rejected
	BUY_NONBANK_MLONG does not Granger Cause SELL_NONBANK_MLONG	8.842406	1	0.0029	H0 rejected	
	SELL_CENTRALBANK_LONG does not Granger Cause INDEX_LONG	12.43898	1	0.0004	H0 rejected	
	SELL_CENTRALBANK_MSHORT does not Granger Cause INDEX_MSHORT	9.351969	1	0.0022	H0 rejected	
	INDEX_SHORT does not Granger Cause SELL_CENTRALBANK_SHORT	5.377949	1	0.0204	H0 rejected	

Granger causality test with 5% significance level, if p-value < 5% then reject null hypothesis

Table 5
Granger causality summary

Bond Index	Investor	Period			
		Pre-crisis	Crisis	Recovery from crisis	Post-crisis
Long Tenor	Foreign Bank		BUY =>INDEX	BUY => INDEX	BUY => INDEX
	Non-Bank	BUY <=> SELL		INDEX => BUY	BUY => INDEX ; BUY => SELL
	Central Bank		SELL => BUY		SELL => INDEX
Medium to Long Tenor	Foreign Bank			BUY <=> SELL	SELL=> INDEX ; BUY => SELL
	Non-Bank			BUY => INDEX ; SELL => INDEX	SELL => INDEX ; BUY => SELL
	Central Bank				
Medium to Short Tenor	Foreign Bank				BUY => INDEX ; BUY=> SELL
	Non-Bank				BUY => SELL
	Central Bank				SELL => INDEX
Short Tenor	Foreign Bank			SELL => INDEX	SELL => BUY
	Non-Bank	SELL => BUY	SELL => BUY		
	Central Bank		SELL => BUY		INDEX => SELL

Notes: <=> indicates bidirectional causality
=> indicates unidirectional causality
Granger causality test with 5% significance level

RESULTS

According to Figure 2, some breakpoints, which are at extreme points, have been selected to determine the dates. A Chow test was conducted to verify whether the date was significant enough to lead us to reject the null hypothesis. When the result shows the *p*-value is less than the 5% level of significance, it means the null hypothesis is rejected and indicates that there is a break at the specified breakpoint.

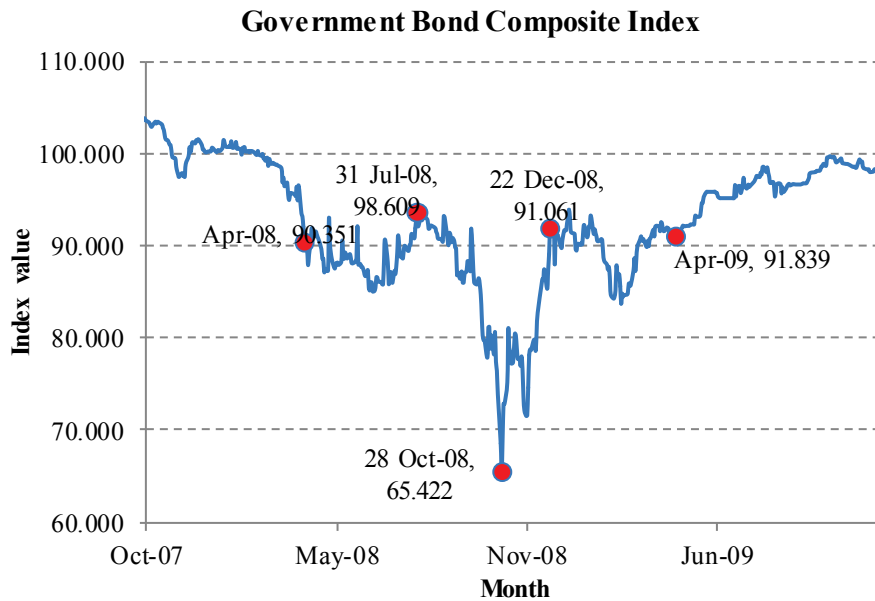


Figure 2. Government bond index by Chow test

The first breakpoint selected is at the end of July, 2008. At that time, several events occurred that led to crises, such as the increase in the inflation rate in April 2008 and the bankruptcy of Lehman Brothers in June 2008. The second breakpoint selected is 28 October 2008, which represents the lowest point of the index (shown in Figure 2). From August 2008 until 28 October 2008, there were several events including the US bank bailout, the losses in the global financial markets that led many foreign investors who were experiencing liquidity difficulties to withdraw their funds from Indonesia (Central Bank of Indonesia, 2009a), and yields on government bonds declined significantly from the peak period of the global financial crisis in October 2008 (Central Bank of Indonesia, 2009b). The third breakpoint selected was 22 December 2008, which coincides with the apex. During the period from 28 October 2008 until 22 December 2008, several events occurred that led investors to act with caution—namely, the bond market was bullish due to the low inflation environment in Indonesia, which attracted foreign investors to buy government bonds; the Indonesian currency had not yet stabilised (Central Bank of Indonesia, 2009b); and the Indonesian government had made IDR 1 trillion in funds available to Century Bank (Jakarta Globe, 2010).

The post-crisis period extends into late April, 2008, as there was a rescue package worth USD 838 billion dollars that was approved by the US Senate (Central Bank of Indonesia, 2009b) and foreign investors were increasing their bond ownership (Ministry of Finance of the Republic of Indonesia, 2010).

By performing the stationarity test, the null hypothesis of no unit roots for all time series' variables is rejected at their first difference by using the Augmented Dickey Fuller test, because the ADF values are less than the critical value at a 5% level of significance. For some buying and selling transaction variables, they are stationary at levels while index variables were mostly stationary at first difference. In short, all variables were stationary (no unit roots) at first difference.

The Johansen test allowed us to test all variables' cointegration with both trace statistics and maximum Eigenvalue statistics. If the values were greater than the critical value at the 5% significance level then the null hypothesis would be rejected. The results indicate that there are one or more cointegrating equations with both variables used in the Granger causality and VECM tests. This indicates that the variables are cointegrated, and we can therefore proceed to estimate them in the VECM.

From the 64 separate Granger causality tests, 29 results reject the null hypotheses (Table 4). The p-values are less than the 5% significance levels. The results are shown by pair-wise analysis between one variable and another for each investor group, each bond tenor and each time period. According to Table 6, there are 46 results that show the value and sign of the correlation between one variable and another. The summary of the VECM results is provided in Table 7.

Table 6
VECM matrix

Dependent Var	Independent Var	Index	F		B		NIB		CB	
			buy	sell	buy	sell	buy	sell	buy	sell
Bond-Tenor Index	buy	P2(-0.02) LONG			P2(-0.43) MSHORT					
		P4(-0.03267) LONG	P3(-0.28) SHORT		P4(-0.63) LONG		P2(3.15) MSHORT		P2(-0.99) MSHORT	
Foreign	sell	P3(-0.09) SHORT								
		P4(-0.05) MLONG								
Bank	buy	P1(-0.015) MLONG								
		P2(-0.62) MLONG								
Non-Bank	sell	P3(-0.51) MLONG								
		P4(-0.03) SHORT								
Central Bank	buy	P1(-0.34) MSHORT								
		P2(-0.74) LONG								
Central Bank	sell	P3(-0.13) LONG								
		P4(-0.45) LONG								

Note: 0 indicates correlation value.

Table 7
Investors' trading strategies based on VECM result

Bond Index	Transaction	Pre-Crisis	Crisis	Recovery From Crisis	Post-Crisis
Long Tenor	Buy		<i>Non-Bank and Foreign (D)</i>		<u><i>Non-Bank and Foreign (S)</i></u>
	Sell			<u><i>Non-Bank and Foreign (S)</i></u>	
Medium to Long Tenor	Buy		<i>Non-Bank and Foreign (D)</i>		
	Sell				<i>Central Bank and Non-Bank (D)</i>
Medium to Short Tenor	Buy	<u><i>Non-Bank and Foreign (S)</i></u>	<i>Non-Bank and Central Bank (D)</i>	<u><i>Non-Bank and Central Bank (S)</i></u>	<u><i>Non-Bank and Foreign (S)</i></u>
	Sell		<i>Bank and Non-Bank (D)</i>		<i>Non-Bank and Bank (D)</i>
Short Tenor	Buy			<i>Foreign and Bank (D)</i>	
	Sell				<i>Non-Bank and Central Bank (D)</i>

(S) denotes similar trading strategy based on VECM result

(D) denotes different trading strategy based on VECM result

Pre-Crisis

In the pre-crisis period, there was unidirectional causality from SELL to BUY in short-tenor bonds from bank investors. This indicates that bank's selling transactions can lead to bank's buying transactions in the bank group. This describes an active trading environment among banks. Based on Table 5, the Granger causality test for short-tenor bonds occurred only in banks and therefore there was no other investor type that became the banks' counterpart trader.

The result of the Granger causality test shows bidirectional causality from non-banks' SELL to non-banks' BUY and vice versa on long-tenor bonds, which indicates that there was active trading among non-bank investors. Some non-banks sold their bonds and caused a buying reaction from other non-bank investors and vice versa.

The results of the VECM test (Table 6) illustrate the growth of the long-tenor index is followed by banks' BUY for medium- to long-tenor bonds in the pre-crisis period. This indicates that banks provided positive feedback as traders in the medium- to long-tenor bond market. Furthermore, the non-banks' buy was positively related to foreign buy with a one-day lag (from the foreign equation), which indicates that the non-bank trading strategy was similar to the foreign investors' trading strategy.

The pre-crisis period shows that non-bank investors were the market makers in the long-tenor bonds, while bank investors were the market makers in

the short-tenor bonds. In addition, non-bank investors exhibited similar trading strategies to foreign investors in the medium- to short-tenor bond market.

Crisis

During the crisis period there were some causality results from foreign, bank and central bank investors. The results of the foreign investor variable showed unidirectional causality from BUY to INDEX in long-tenor bonds. Foreign investors' buying actions affected the long-tenor bond index, which indicates that foreign investors played an important role in the long-tenor bond market, acting as the market leader. The results for central bank investors indicate that there was unidirectional causality from SELL to BUY for long-tenor bonds. Central bank investors, as a regulator, conducted selling and buying transactions to maintain the price stability of long-tenor bonds during the crisis. For short-tenor bonds, there were two investor groups—bank and central bank—who had the same causality result, which shows unidirectional causality from SELL to BUY.

Based on the VECM results for long-tenor bonds, the reduction of INDEX is followed by the foreign investors' BUY. If foreign investors purchase more long-tenor bonds, then the index value will decrease which shows that foreign investors are contrarian traders. Non-bank investors' SELL activities are also correlated negatively to the index, which means that if non-bank investors sell more bonds, the index value will decrease. Non-bank investors' BUY is negatively related to foreign investors' BUY transactions. The output confirms the previous VECM result, which found different trading strategies existed between foreign and non-bank investors.

For medium- to long-tenor bonds, the VECM result shows that non-bank SELL activity was negatively correlated to the index. If non-bank investors sell more bonds, the index value will decrease, which indicates that non-bank investors act as positive feedback traders. A secondary finding is that bank investors' BUY activity was positively related to foreign investors' BUY, whereas non-bank investors' BUY was negatively related to foreign investors' BUY. This means non-bank investors' trading strategies are different than those of either foreign or bank investors.

The VECM result for medium- to short-tenor bonds shows that the index is positively related to three investor groups—bank, non-bank and central bank. In the bank investor equation, a 1% increase in the bond index is followed by IDR 15.43 trillion from the bank investors' BUY. In the non-bank equation, a 1% increase in the bond index is followed by IDR 3.15 trillion from the non-bank investors' BUY. In the central bank equation, a 1% increase in the bond index is followed by IDR 6.99 trillion from the central bank investors' BUY. These

equations demonstrate that bank investors contributed more than did the other two investor types. Both central bank and bank investors have different trading strategies compared with non-bank investors, which can be seen by the fact that central bank investors' BUY activity is negatively related to non-bank investors' BUY activity and bank investors' SELL activity is negatively related to non-bank investors' SELL activity.

During the crisis period, foreign investors became the market leader and tended to hold long-tenor bonds to maintain an optimal level of risk in their portfolios. Moreover, bank and central bank investors exhibited similar strategies in their short-tenor bond transactions, whereas foreign and non-bank investors exhibited different strategies in their long- and medium- to long-tenor bond transactions.

Recovery

The results from the recovery period show that in the long-tenor bond market, foreign investors became the market leader (unidirectional causality from foreign investors' BUY to INDEX) and preferred to hold long-tenor bonds. Meanwhile, non-bank investors followed foreign investors' transactions involving long-tenor bonds (the causality from INDEX to BUY). It is also implied that foreign investors observed a similar trading strategy to non-bank investors, because foreign investors' SELL was found to be positively related to non-bank investors' SELL transactions. However, foreign investors and bank investors moved in different directions in short tenor bonds (foreign investors' BUY was negatively related to bank investors' BUY).

Non-bank investors became the market leader in medium- to long-tenor bonds from both the buying and selling sides (bidirectional causality from non-bank investors' BUY to INDEX and SELL to INDEX). In addition, non-bank investors and central bank investors moved in the same direction in purchasing medium- to short-tenor bonds (non-bank investors' BUY was positively related to central bank investors' BUY).

Meanwhile, bank investors were the market makers who traded actively for medium- to long-tenor bond markets (bidirectional causality from bank investors' BUY to SELL and bank investors' SELL to BUY).

Post-crisis

Based on the results observed for the post-crisis period, both foreign and non-bank investors are market leaders for the long tenor (BUY caused INDEX) and medium- to long-tenor (SELL to INDEX) bond markets. They also have similar buying strategies (foreign investors' BUY was positively related to non-bank investors' BUY) for long and medium-to short- tenor bonds.

Central bank investors became the counterpart traders for foreign investors in the long- and medium- to short-tenor markets and for non-bank investors in the long-tenor bond market. Central bank investors' selling activity affected index while foreign and non-bank investors' buying activity affected index. Because demand for long-tenor bonds steadily increased, it positively affected the bond price. Central bank investors needed to stabilise the bond price by selling their long-tenor bonds. The VECM result also showed that central bank investors' observed a different selling strategy than non-bank investors for all tenor bonds except long tenor bonds.

Similar to the recovery period, bank investors became market makers in the medium- to long-tenor (unidirectional causality from bank investors' SELL to bank investors' BUY) and medium- to short-tenor (unidirectional causality from bank investors' BUY to bank investors' SELL) bond markets. Moreover, bank investors exhibited a different trading strategy on the buying side compared to non-bank investors in the medium- to short-tenor bond market (non-bank investors' SELL was negatively related to bank investors' SELL).

CONCLUSION

According to the fall of bond prices during the crisis in 2008 and the factoring of institutional investors as major players in the bond market, the purpose of this study is to examine how strongly institutional investors' behaviour in bond trading affects the government bond market return and bond trading strategies among the institutional investors. By using Granger causality and VECM tests, we can conclude that the foreign investor becomes the only market leader during the crisis. It shows that the foreign investor is brave enough to influence index movement. Foreign investor buys of long tenor bonds during the crisis provide an explanation that foreign investors tend to hold the drop in the bond index. Another market leader is non-bank investors whose transactions affect the bond index in pre-crisis, recovery from crisis and post-crisis periods. Both foreign and non-bank investors have similar buying strategies in normal crisis, whereas they have different selling strategies in the crisis period.

Meanwhile, bank investors become market makers who tend to trade actively among themselves. Bank investors have different trading strategies than non-bank investors, particularly for selling medium-to short-tenor bonds. In addition, both bank and foreign investors have different strategies in the recovery period for buying activity.

The central bank, who begins to trade actively after the crisis period, becomes a counterpart trader for foreign investors and non-bank investors. Because the Ministry of Finance enters the bond market only by intervention programs in auction, they need the central bank as a regulator, to participate in the bond trading. Therefore, although the central bank plays the role as an “investor” in the bond market, their purpose is different from the other three groups of investors. In several periods, the central bank investor trades actively at specified bond tenors to stabilise the bond price fluctuations. When bond prices decrease due to low demand, the central bank acts to buy those bonds to make sure the price does not go down further. Therefore, a coupon bond is more attractive than the interest rate, which will attract the investors to buy bonds. This action shows that the central bank provides bond liquidity. However, when there is a high demand, bond price is increasing and will cause a higher interest rate. The central bank needs to sell the bond to stabilise bond prices and decrease its interest rate. All of this action shows that the central bank provides bond price stability. The findings in this research can provide some input to government for understanding the market dynamics in bond markets, especially during a crisis. The government can share the knowledge about which foreign investors do not fully withdraw their funds in the market during a crisis with domestic investors. Therefore, domestic investors can be more confident about trading during a crisis and anticipate a more liquid market.

REFERENCES

- Agarwal, S., Faircloth, S., Liu, C., & Rhee, S. G. (2009). Why do foreign investors underperform domestic investors in trading activities? Evidence from Indonesia. *Journal of Financial Markets*, 12(1), 32–53. doi: 10.1016/j.finmar.2008.04.001
- Boyer, B., & Zheng, L. (2009). Investor flows and stock market returns. *Journal of Empirical Finance*, 16(1), 87–100. doi: 10.1016/j.jempfin.2008.06.003
- Central Bank of Indonesia. (2009a). *Global financial crisis and impact on Indonesia's economy*. Indonesia Economic Outlook 2009–2014 edition, January 2009. Retrieved 16 January 2013 from <http://www.bi.go.id/id/publikasi/kebijakan-moneter/outlook-ekonomi/documents4fd34648c8724da7b93e4f8021850012Bab3KrisisEkonomiGlobaldanDampaknyaterhadapPerekon.pdf>.

- Central Bank of Indonesia. (2009b). *Monetary policy response in global crisis*. Retrieved 16 January 2013 from <http://www.bi.go.id/id/publikasi/laporan-tahunan/perekonomian/Documents/5ae6a2f06ba64a879eb2dcd25d477c33BabIII1.pdf>.
- Choe, H., Kho, B-C., & Stulz, R. M. (2005). Do domestic investors have an edge? The trading experience of foreign investors in Korea. *Review of Financial Studies*, 18(3), 795–829. doi: 10.1093/rfs/18.3.795
- Griffin, J. M., Nardari, F., & Stulz, R. M. (2004). Are daily cross-border equity flows pushed or pulled? *The Review of Economics and Statistics*, 86(3), 641–657.
- Gujarati, D. N. (2004). *Basic econometrics*. London: McGraw-Hill.
- Jakarta Globe. (2010). *The bank century bailout: A chronology*. Retrieved 16 January 2013 from <http://www.thejakartaglobe.com/home/the-bank-century-bailout-a-chronology/361491>
- Indonesia Bond Pricing Agency (IBPA). (2011). *Indonesia bond market directory*. Retrieved 16 January 2013 from <http://www.idx.co.id/Home/Publication/BondBook/tabid/147/language/en-US/Default.aspx>
- Kamesaka, A., & Wang, J. (2004). *Foreign and domestic investors in Indonesia: Impact of the Asian crisis to their trades*. NE, USA: Midwest Finance Association.
- Kim, W. & Wei, S. (1999). *Foreign portfolio investors before and during a crisis*. Center for International Development Working Paper no 6. Massachusetts: Harvard University.
- Kim, J., Landi J., & Yoo, S. S. (2009). Inter-temporal examination of the trading activities of foreign investors in the Korean stock market. *Pacific-Basin Finance Journal*, 17(2), 243–256. doi: 10.1016/j.pacfin.2008.05.001
- Ministry of Finance of the Republic of Indonesia. (2010). *Government efforts in the prevention and handling of crisis*. White Paper Edition, January 2010. Indonesia: Ministry of Finance.
- Nam, D. (2004). Do foreign investors cause noise in an emerging stock market? *Journal of Emerging Market Finance*, 3(1), 21–36. doi: 10.1177/097265270400300102
- Patnaik, I., Shah, A., & Singh, I. (2012). *Foreign investors under stress: Evidence from India*. Working Paper 2012–103, June 2012. New Delhi: National Institute of Public Finance and Policy.
- Rhee, S. G., & Wang, J. (2009). Foreign institutional ownership and stock market liquidity: Evidence from Indonesia. *Journal of Banking & Finance*, 33(7), 1312–1324.
- Ryan, L. V., & Schneider, M. (2002). The antecedents of institutional investor activism. *The Academy of Management Review*, 27(4), 554–573.
- Sevil, G., Ozer, M., & Kulah, G. (2012). Foreign investors and noise trade in Istanbul Stock Exchange. *International Journal of Business and Social Sciences*, 3(4), 93–101.