

May 10, 2013

Effects of Quantitative Easing on Asia:

Capital Flows and Financial Markets

Dongchul Cho* and Changyong Rhee**

Abstract

This paper studies the effects of US quantitative easing on Asia by examining capital flows and financial markets. After the global financial crisis, Asian economies with more open and developed capital markets experienced greater swings in capital inflows. In particular, large capital flows were manifest more in portfolio investment and other investment such as bank loans than in foreign direct investment. Empirical analysis shows QE, QE1 in particular, significantly contributed to the rebounding of capital inflows to the region after the onset of the crisis by lowering domestic yield rates as well as CDS premiums. Although the currency value responses differed across countries, it appears that economies with stable exchange rates roughly coincide with those in which house prices have been rising, suggesting that monetary easing of advanced countries have affected Asian countries through either appreciation of currency values or increases in the prices of housing.

* Professor at the KDI School of Public Policy and Management. ** Chief Economist at the Asia Development Bank. We are grateful to Nedelyn Magtibay-Ramos, Lea R. Sumulong, and Kyusuk Han for their excellent research assistance and to Maria Socorro Bautista for her comments on an earlier draft. This paper was one of the background papers for the Asian Development Outlook 2013. The views expressed in this document are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank, or its Board of Governors, or the governments they represent.

1. Introduction

As the global financial crisis (GFC) unfolded, advanced economies relied heavily on expansionary monetary and fiscal policy to stabilize markets. However, with credit constraints so severe and nominal interest rates nearing the zero lower bound, traditional monetary policy proved inadequate. Advanced economies thus resorted to employing unconventional measures to increase money supply, which involved not only the active management of the size and composition of central bank balance sheets, but also nontraditional mechanisms for central bank operations. In particular, the US launched three rounds of historically unprecedented quantitative easing (QE) since the GFC erupted in 2008, resulting in an enormous expansion of the Federal Reserve's balance sheet of almost threefold in 3 years.

The impacts of such unconventional monetary policy measures have become increasingly controversial. Advanced economies are of the view that unconventional expansionary monetary policy stabilizes financial markets and promotes growth, therefore its global effects must be positive. On the other hand, emerging economies are concerned about its negative spillover effects on their capital flows, exchange rates, and asset prices. For example, Brazil's Finance Minister Guido Mantega went as far as raising alarm bells over a "currency war" in 2010 to describe how the Federal Reserve's QE was raising the values of emerging market economies' currencies. This has prompted the IMF to come out with regular spillover reports for G20 meetings. With the recent announcement by the Japanese Government of aggressive unconventional monetary policy, such fears of emerging economies have resurfaced.

While it is generally accepted in the literature that QE was effective in lowering US long-term yield rates and stimulating economic activity, evidence on their international spillover effects are somewhat mixed.¹ In this context, this paper examines the empirical impact of US QE on Asian economies, since Japan's QE has only recently been announced. The analysis consists of two parts: (i) trend analysis of capital flow aggregates and their composition; and (ii) regression analysis to more directly examine the effects on domestic financial variables.

¹ Related literature is reviewed in Section 2.

From capital flow data, we found that inflows were extremely volatile around the GFC. In the depth of global financial turmoil, aggregate capital inflows to 10 large regional economies² plummeted to 1.7% of GDP in 2008–2009 from an average of 8.4% the previous 3 years. Faced with sudden liquidity shortages due to the drastic sell-offs of foreign investors from Asian equity and bond markets, Asian residents responded by withdrawing their external loans including public reserve until the liquidity situation was improved. QE seems to have significantly contributed to the improvement of liquidity situation of Asia by recovering capital flows into Asia. Indeed, inflows rebounded nearly as sharply, returning to an average of 7.8% of GDP in 2010–2012. It is noticeable that the wild fluctuation of capital inflows around the GFC was mainly driven by portfolio investment, while FDI was robust. In particular, the economies with more open and developed capital markets experienced greater swings in portfolio investment.

From regression analyses, we found that while QE2 and QE3 effects were relatively mute, QE1 had pronounced effects in lowering domestic interest rates, containing sovereign risk premiums, and appreciating local currencies in Asia. In addition, Asia's financial variables were significantly affected by global variables such as US interest rates and VIX index, which implies that Asia's financial conditions were loosened by QE to the extent that QE affected the global variables. In fact, housing prices have been sharply rising in some Asian countries where exchange rates have been stable or rigid. This trade-off relationship between exchange rate and housing price suggests that monetary easing in advanced economies has affected Asian economies through either currency appreciation or asset price inflation.

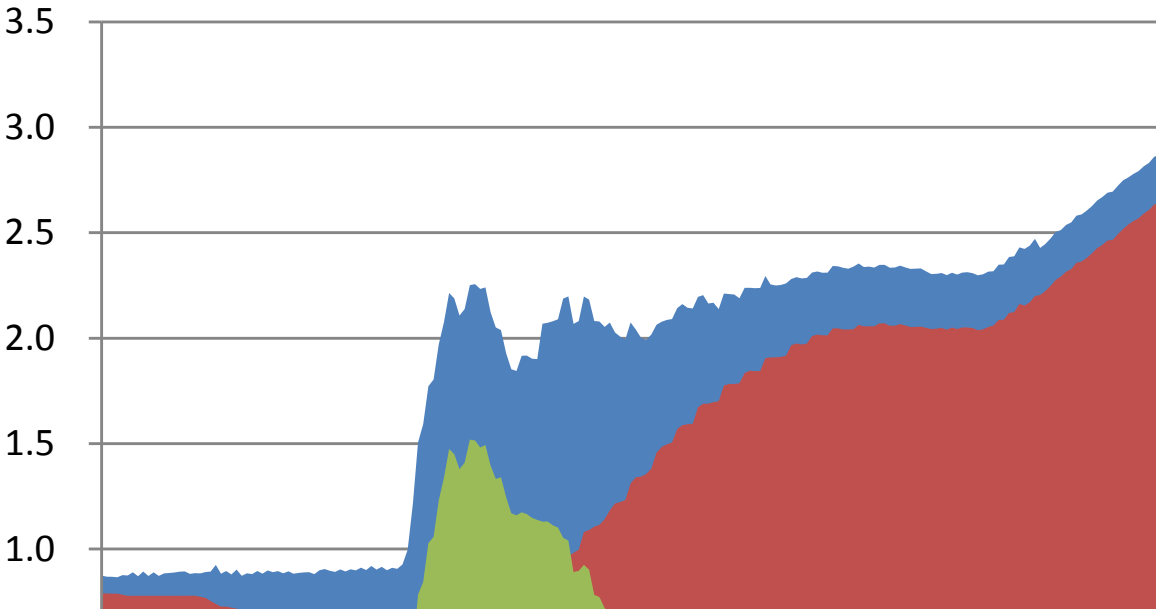
The paper is organized as follows. Section 2 briefly explains how the US quantitative easing policy has been carried out and surveys existing literature on its effects. Section 3 overviews trends of capital flow aggregates and their composition, and Section 4 discusses regression analysis results to more directly examine the effects on Asia's domestic financial variables. Section 5 adds comments on the movements of housing prices, and Section 6 concludes with some policy suggestions.

² The 10 economies are the PRC; Hong Kong, China; India; Indonesia; Japan; the Republic of

2. Quantitative Easing of the U.S.

As the sub-prime mortgage crisis deepened and the economy slowed down in 2007, many segments of capital markets became dysfunctional. In order to support these market segments experiencing liquidity shortages, the Fed introduced several facilities since December 2007,³ which changed the composition, rather than the size, of the Fed's balance sheet.

Figure 1: Fed's Asset



Upon the global financial panic triggered by the Lehman collapse in September 2008, however, the Fed's balance sheet was sharply expanded. As Figure 1 shows, the total asset of the Fed was increased from below 1 trillion dollars before the Lehman collapse to almost 2 trillion dollars by October, just in a month. Main components of the increase were still emergency liquidity provision facilities (including central banks liquidity swaps) as well as supports for specific financial

Korea; the Philippines; Singapore; Taipei,China; and Thailand.

³ The Term Auction Facility (TAF), the Term Securities Lending Facility (TSLF), and the Primary Dealer Credit Facility (PDCF) were established.

institutions in trouble.

As the interest rate continued to be lowered to the zero bound and the economic recession became evident, the Fed announced a large-scale asset purchase (LSAP) program in November 2008, which was extended in 2009.⁴ This allowed the Fed to expand its open market operations and support credit market through the purchase of longer-term securities. The announced total amount of asset purchases was 1.7 trillion dollars, which, according to Chen *et. al.* (2012) represented 22% of the combined outstanding Treasuries, long-term Agency debt, and fixed rate agency MBS at the beginning of the operation. This LSAP was carried out between November 2008 and March 2009 during the GFC, and extended to March 2010. As a result, the securities held by the Fed skyrocketed from 0.5 trillion dollars in November 2008 to 2 trillion dollars in March 2010, maintaining the total asset size despite the reduction of emergency liquidity provision facilities.

On November 3, 2010, the Fed again announced additional purchase of \$600 billion of Longer-term Treasury securities by the end of the second quarter of 2011 as the global recovery faltered with the euro crisis. This action, which pushed up the Fed's total asset size to almost 3 trillion dollars, is commonly dubbed as QE2. On September 12, 2012, the Fed decided to launch a new \$40 billion a month, open-ended, bond purchase program of agency MBS and also to continue the extremely low rates policy until at least mid-2015. This policy, QE3, was intended to lower borrowing costs and ease credit conditions for the private sector to promote growth and employment as the crisis subsided. The Fed's total asset finally broke 3 trillion dollars as of January 2013.

The QE policy is assessed to have largely succeeded at achieving their intended domestic goals --- restoring financial market functioning and reducing tail risks --- at the time of greatest financial turmoil in particular. For example, Sack (2010) discussed how the emergency liquidity provision facilities including the Term Asset

⁴ More specifically, the Fed announced purchases of \$100 billion in GSE debt and up to \$500 billion in MBS on November 25, and FOMC statement first mentioned possible purchase of long-term Treasuries on December 16. On March 18, 2009, FOMC announced that it would purchase additional \$750 billion in agency MBS and increase its purchase of agency debt and long-term Treasuries by \$100 and \$300 billion, respectively.

Backed Securities Loan Facility (TALF) revitalized transactions in the securitized credit markets, and Mancini-Griffoli and Ranaldo (2010) showed that cross-border money market arbitrage opportunities were restored as soon as the exchange swap lines were established. Krishnamurthy and Vissing-Jorgenson (2010) estimated that QE1 decreased MBS yields by 150 bps, and Hancock and Psaamore (2011) estimated that its effect on mortgage rate was almost 50 bps.⁵ To the extent that QEs reduced long-term interest rates and credit spreads, it is believed that they also helped the economy to recover. Employing counterfactual simulation exercises of various macroeconomic models, some researchers actually reported positive macroeconomic effects although the results need to be appreciated with caution.⁶

As for international spillover effects, it is consistently found that QE (in particular, the first round) was also effective in lowering bond yield rates in other countries. After Neely (2010) first reported substantial impacts of QE1 on yield rates in other advanced countries, the IMF (2011) estimated that a 100 basis point lower US long bond yield was associated with a 150 basis point decline in emerging market yields in QE1 but less than 50 basis points in QE2. Chen *et. al.* (2012) also reported that the cumulative impact of US QE was to lower EM Asian bond yields, boost equity prices and exert upward pressure on bilateral exchange rates against the US dollar.

Looking at capital flow data of the US, however, the IMF (2012) found that there was no significant sign of US liquidity heading out of the US. While net capital flows to emerging countries are almost back to their peak levels before the GFC, US net external purchases of stocks and bonds were generally *lower* than before the crisis until 2010. Nevertheless, this is not definitive evidence that US QE policy had no effect on US dollar capital flows to Asia or other EMEs. Chen *et. al.* (2012) pointed out that while total outflows of capital from the US have not been exceptional during the US QE period, additional dollar funding in Asia originating outside the US could come from international financial centers such as Hong Kong, China and Singapore.

⁵ As for the impacts of QE on US long-term yield rates, also see Ihrig et al. (2012), D'Amico and King (2012), and Gagnon et al. (2010, 2011).

3. Capital Flow Trends

To understand whether US expansionary monetary policy has increased capital flows into Asia or changed their composition, the first step is to compare trends before and after the GFC. Extraordinary movements in capital flows, if any are found, cannot be attributed solely to QE, as these could be driven by a multitude of other factors. The trend analysis simply identifies noticeable changes after QE that policy makers may need to be concerned about, though the causes may not be clearly identified.

3.1. Capital Inflows

Figure 1 shows aggregate private capital inflows⁷ to 10 Asian economies⁸ since 2005. In Figure 2(a), which presents the aggregate size of capital inflows to the region, most pronounced is the volatility. Inflows rapidly increased to over \$1.4 trillion in 2007 and collapsed with the GFC in 2008 and 2009. It then sharply rebounded to the pre-crisis level in 2010 and 2011 when the global economy recovered along with the QE, and then slowed down after the second half of 2011 when the European crisis escalated.⁹ While Figure 2(a) shows that approximately half of the aggregate capital inflows were accounted for by the G2, i.e., the People's Republic of China (PRC) and Japan, Figure 2(b) shows that the volatility of capital inflows was perceptible in most Asian countries.

By presenting the average of the capital inflow to GDP ratios, Figure 2(b) suppresses the dominating effects of the G2 economies, but instead exaggerates the influence of the region's financial hubs, Hong Kong, China and Singapore, as their capital inflows are extremely large relative to their GDP. In the depth of GFC, the capital inflows to these 10 countries plummeted to 1.7% of GDP in 2008~2009 from

⁶ See, for example, Baumeister and Benati (2010), Chung *et. al.* (2011), and Chen *et. al.* (2012).

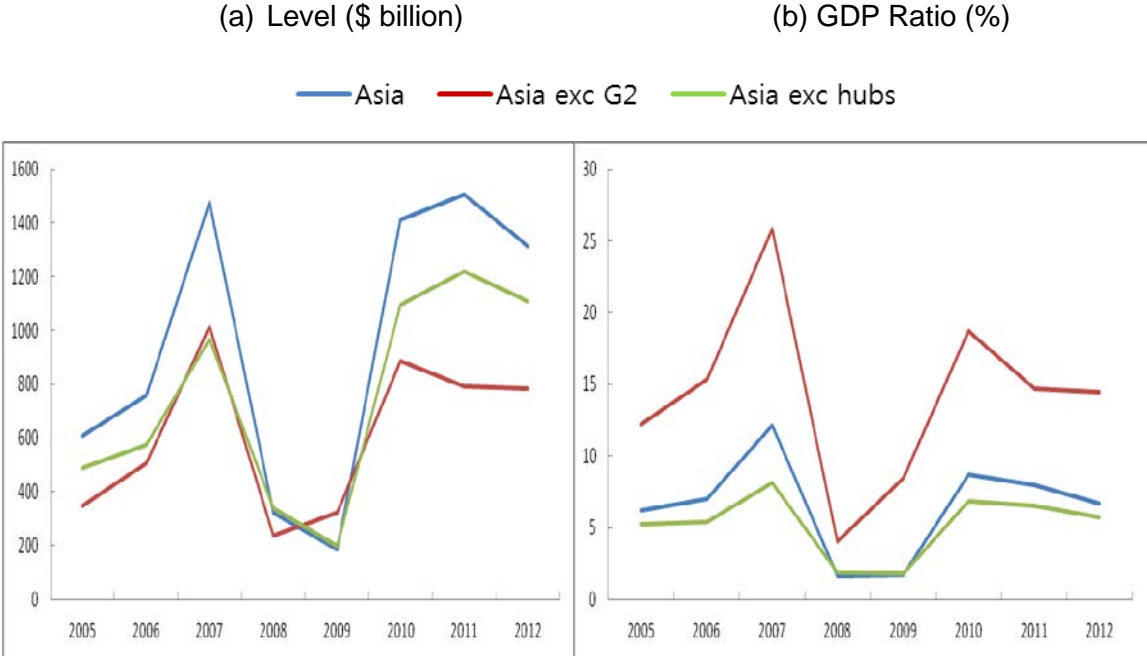
⁷ Aggregate private capital inflows are defined as the sum of the 'Direct Investment', 'Portfolio Investment' (including 'Derivatives'), and 'Other Investment' inflows in financial accounts. For India, data refer to 'Direct Investment', 'Portfolio Investment', 'Loans', 'Banking Capital', 'Rupee Debt Service', and 'Other Capital'.

⁸ The 10 Asian economies are Hong Kong, China; India; Indonesia; Japan; the People's Republic of China (PRC); the Republic of Korea; the Philippines; Singapore; Taipei,China; and Thailand.

⁹ This finding is consistent with Morgan (2011), who argues that excess portfolio inflows to emerging Asia were higher during the QE1 period than during the QE2 period.

an average of 8.4% in the previous 3 years. But inflows rebounded nearly as sharply, returning to an average of 7.8% of GDP in 2010~2012. The same pattern is observed even excluding Hong Kong, China and Singapore. Capital inflows collapsed from 6.3% of GDP on average in 2005~2007 to 1.9% in 2008~2009, and recovered to 6.4% in 2010~2012, nearly equal to the pre-crisis level.

Figure 2: Private Capital Inflows to Asia

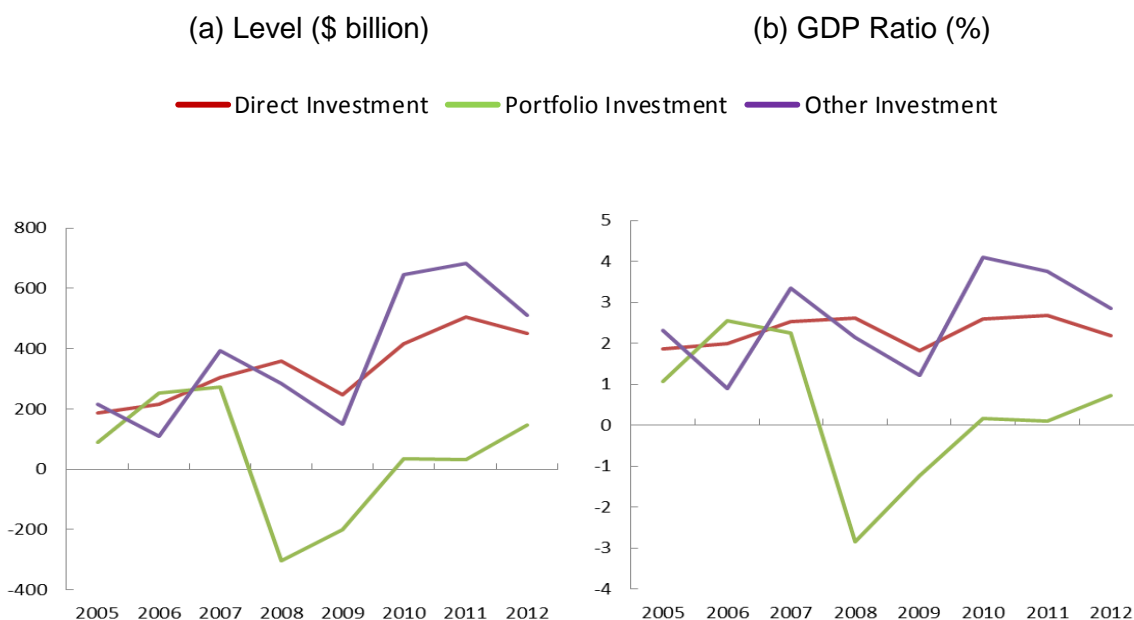


Note: Ratios are weighted averages of the GDP ratios for individual countries.

Source: Authors' calculations from CEIC Data Company Ltd.

Figure 3 shows the composition of capital inflows for all countries excluding Hong Kong, China and Singapore. It is noticeable that while FDI was robust around the GFC, portfolio investment was most volatile, collapsing from 2.2% of GDP in 2007 to -2.9% in 2008, as foreigners sold off Asian equities and bonds. Another noteworthy observation is that other inflows, which are mostly bank loans, exceeded the pre-crisis level and became the main source of capital inflows after the GFC. Meanwhile, the ratio of FDI slipped in 2012, and the ratio of portfolio investment has not fully recovered to the pre-crisis level.

**Figure 3: Components of Private Capital Inflows to Asia
(Excluding Hong Kong, China and Singapore)**

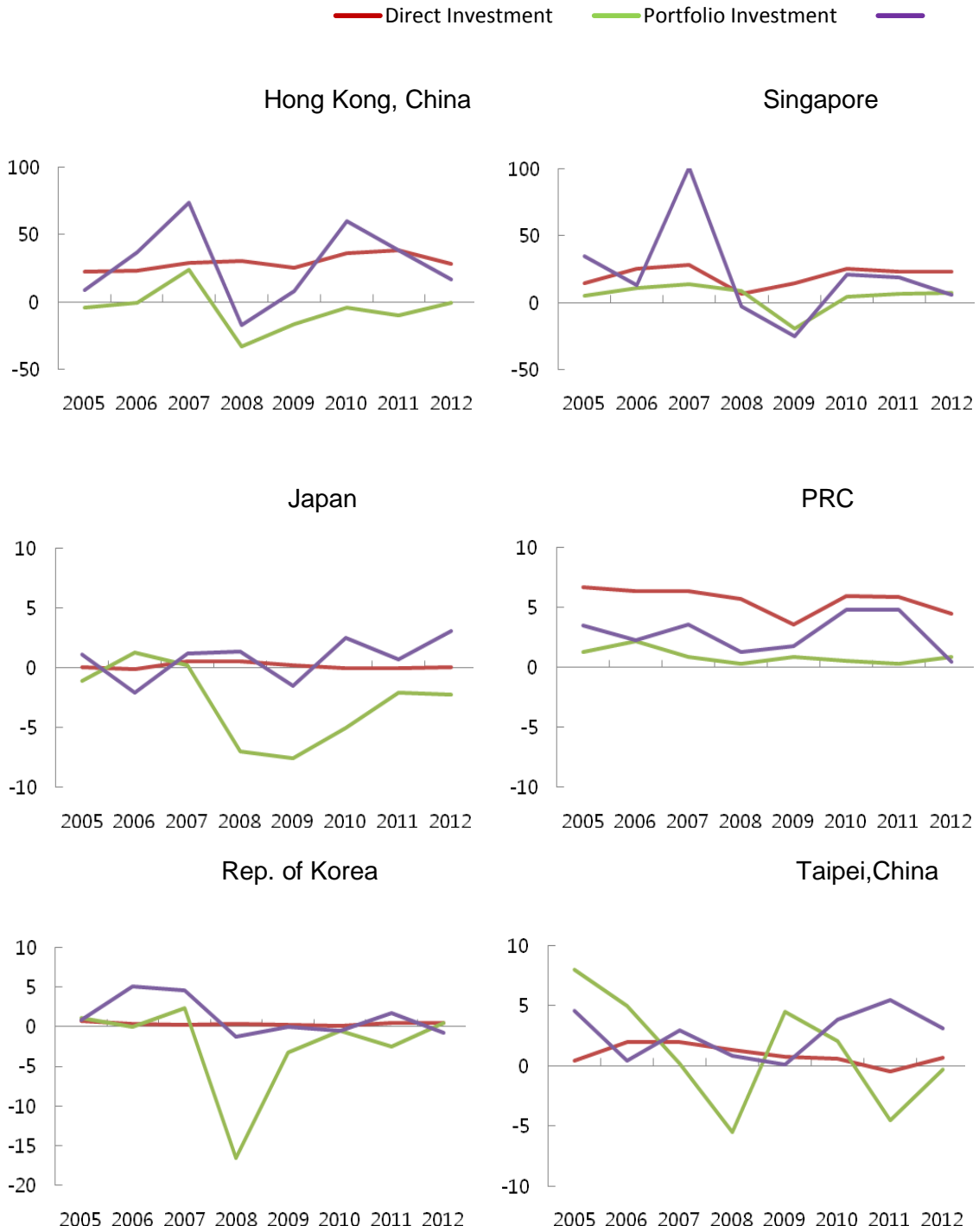


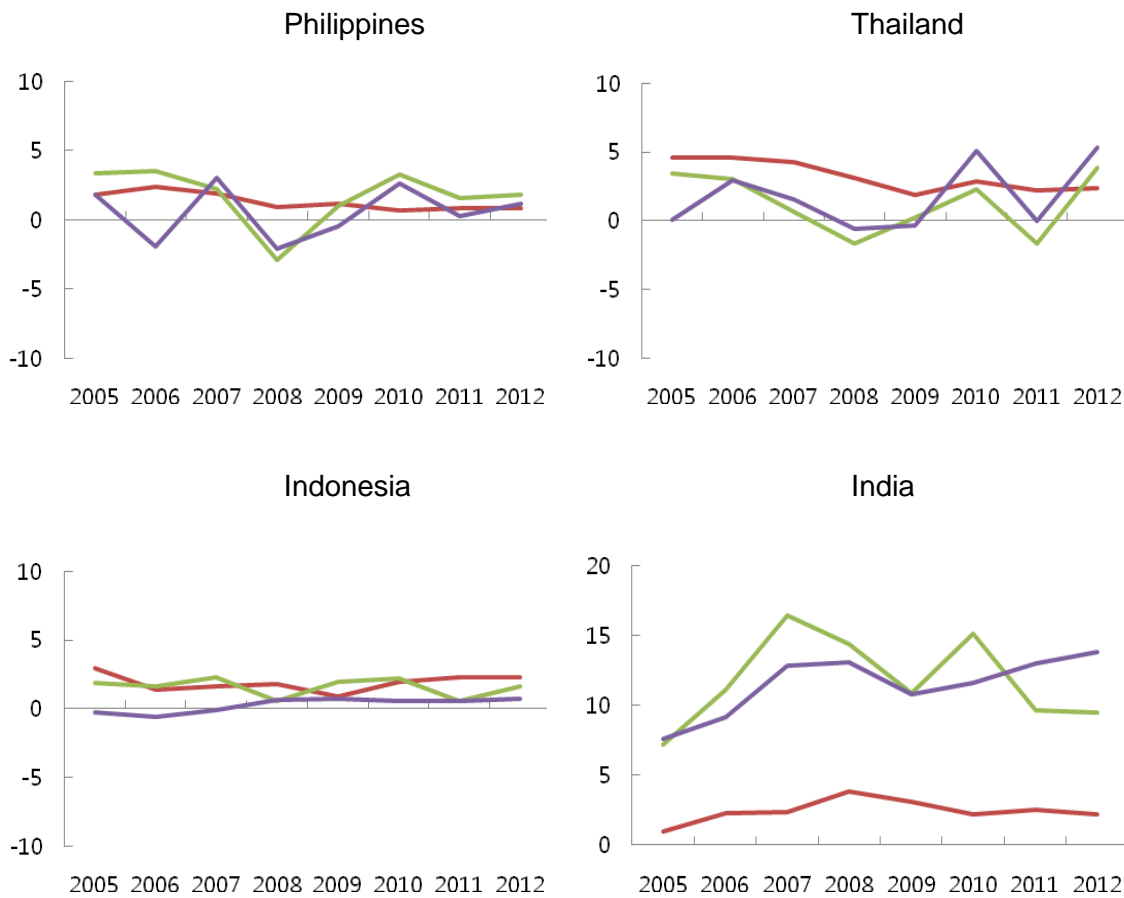
Note: Ratios are weighted averages of the GDP ratios for individual countries.

Source: Authors' calculations from CEIC Data Company Ltd.

Figure 4 shows the composition of capital inflows by individual country. For the two financial hubs, capital inflows easily exceed 10 percent of GDP, mainly driven by other investment. Patterns of capital inflows to the G2 economies—Japan and the PRC—are in stark contrast: whereas capital inflows to the PRC are mainly FDI and have been relatively smooth, the main component of capital inflow fluctuations in Japan are portfolio investment. This difference between Japan and the PRC seems to reflect their differing degree of financial market liberalization. The relatively open financial markets of the Republic of Korea and Taipei, China experienced patterns similar to Japan's, in that portfolio investment drove the wild swings in capital inflows around the GFC. In other Asian economies (except India), the role of portfolio investment was relatively weak and the amplitude of fluctuation was relatively small, while the patterns were similar.

Figure 4: Components of Capital Inflows to Individual Countries (% of GDP)





Note: For India, data for 'Others' are composed of 'Loans', 'Banking Capital', 'Rupee Debt Service', and 'Other Capital'.

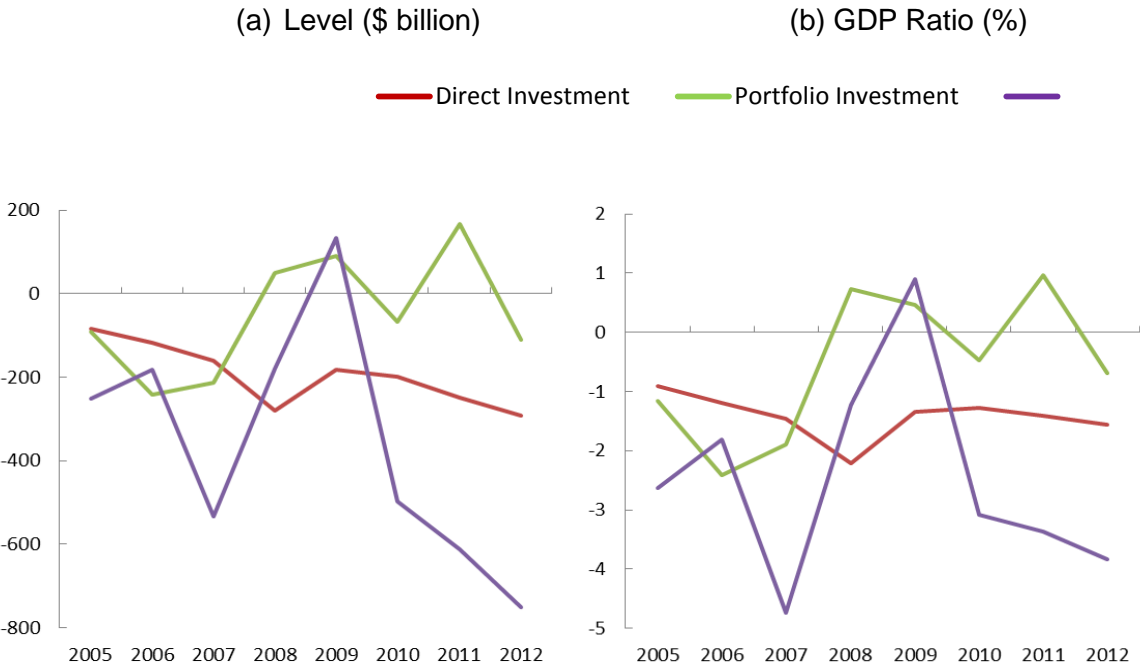
Source: Authors' calculations from CEIC Data Company Ltd.

In sum, capital inflows to Asia went through drastic fluctuations around the GFC, driven mainly by portfolio investments into countries with relatively open financial markets. In particular, the quick rebound of capital inflows in 2010, despite the heightened uncertainties and massive credit constraints of financial institutions in advanced economies, suggests that QE contributed to stabilizing the global financial market and turning capital flows back to Asia.

3.2. Capital Outflows, Net Flows, and Foreign Reserves

Figure 5 presents the composition of capital outflows (negative values) for all countries excluding Hong Kong, China and Singapore, which is comparable to Figure 3. An interesting difference from Figure 3 is that other investment was more volatile than portfolio investment around the GFC period, suggesting that Asian residents were not as exposed to external capital markets as foreign investors were to Asian markets. This conjecture seems to be supported by the fact that portfolio outflows were more volatile in the countries with more liberalized capital markets such as Republic of Korea and Taipei,China (not shown).

**Figure 5: Components of Private Capital Outflows from Asia
(Excluding Hong Kong, China and Singapore)**

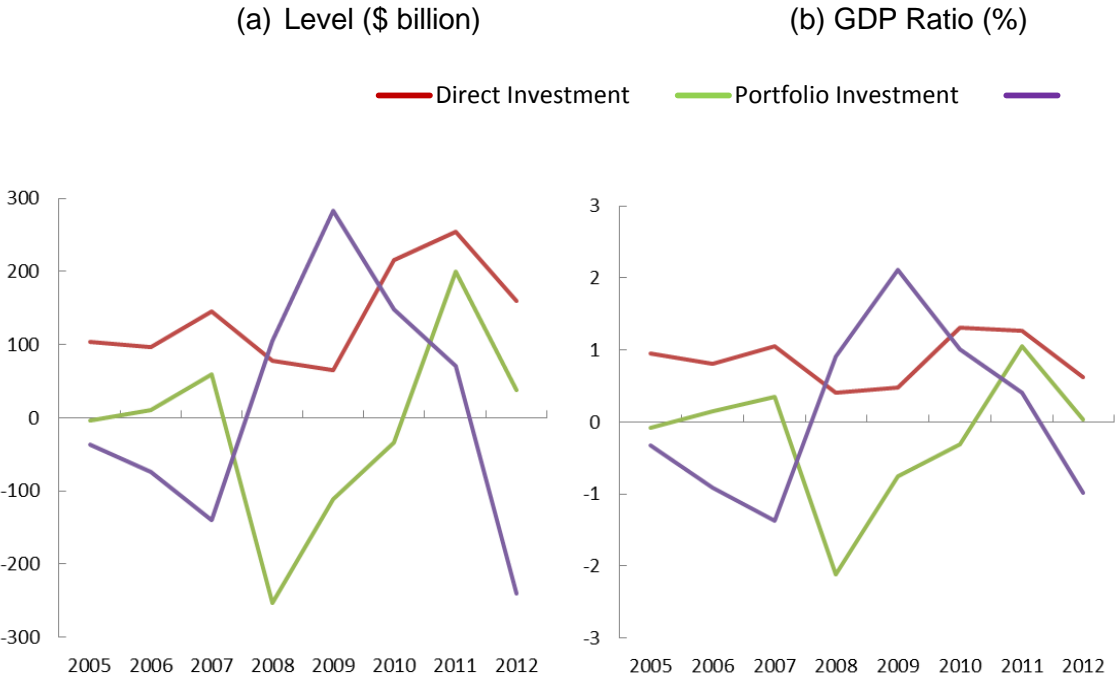


Note: Ratios are weighted averages of the GDP ratios for individual countries.

Source: Authors' calculations from CEIC Data Company Ltd.

The different response of portfolio investment from that of other investment becomes more evident in net private capital flows, presented in Figure 6. Whereas net portfolio investment collapsed to -2.1% of GDP in 2008, net other investment increased in 2008 and further rose to 2.1% of GDP in 2009. These contrasting movements seem to indicate that, faced with sudden liquidity shortages due to the drastic sell-offs of foreign investors from Asian equity and bond markets in 2008, Asian residents responded by accessing external loans rather than selling external assets.

**Figure 6: Components of Net Private Capital Inflows
(Excluding Hong Kong and Singapore)**



Note: Ratios are weighted averages of the GDP ratios for individual countries.

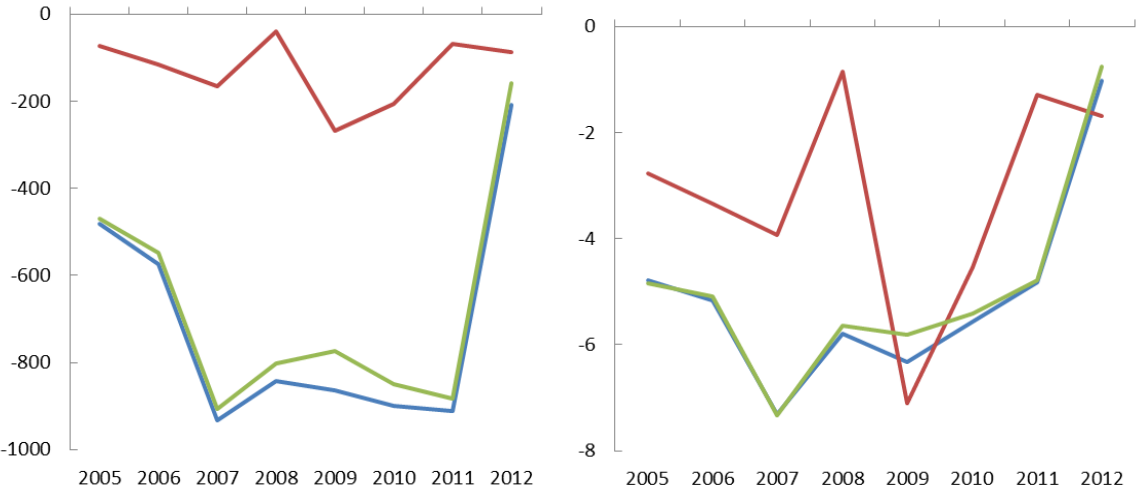
Source: Authors' calculations from CEIC Data Company Ltd.

However, the response to the sudden withdrawal of portfolio investment upon the GFC was more immediately made by the public rather than private sectors. Figure 7 shows that, excluding the G2, reserve accumulation (negative value) fell to 0.9% of GDP in 2008 from 3.9% in the previous year, and then tremendously increased to 7.1% in 2009 as the liquidity situation of private sectors improved with QE. This active counter-cyclical response of the public reserve around the GFC was most prominent in the Republic of Korea whose reserves shrank by 6.9% of GDP in 2008 but increased by 7.5% in 2009 (not shown). Yet, the PRC has been a dominant player in the whole region, accounting for 70–80% of the total (approximately \$700 of the \$900 billion total per year) accumulated by the 10 sample economies from 2007 to 2011, although this pace substantially slowed down in 2012.

Figure 7: Reserve Accumulation

(a) Level (\$ billion) (b) GDP Ratio (%)

— Asia — Asia exc G2 — Asia exc hubs



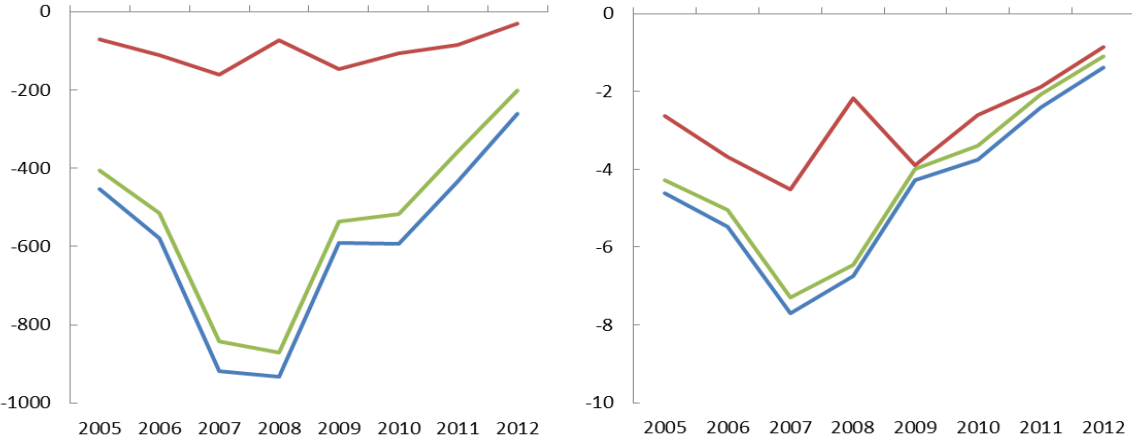
Note: Ratios are weighted averages of the GDP ratios for individual countries.
 Source: Authors’ calculations from CEIC Data Company Ltd.

In terms of net aggregate financial account that includes reserve accumulation as well as private capital inflows and outflows, most Asian economies (except India) were capital exporters (outflows larger than inflows) prior to the GFC mainly due to the sizable amounts of reserve accumulation. After the GFC, however, the amount of capital export is shrinking in most countries, which may be related to the global rebalancing process.

Figure 8: Net Aggregate Financial Account

(a) Level (\$ billion) (b) GDP Ratio (%)

— Asia — Asia exc G2 — Asia exc hubs



Note: Ratios are weighted averages of the GDP ratios for individual countries.

Source: Authors’ calculations from CEIC Data Company Ltd.

4. Regression Analysis

4.1. QE and Global Variables

The review of trends before and after the GFC has severe limitations as the impact of QE cannot be clearly identified. To analyze the impacts of QE more rigorously, regression analyses using weekly data¹⁰ were carried out. As proxies for QE, 10 dummy variables (E1–E10) for the weeks of important QE announcements were used.

Table 1: Event Dummies

	Dummy Variable	Event Date	Event
QE1	E1	2008-11-25	The Federal Reserve announces purchases of \$100 billion in GSE debt and up to \$500 billion in MBS.
	E2	2008-12-01	Chairman Bernanke mentions that the Federal Reserve could purchase long-term Treasuries.
	E3	2008-12-16	FOMC statement first mentions possible purchase of long-term Treasuries.
	E4	2009-01-28	FOMC statement says that it is ready to expand agency debt and MBS purchases, as well as to purchase long-term Treasuries.
	E5	2009-03-18	FOMC announces that it will purchase additional \$750 billion in agency MBS and increase its purchase of agency debt and long-term Treasuries by \$100 and \$300 billion, respectively.
QE2	E6	2010-11-03	The Federal Reserve announces purchase of \$600 billion of Treasury securities by the end of the second quarter of 2011.
	E7	2011-07-13	Chairman Bernanke says, "The Federal Reserve is ready to ease monetary policy further if economic growth and inflation slow much more."
QE3	E8	2012-08-31	Chairman Bernanke mentions that the Federal Reserve is ready to additionally act, and purchase long-term Treasuries.
	E9	2012-09-12	The Federal Reserve decides to launch a new \$40 billion a month, open-ended, bond purchase program of agency MBS and also to continue the extremely low rates policy until at least mid-2015.
	E10	2012-12-12	FOMC decides to continue its purchases of agency MBS and longer-term Treasury securities at a pace of \$40 and \$45 billion, respectively.

Source: Neely (2010) for E1–E5 and Federal Reserve Board Homepage for E6–E10.

¹⁰ Every Wednesday quotes (Thursday if Wednesday quote is not available, Tuesday if Thursday is not available either) were used, and for Asian countries' data, one-day lagged data were used. Sample period is 2003–2012.

Along with these event dummies, USRATE (yield rate on 5-year US Treasuries) and VIX (index of global investor sentiment and market volatility) were also considered. Of course, USRATE and VIX cannot be sharp proxies of QE policy as they are affected by a large number of other factors. However, we believe that these variables can help provide a full picture of QE effects because the literature consistently reports that QE succeeded in lowering US long-term yield rates and tail risks of the global financial market.

Before examining the effects of the QE variables on Asia, mutual relationships among these variables were briefly checked through regressions of USRATE, VIX, and oil price (DUBAI) on QE dummy variables. Table 2 reports the results.

Table 2: QE and Global Indicators

		USRATE	VIX		DUBAI		
Const.		-0.001	0.000	0.000	0.242	0.247	0.258
USRATE		-	-	-0.063***	-	3.420**	1.272
VIX		-					-33.749***
QE1	E1	-0.069	-0.194***	-0.198***	-1.011	-0.776	-7.465
	E2	-0.409***	0.058*	0.032	-12.268***	-10.871**	-9.805**
	E3	-0.269*	-0.059**	-0.076***	10.587**	11.505**	8.926**
	E4	0.101	-0.068**	-0.062**	8.439*	8.092*	6.015
	E5	-0.419***	-0.036	-0.062**	7.682*	9.114**	7.003
QE2	E6	-0.229*	-0.012	-0.026	4.216	4.998	4.105
	E7	-0.209	0.035	0.022	4.022	4.735	5.478
QE3	E8	-0.069	0.006	0.002	2.014	2.248	2.316
	E9	0.001	-0.020	-0.020	-4.102	-4.107	-4.766
	E10	0.051	-0.006	-0.002	-3.117	-3.293	-3.369

Note: Differenced data for VIX and US Rate and log-differenced data for DUBAI were used. All variables were expressed in percent so that coefficients can be interpreted as percent changes. *, **, *** denote statistical significance at a 10%, 5%, and 1%, respectively.

The effects of QE event variables on USRATE and VIX are clear: QE1 events lowered US long-term yield rates and reduced financial market uncertainty, although the effects of QE2 and QE3 events are generally not statistically significant.¹¹ In contrast, their effects on DUBAI are unclear: while the oil price fell on the E2 event

¹¹ These results are consistent with the existing literature as discussed in Section 2.

week by approximately 10%, it increased by more than 20%, cumulatively, for the E3~E5 weeks.¹²

A notable observation is that USRATE seems to contain an element reflecting the market's anticipation of future business conditions in addition to an element that reflects QE effects. That is, optimistic expectations of the market about the future increases USRATE but decreases VIX simultaneously to generate a negative coefficient of USRATE in the VIX regression.¹³ This reasoning is reinforced by the DUBAI regression results. A rise in USRATE appears to increase DUBAI before VIX is included in the regression, but this result disappears once the effects of VIX are controlled. In contrast, the effect of VIX on DUBAI remains extremely significant both statistically and economically (a 1% rise in VIX lowers DUBAI by 34%) regardless of specification. In this regard, oil prices seem to have responded to financial market risks more than to US long-term yield rates, and QE contributed to the rise of oil prices to the extent that QE reduced financial market uncertainty.

4.2. Effects of QE on Local Financial Variables

To examine the effects of QE variables on Asia, similar regressions were carried out for three major financial variables: CDS (Credit Default Swap premium on 5-year sovereign debt); BOND (local currency denominated bond yield rate on 5-year government bond); and EXR (exchange rate vis-à-vis US dollar) from eight Asian economies (the PRC; Hong Kong, China; Japan; the Republic of Korea; Malaysia; the Philippines; Singapore; and Thailand). As explanatory variables, we included USRATE and VIX,¹⁴ together with QE event dummies, which we presume are exogenous to Asian financial markets. The three domestic financial variables from each country may, however, be simultaneously determined. An implicit assumption in this paper is that causality runs from CDS→BOND→EXR, i.e., CDS is included

¹² This is different from the previous result reported by Glick and Leduc (2011) who found negative cumulative effects of QE events on oil prices. The different results may stem from the use of different frequency data: while they used daily data, we used weekly data.

¹³ This result did not change when term spread data (e.g., 5-year Treasury rate – federal fund rate) was used.

¹⁴ VIX is the Chicago Board Options Exchange Market Volatility Index, which provides “a key measure of market expectations of near-term volatility conveyed by S&P500 stock index option prices” (<http://www.cboe.com/micro/VIX/vixintro.aspx>).

in BOND and EXR regressions, and BOND is included in EXR regressions. Although results differ across countries, they can be roughly summarized as in Table 3 (see the Appendix for detailed results).

Table 3: Summary of Local Variable Regressions

Dependent Variable		CDS	BOND	EXR
Local Variables	BOND			“0”
	CDS		“0”	“++”
Global Variables	USRATE	“0”	“+++”	“0” ⁽ⁱ⁾
	VIX	“+++”	“0”	“+++” ⁽ⁱⁱ⁾
QE1 (5 Events)		“-”	“-”	“-”
QE2 (2 Events)		“0”	“0”	“0”
QE3 (3 Events)		“0”	“0”	“0”

Notes: “+++”, “++”, and “+” indicate that the coefficients are positive and statistically significant at the 1%, 5% and 10% levels, respectively. “---”, “—”, and “-” indicate that the coefficients are negative and statistically significant at the 1%, 5%, and 10% levels, respectively. “0” indicates that the coefficients are not statistically significant.

- (i) “+++” for Japan and Singapore.
- (ii) “0” for the PRC and “---” for Japan.

First, we find that QE1 events have pronounced effects on domestic financial variables, while QE2 and QE3 effects are relatively muted. Despite some exceptions, QE1 events generally lowered CDS, BOND, and EXR (local currency appreciation). The magnitudes of some QE impacts were sizable even after controlling for their indirect effects through USRATE and VIX¹⁵: for example, E3 lowered (appreciated) Asia’s exchange rates (except for the PRC and Hong Kong, China) by between 1.5% (Malaysia) and 5.6% (Japan). The finding that only QE1 has a significant impact on Asian currency values is in line with the existing literature as well as the eyeball tests that capital inflows recovered quickly after 2008 but did not show any further large increases after 2010.

Second, the QEs were also likely to have influenced Asia’s financial markets

¹⁵ A notable result is that the impacts of QE events are generally reduced when VIX is included, implying that the impacts of QE events were also transmitted through the channel of lowering global financial market uncertainty.

through their impacts on global variables. With no single exception, Asia's CDS premiums (particularly for emerging countries) were significantly lower when VIX was lower,¹⁶ and Asia's BONDS were lower when USRATE was lower.¹⁷ To the extent that the QEs reduced VIX and USRATE, therefore, the QEs must have contributed to easing financial conditions in Asia.

In contrast, the impacts of global variables on exchange rates substantially differ across countries depending on their exchange rate regimes and degrees of financial market liberalization. In general, Asia's exchange rates are insensitive to the variations in USRATE, except for Japan and Singapore where financial markets are fully liberalized and exchange rates are floating.¹⁸ In contrast, Asia's exchange rates are extremely sensitive to the variations in VIX, with the Republic of Korea being the most vulnerable.¹⁹ While the PRC's exchange rate is robust to VIX, Japan's exchange rate shows a negative sensitivity to VIX reflecting the safe haven role of the yen during the crisis period.

Third, impacts of domestic variables on Asia's financial markets appeared to be minimal, once the global variables were controlled for. The only surviving variable at the 5% significance level is CDS in the EXR regressions for Malaysia and the Philippines, perhaps indicating that these countries' exchange rates were also influenced by country-specific risk factors in addition to the global indicator, VIX. All in all, however, the effects of country-specific factors are dwarfed by the global factors.

¹⁶ A 1% change in VIX leads to 0.6–0.7% changes in advanced Asian economies' CDSs (i.e., in Japan and Hong Kong, China), but more than 2% changes for most of emerging Asia's economies, with the Republic of Korea having the greatest impact (3.6%).

¹⁷ A 1% change in USRATE leads to 0.2–0.3% changes in most of Asia's BONDS, with Malaysia having the lowest effect (0.12%) and Hong Kong, China the highest (0.59%).

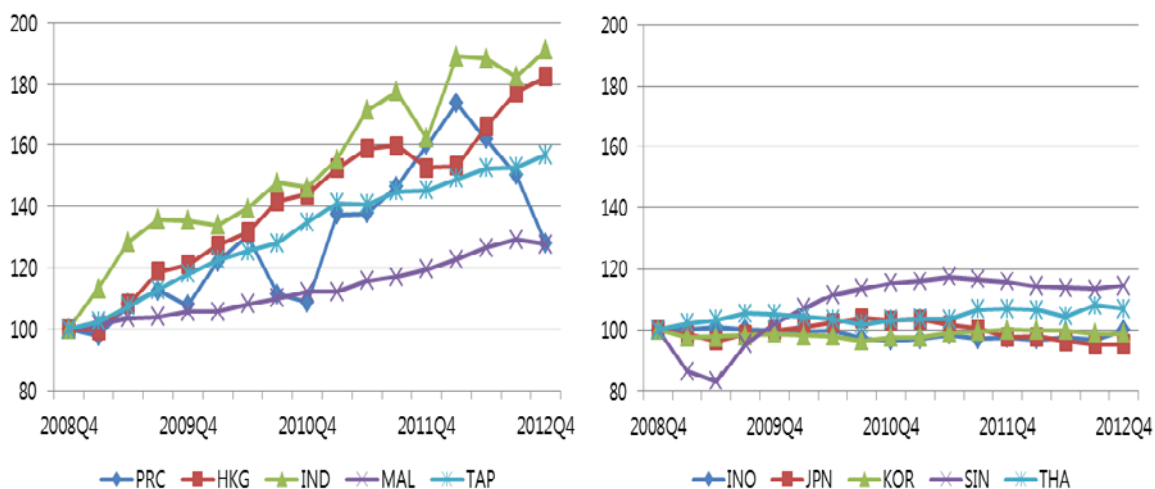
¹⁸ A 1% increase in USRATE is associated with 4.1% depreciation of the Japanese yen and 0.6% depreciation of the Singapore dollar, respectively. The coefficients for all the other countries were insignificant.

¹⁹ A 1% increase in VIX is associated with a 22% depreciation of the Korean won and 11% of Singapore dollar.

5. Housing Prices

The results of Section 4 suggest that explicit announcements on QE (QE1, in particular) directly affected Asia's financial market sentiments. However, QE seems to have made further contributions to easing Asia's financial conditions through at least two additional channels: (i) by reducing tail risks of the global financial market, which lowered CDS premiums of Asia, and (ii) by stabilizing the US long-term interest rate, which lowered Asia's domestic interest rates. While inflation has been relatively stable in Asia notwithstanding easy liquidity conditions, asset prices (housing prices in particular) have sharply increased in some economies since the GFC, raising cautionary flags to regional policy makers. In real terms, housing prices nearly doubled in Hong Kong, China and India during the 4 year period from 2008 to 2012, and steadily rose by 57% and 27% in Taipei, China and Malaysia, respectively. Real housing price index in the PRC also skyrocketed until the first quarter of 2012, though it rapidly declined since then.

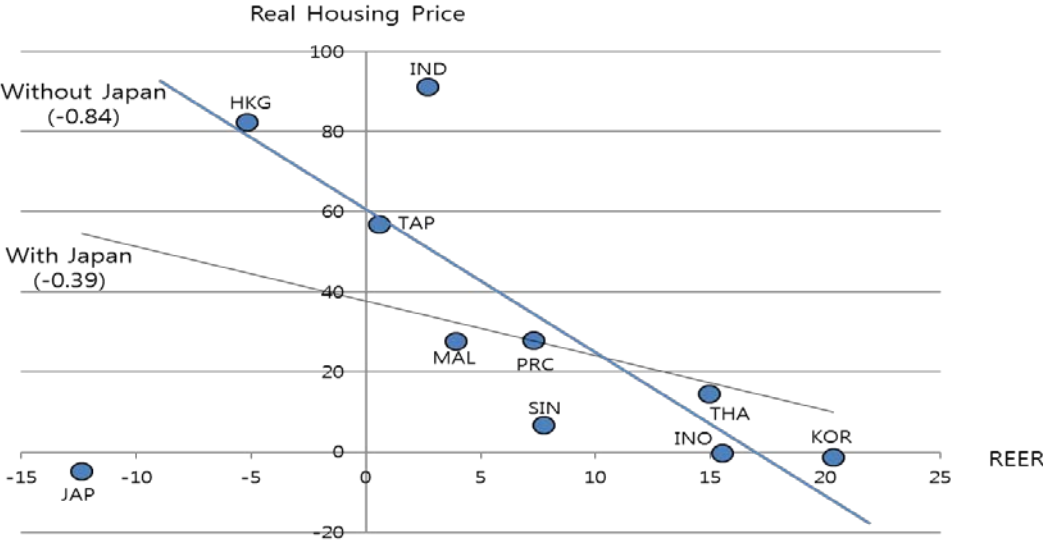
Figure 9: Real Housing Price Index: 2008.12~2012.12



With respect to the different exchange rate responses to the global shocks across Asian countries, an interesting observation is that economies with housing price hikes roughly coincided with those in which exchange rates have been stable or rigid. Housing prices have been relatively stable in countries with exchange rates that have been appreciating. Figure 10 demonstrates the tradeoff between exchange rates and

housing prices. Excluding Japan, the correlation coefficient between the two variables is -0.84 , strongly suggesting that monetary easing in advanced countries after the GFC affected Asian countries through either appreciation of currency values or price increases in housing, the most important household asset in many Asian countries. Japan appears to be an outlier in this figure, but it is necessary to note that its currency value has rapidly depreciated since the fourth quarter of 2012 with the announcement of aggressive quantitative easing. In fact, if we limit the period up to the third quarter of 2012, Japan's currency value had appreciated by 6% and would be well situated in the figure's trade-off relationship.

Figure 10: Changes in REER and Real Housing Price Index: 2008.12~2012.12



Note: HKG=Hong Kong, China; IND=India; INO=Indonesia; JAP=Japan; KOR=Republic of Korea; MAL=Malaysia; PRC=People's Republic of China; SIN=Singapore; TAP=Taipei,China; THA=Thailand.

Sources: CEIC Data Company Ltd. for the PRC; Hong Kong, China; India; Indonesia; Japan; Malaysia; Singapore. For the PRC, data from 2008–2010 refer to the average price of buildings in 70 cities; data for 2011–2012 refer to the average price of newly constructed residential buildings in 70 cities. As the former data series was discontinued after 2010, we generated a new index that spliced the former and latter data. For Thailand, data was collected from the Government Housing Bank, and calculated as a simple average of three housing price indexes ('Single Detached House: Including Land', 'Town House: Including Land', and 'Condominium'), whose trends are substantially different across indexes. For Japan, 'TSE Home Price Index: Used Condominium: Tokyo Metro Area' was used. The trends are all similar across various indexes for Japan. For Taipei,China, data was collected from Sinyi Realty Incorporation. For the Republic of Korea, data came from Kookmin Bank.

6. Concluding Remarks

It is a daunting task to identify the effects of US QE on Asia. The policies were taken when the global financial market was in turmoil, and thus a constellation of other factors simultaneously affected capital flows and financial markets in the region. The trend and regression analyses conducted in this paper, nonetheless, seem to provide some insights on the impacts of QE on Asia.

First, QE1 made significant contributions to the sharp rebound of capital inflows to the region after the global financial crisis. By reducing tail risks and lowering US yield rates, it re-directed capital flows toward Asia, which suffered from US dollar liquidity shortage during the GFC period. In comparison, QE2 and QE3 effects appear to have been relatively muted. Second, the recent volatility of capital flows into Asia mainly stemmed from precarious portfolio investments, which does not seem to be unrelated to the abundant liquidity provision of monetary authorities in advanced countries. Third, housing prices in some Asian countries have sharply increased. This also seems to be affected by the prolonged QE policies and capital flows, as housing prices rose more in the countries where currencies have not appreciated.

Considering the sluggish growth of advanced economies, loose monetary policies are likely to continue for a while. Together with the recent announcement of Japan of aggressive unconventional monetary policy in particular, the spillover of liquidity in conjunction with potentially volatile capital flows remains a risk factor to Asia. Unlike QE1, which was implemented in the midst of global financial crisis, excess global liquidity with subdued risk aversion can cause aggressive yield search and larger capital inflows to Asia, where macro fundamentals are relatively sound.²⁰

Based on these observations, we provide three areas where Asian policy makers could directly focus on to avoid adverse implications from the QE of advanced economies. First is the need to strengthen macro-prudential policies. Although QEs

²⁰ Its impacts on developing Asia will not be uniform across countries. For example, if QE of Japan succeeds in reigniting its growth, economies in developing Asia where Japanese companies are operating in large scale may benefit from FDI inflows from Japan. In contrast, economies competing with Japan in export markets can be adversely affected by yen depreciation.

of advanced economies have been extended, it is inevitable that these unprecedented and unconventional policies will have to end at some point in the future. To the extent that QEs have affected Asia's financial markets, future unwinding will also have impacts on Asia, and adverse effects could be magnified in countries that have not prepared for such eventuality. Close monitoring of cross-border financial transactions (in particular, portfolio investment, which was most volatile around the GFC) and their implications on banking sector soundness is thus imperative. Where necessary, macro-prudential policy must be strengthened.

Second, improved monitoring of asset markets is necessary. In some Asian economies, housing prices have risen sharply enough to cause concern to policy makers. As proven by the recent GFC, bubbles in real estate markets are detrimental to financial and macroeconomic stability. Policy makers thus need to closely monitor potential risks in the banking sector that may trigger instability when asset price trends are reversed.

Third is the need to maintain the size of reserves in line with the increasing volatility of financial flows. While it is not optimal for central banks to target exchange rates by market intervention, it will be prudent for them (especially the non-reserve currency issuers) to maintain sufficient foreign reserve holdings in line with the rising volatility of financial flows. This will give them sufficient buffer to cope with potential sudden reversals of financial flows.

References

- Baumeister, Christiane, and Luca Benati. 2012. "Unconventional Monetary Policy and the Great Recession: Estimating the Impact of a Compression in the Yield Spread at the Zero Lower Bound?" *European Central Bank Working Paper Series* 1258. European Central Bank. Frankfurt.
- Chen, Q., A. Filardo, D. He, and F. Zhu. 2012. "International spillovers of central bank balance sheet policies." *BIS Papers* No. 66. Bank for International Settlements (BIS). Basel.
- Chung, H. J. Laforte, D. Reifschneider, and J.C. Williams. 2012. "Have We Underestimated the Likelihood and Severity of Zero Lower Bound Events?" *Journal of Money, Credit and Banking* Vol. 44 supplement (February). pp.47-82.
- D'Amico, S. and T. B. King. 2012. "Flow and Stock Effects of Large Scale Treasury Purchases: Evidence on the Importance of Local Supply." *Finance and Economics Discussion Series* No. 2012-44. Federal Reserve Board. Washington, D.C.
- Gagnon, J., M. Raskin, J. Remache, and B. Sack. 2011. "The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases". *International Journal of Central Banking* 7(1): 3-43.
- Hancock, Diana, and Wayne Passmore. 2011. "Did the Federal Reserve's MBS Purchase Program Lower Mortgage Rates?" *Journal of Monetary Economics*. Vol. 58, No.5. pp.498-514.
- Ihrig, J., E. Klee, C. Lee, B. Schulte, and M. Wei. 2012. "Expectations About the Federal Reserve Balance Sheet and the Term Structure of Interest Rates." *Finance and Economics Discussion Series* 2012-57, Federal Reserve Board. Washington, D.C.
- International Monetary Fund (IMF). 2011. "2011 Spillover Report." July 22. Washington, D.C.

_____. 2012. “2012 Spillover Report.” July 9.
Washington, D.C.

Krishnamurthy, Arvind, and Annette Vissing-Jorgensen. 2011. “The Effects of Quantitative Easing on Interest Rates.” *Brookings Papers on Economic Activity* 43(2). pp.215-287.

Mancini-Griffoli, Tommaso, and Angelo Ranaldo. 2010. “Limits to Arbitrage During the Crisis: Funding Liquidity Constraints and Covered Interest Parity.” *Swiss National Bank Working Paper*.

Morgan, P. 2011. “Impact of US Quantitative Easing Policy on Emerging Asia.” *ADB Working Paper* 321. Asian Development Bank Institute (ADB). Tokyo.

Neely, C. J. 2010. “The Large Scale Asset Purchase Had Large International Effects.” *Working Paper Series* No. 2010-018D. Research Division, Federal Reserve Bank of St. Louis.

Sack, Brian P. 2010. “Reflections on the TALF and the Federal Reserve’s Role as Liquidity Provider”. Remarks given at the New York Association for Business Economics. New York City, June 9.

Appendix: Regression Results by Individual Country

HKG: CDS data are available after 2009.7.1.

		CDS	BOND	EXR
Const.		-0.001	-0.004	0.001
Local Variables	BOND	-	-	0.047
	CDS	-	0.086	0.211*
Global Variables	US Rate	0.001	0.591***	-0.004
	VIX	0.687***	-0.100	0.851***
QE1	E1			
	E2			
	E3			
	E4			
	E5			
QE2	E6	0.002	0.016	-0.082
	E7	0.048	-0.067	0.037
QE3	E8	0.010	0.058	-0.001
	E9	-0.003	0.009	-0.005
	E10	-0.050	0.004	0.014

JPN:

		CDS	BOND	EXR
Const.		0.001	0.000	-0.039
Local Variables	BOND	-	-	-1.530
	CDS	-	-0.029	-1.328
Global Variables	US Rate	-0.015	0.172***	4.141***
	VIX	0.664***	-0.040	-8.987***
QE1	E1	0.180***	0.025	-1.815
	E2	0.000	0.059	0.054
	E3	0.008	-0.075	-5.591***
	E4	0.069	0.023	0.310
	E5	-0.175***	0.042	0.008
QE2	E6	0.012	0.055	0.106
	E7	-0.009	-0.030	-1.339
QE3	E8	0.015	0.001	0.024
	E9	0.115**	-0.031	0.624
	E10	0.023	0.009	0.787

Note: (i) Differenced data for CDS, BOND, USRATE, and VIX and log-differenced data for EXR were used.

All variables were expressed in percent.

(ii) *, **, *** denote statistical significance at a 10%, 5%, and 1%, respectively.

KOR:

		CDS	BOND	EXR
Const.		0.000	-0.002	0.002
Local Variables	BOND	-	-	0.655
	CDS	-	-0.107***	0.665
Global Variables	US Rate	0.052	0.255***	-0.773
	VIX	3.606***	0.472*	22.157***
QE1	E1	0.311*	-0.191	3.246*
	E2	0.162	-0.334**	-1.475
	E3	-0.064	-0.213	-3.549**
	E4	0.078	-0.139	1.801
	E5	-0.360**	-0.179	-5.990***
QE2	E6	0.043	0.325**	-1.550
	E7	0.047	0.028	-0.182
QE3	E8	-0.071	-0.029	-0.165
	E9	0.029	-0.033	0.005
	E10	-0.015	0.038	-0.791

MAL:

		CDS	BOND	EXR
Const.		-0.001	0.002	-0.042
Local Variables	BOND	-	-	0.656**
	CDS	-	0.024	1.281***
Global Variables	US Rate	-0.072	0.115***	0.086
	VIX	1.993***	-0.186	6.805***
QE1	E1	0.130	-0.344***	2.242***
	E2	0.157	-0.032	-0.168
	E3	-0.087	-0.248***	-1.484**
	E4	0.048	0.096	-0.296
	E5	-0.232	-0.114	0.397
QE2	E6	-0.011	-0.008	-0.546
	E7	0.002	0.006	0.051
QE3	E8	-0.012	0.009	-0.215
	E9	0.043	-0.036	-0.204
	E10	-0.240*	-0.003	0.738

Note: (i) Differenced data for CDS, BOND, USRATE, and VIX and log-differenced data for EXR were used.

All variables were expressed in percent.

(ii) *, **, *** denote statistical significance at a 10%, 5%, and 1%, respectively.

PHI:

		CDS	BOND	EXR
Const.		-0.009	-0.001	-0.039
Local Variables	BOND	-	-	-0.038
	CDS	-	0.024	0.745***
Global Variables	US Rate	-0.099	0.328*	-0.082
	VIX	3.528***	1.163	6.833***
QE1	E1	-0.118	0.269	-0.413
	E2	0.062	0.061	0.469
	E3	0.023	0.162	-1.891**
	E4	0.212	-6.022***	-0.108
	E5	-0.023	0.183	0.167
QE2	E6	0.006	0.091	-0.938
	E7	-0.118	0.028	-0.121
QE3	E8	-0.009	0.016	-1.310*
	E9	0.077	-0.197	0.402
	E10	0.037	-0.071	0.364

PRC:

		CDS	BOND	EXR
Const.		0.000	0.001	-0.064***
Local Variables	BOND	-	-	-0.160*
	CDS	-	0.082	0.150
Global Variables	US Rate	-0.094***	0.211***	0.123
	VIX	1.229***	-0.470**	-0.087
QE1	E1	-0.025	-0.330***	0.031
	E2	0.213**	-0.043	0.731***
	E3	-0.033	-0.248**	-0.401*
	E4	0.148	-0.064	0.037
	E5	-0.424***	0.058	0.083
QE2	E6	-0.051	0.317***	0.052
	E7	-0.070	0.063	0.090
QE3	E8	-0.029	0.019	0.044
	E9	0.024	0.007	-0.209
	E10	0.016	0.001	0.474**

Note: (i) Differenced data for CDS, BOND, USRATE, and VIX and log-differenced data for EXR were used.

All variables were expressed in percent.

(ii) *, **, *** denote statistical significance at a 10%, 5%, and 1%, respectively.

SIN: CDS data are not available.

		CDS	BOND	EXR
Const.		-	-0.002	-0.057*
Local Variables	BOND	-	-	0.601*
	CDS	-	-	-
Global Variables	US Rate	-	0.342***	0.573**
	VIX	-	0.164	11.307***
QE1	E1	-	0.031	1.050
	E2	-	0.038	0.472
	E3	-	0.040	-3.638***
	E4	-	0.105	0.922
	E5	-	0.215**	-0.508
QE2	E6	-	0.020	-1.133*
	E7	-	-0.123	-1.036
QE3	E8	-	0.019	-0.463
	E9	-	0.012	-0.178
	E10	-	-0.056	0.292

THA:

		CDS	BOND	EXR
Const.		0.000	0.006	-0.060
Local Variables	BOND	-	-	-0.060
	CDS	-	-0.052	0.503*
Global Variables	US Rate	-0.076*	0.341***	0.344
	VIX	2.130***	0.233	3.572**
QE1	E1	0.482***	0.160	1.440
	E2	0.167	-0.687***	0.742
	E3	-0.297**	-0.323**	-1.947**
	E4	0.173	0.023	0.173
	E5	-0.199	-0.011	-0.227
QE2	E6	-0.013	0.038	-0.649
	E7	-0.071	0.123	-1.291
QE3	E8	-0.025	0.026	-0.208
	E9	0.041	-0.028	-0.504
	E10	-0.407***	-0.090	0.075

Note: (i) Differenced data for CDS, BOND, USRATE, and VIX and log-differenced data for EXR were used.

All variables were expressed in percent.

(ii) *, **, *** denote statistical significance at a 10%, 5%, and 1%, respectively.