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Macro-prudential Response to Increased Global Market Volatility

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Introduction

The volatility of price indicators has remained extremely stable during the period of low interest rates since the Global Financial Crisis (GFC) of September 2009. Low volatility pushes down risk premium, which can cause an upturn in global investors' risk appetite. There has been a big change in global liquidity flows since 2009. Emerging market economies (EMEs), with relatively high credit risk, received huge capital inflows backed by the escalated risk appetite of global investors.

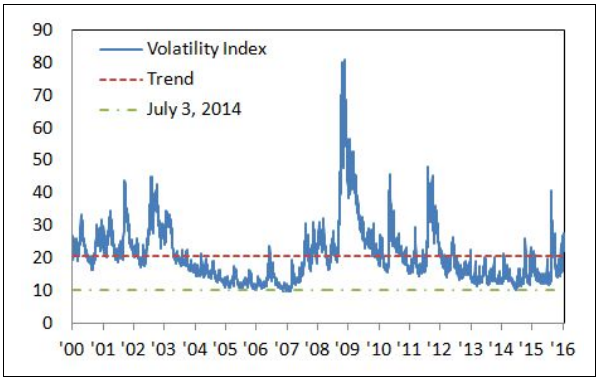
The US Federal Reserve is now trying to normalize its monetary policy by pushing up the policy rate, tied at zero lower bound for about seven years. In December 2015, the Federal Reserve raised interest rates for the first time in nine years. This will bring about asset price volatility and cause risk premiums to normalize. We remain concerned about the downside risk to capital outflows from EMEs, including Korea. And this may well potentially cause a decrease in asset price and growth contraction in EMEs.

Accordingly, we provide an overview of the volatility of financial markets and new trends in capital flows, and identify the determinants of capital flows to/from EMEs. We also review the use of capital flow management policies in EMEs including Korea, and examine the effectiveness of Asset-Based Reserve Requirements (ABRR) as an alternative macro-prudential policy measure to manage capital flows.

Overview of Volatility of Financial Markets and Recent Trends in Capital Flows

Figure 1. Volatility Index

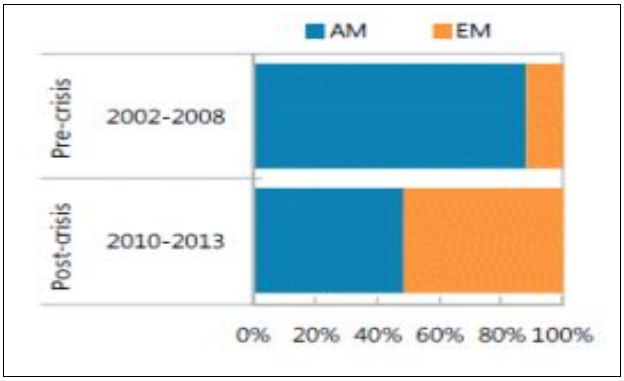
(percentage point)



Source: Bloomberg DB (accessed: Jan. 18, 2016)

Figure 2. Composition of Global Capital Flows

(share of total flows)



Source: Sahay *et al.* (2014), Figure 2, p. 7[1]

After the global financial crisis, the accommodative monetary stance in major advanced economies increased global liquidity in financial markets and maintained a low level of interest rates and volatility of price indicators. The continuation of low volatility and ample funding at low rates has encouraged market participants to take increasingly speculative positions. Thus, many large EMs have experienced a surge in capital inflows in the aftermath of the GFC. Large capital inflows can expose EMs to the risks that growth of domestic credit and a jump in asset prices entail. Besides, a sudden stop may lead to a sharp drop in asset prices and a contraction in output.

In addition, the composition of capital flows has changed significantly over the past few years. Prior to the GFC, banks' short-term loans mainly accounted for a large volume of capital inflow to EMEs. After 2009, however, portfolio investment (equity and fixed income debt) has taken up a larger share. This would be dubbed 'the second phase' of global liquidity.

Table 1 shows the results from estimating the impacts of push (global) and pull (country-specific) factors on capital inflows to EMEs. According to the results, push factors are more significant for capital inflows to EMs. This implies that domestic policy tools are limited in terms of addressing the macroeconomic and financial stability risks driven by capital inflow surges from abroad. There is concern that the US Fed's imminent lift-off in policy rates may have a significant impact on capital flows and economic growth in emerging market countries. Thus we may need to find policy tools to respond to these important issues.

[1] Sahay, Ratna, Vivek Arora, Thanos Arvanitis, Hamid Faruqee, Papa N'Diaye, Tommaso Mancini-Griffoli, and an IMF Team. 2014. "Emerging Market Volatility: Lessons From the Taper Tantrum." IMF Staff Discussion Notes No. 14/9.

Table 1. Determinants of Capital Inflows in Emerging Market Economies

		Total Inflows	Direct Inflows	Equity Inflows	Bond Inflows	Other Inflows	Bank Loans
Push factor	US 10yr T-bond yield	**-0.27*****	**-0.21*****	**-0.20*****	**-0.36*****	**-0.16*****	**-0.27*****
	VIX index (Log)	**-0.39*****	**-0.13***	**-0.53*****	**-0.27****	-0.17	**-0.27***
Pull factor	Trade openness	-0.38	0.14	-0.68*	0.28	0.11	-0.38
	Growth (in percent)	0.04***	0.02**	0.04***	0.01	0.01	0.00
	Inflation (in percent)	0.00	0.00***	0.00	0.00	0.00	0.00
	Avg. Size (log avg. GDP)	0.51**	1.35***	0.52	0.17	0.63**	-0.09
Constant		-5.80***	-12.08***	-7.77***	-5.49***	-8.40***	-5.10**
No. of Observations		1,261	1,356	923	922	883	664
R-sq		0.28	0.35	0.20	0.14	0.22	0.10

Notes: Dependent variables are the log level of total inflows and their different components. Trade openness is the sum of exports and imports divided by GDP and average size proxied by the logarithm of average GDP in the first, second and third decade of the sample. ***, **, * denote statistical significance at the 1%, 5%, 10% level of confidence.

The Effects of Volatility on Portfolio Inflows to EMs

Against this backdrop, we conducted an empirical research to better understand the effects of price volatility (VIX) and interest rate spreads on the capital flows of emerging economies (Table A1-A4). In the study, we chose to utilize fund flow data from EPFR (Emerging Portfolio Fund Research), whose data has a higher reporting frequency than conventional capital flow data sources.

The implications from our empirical results are threefold. First, an increase in volatility is associated with the net outflow of funds from emerging economies. Second, our results do not unconditionally support the textbook effects of widening interest rate spreads leading to capital inflows in emerging economies. Lastly, interest rate spreads had opposite effects on the capital flows of emerging economies depending on the level of volatility. In times of heightened volatility, widening interest rate spreads were associated with positive (+) capital inflow. In contrast, the widening of interest rate spreads was negatively (-) associated with capital inflows when volatility was low. This particular empirical result on the effect of interest rate spread suggests that it may be difficult to address issues of volatile capital flows using monetary policy alone. The results also suggest it is important to consider the effect of volatility when conducting monetary policies in emerging economies.

Macro-prudential Policy Responses Designed to Limit Outflows

We review the use of capital flow management policies in emerging economies, including Korea. A surge in capital inflows to EMEs may deepen the volatility and vulnerability of the macro-economy and financial markets. The IMF provided a clear and consistent perspective with respect to capital flows and policies.[2] Policymakers should take into account

[2] International Monetary Fund (IMF). 2012. "The Liberalization and Management of Capital Flows: an Institutional View." Discussion Paper, International Monetary Fund.

Table 2. Selected Capital Flow Management Measures Designed to Limit Outflows

Country	Measures
Argentina (2001)	Establishment of *Corralito*, which limited bank withdrawals and imposed restrictions on transfers and loans in foreign currency.
Iceland (2008)	Stop of convertibility of domestic currency accounts for capital transactions.
Malaysia (1998)	Imposition of 12-month waiting period for nonresidents to convert from the sale of Malaysian securities
Ukraine (2008)	Introduction of a 5-day waiting period for nonresidents to convert local currency proceeds from investment transaction to foreign currency.
Thailand (1997)	Imposition of limits on forward transactions and introduction of export surrender requirements.

Source: IMF (2012).

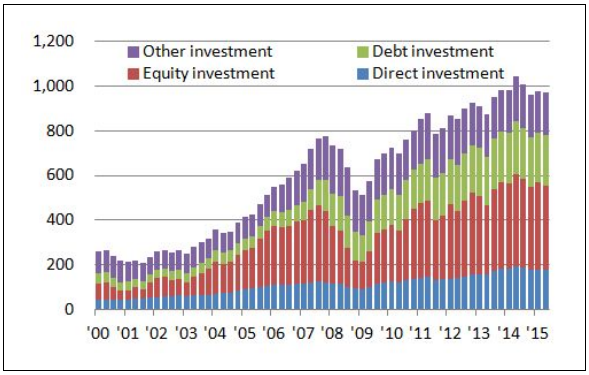
appropriate macro-economic policies at first, and then employ Capital Flows Management Measures (CFMs) and Macro-prudential Measures (MPMs) to respond to capital flow surges.

Several emerging economies introduced CFMs to address the side effects from the high volatility of capital flows (table 2). Beginning in June 2010, Korea introduced a series of Macro-prudential Measures (MPMs) aimed at building resilience against external financial shocks, especially against vulnerability to capital flow reversals in the banking sector. These MPMs succeeded in reinforcing the banking system′s soundness by improving the structure of foreign debt in the banking sector, and reducing capital inflows in short-term portions and stabilizing the volatility of capital flows.

Recently, the composition of capital flows in Korea has changed. Figure 3 plots the liability position in International Investment Position (IIP) classified by functional category, and shows that portfolio investment has picked up. Figure 4 plots the composition of liabilities in IIP accounts by functional category, and shows that the share of portfolio investment rose from 36.7% in the end of 2000 to 61.9% in 2015Q2. Portfolio investments tend to display excessive inflow during boom periods and sudden outflow in times of bust. Like many other emerging economies, Korea, with a small and open economy, can be highly vulnerable to the fluctuations of capital flows due to monetary policy normalization in the US and the slowdown in emerging economies. Korea is especially vulnerable to the excessive volatility of capital flows, since Korea's share of such high volatile capitals is higher than that of other emerging economies. There are, however, limitations that MPMs in Korea are placing more emphasis on consolidating the foreign liquidity soundness of the banking sector. In addition to the above, it is imperative that Korea make preparations to reduce the volatility of capital flows in equity and debt.

Figure 3. Liabilities Position in International Investment Position

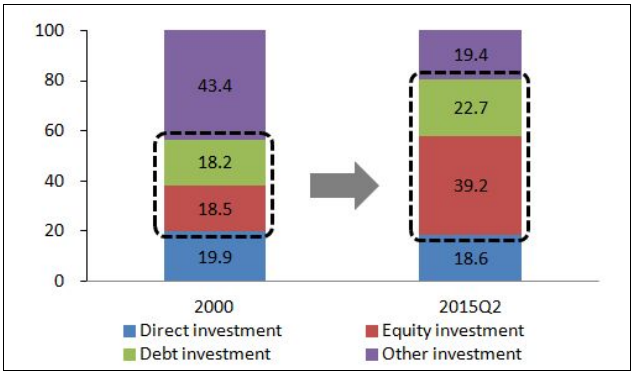
(BIL USD)



Note: International Investment Position (IIP)
Source: BOK ECOS (accessed: Oct.21 2015)

Figure 4. Composition of Liabilities in International Investment Position

(percentage point)



Note: International Investment Position (IIP)
Source: BOK ECOS (accessed: Oct.21 2015)

New MPMs: Asset-based Reserve Requirements

The procyclicality of financial institutions amplifies the volatility of business cycles. During an economic boom, easier access to credit enables more investment and helps the economy grow further. However, borrowers become more leveraged during the process, and thus more vulnerable to financial risks. Moreover, when adverse shocks hit the economy and moral hazards in the financial market exacerbate the situation, financial institutions' ability to intermediate credit is likely to be limited, owing to problems in their own balance sheets. This procyclicality is regarded as one of the main causes of the 2007-2008 global financial crisis, and since then, considerable efforts have been made to mitigate this "time dimension" of financial systemic risk. Examples of these "macro-prudential" measures include the countercyclical capital buffer (CCB) in the Basel III framework for bank regulations, or lending regulations such as caps on the loan-to-value (LTV) and debt service-to-income (DTI) ratios for mortgage lending.

In this paper, we discuss asset-based reserve requirement policy as an instrument to cope with financial systemic risk. Specifically, we compare the effects of asset-based reserve requirement and Basel III-type countercyclical capital buffer using a DSGE (dynamic stochastic general equilibrium) model. Asset-based reserve requirement forces financial institutions to set aside a certain portion of their assets as reserves. In this sense, it contrasts with the current reserve requirement system that is imposed on the liability side of banks. In particular, it can be used to alleviate credit overheating in a particular sector of the economy, such as the household mortgage market.

We introduce heterogeneity in the entrepreneurial sector to explain sectoral credit imbalances in the real economy. In particular, we distinguish entrepreneurs into two sectors by considering features such as member entrepreneurs' expected private benefit, financial institutions' monitoring cost, and investment projects' expected returns. Financial institutions hold lending portfolios financed by capital investments from bankers and deposits from households. Because entrepreneurs in each sector may differ in their state, credit to each

sector may vary as well. We assume that the cost of the intermediary increases as its lending portfolio is more unbalanced between sectors, because of the cost involved in monitoring and operating activities. Given this cost, intermediaries optimally choose sectoral allocation of credit. External shocks in this economy may be either common shocks or sector-specific shocks. Shocks in productivity, interest rate, and bank capital are common shocks. Shocks in entrepreneurs' private return, monitoring cost, and expected project return are sector-specific; they affect a single entrepreneurial sector only. Our main objective is to compare the effects of countercyclical ABRR and the CCB within this model. We choose the CCB as a benchmark policy, because it has become one of the most widely used instruments to mitigate financial institution procyclicality, given that it is an element in Basel III.

The main results can be summarized as follows. Both the ABRR and the CCB can restrict credit and investment expansion arising from common shocks, such as positive productivity shock and unexpected cuts in the interest rate. A bank capital shock has real effects, as an unexpected reduction of intermediary capital decreases credit and investment. When capital regulation is static, the procyclicality of financial institutions is stronger, as the degree of recessionary pressure is exacerbated by the regulation. On the other hand, the ABRR and CCB reduce the adverse impact of the shock, because the capital or reserve accumulated during the boom period can be used as a buffer. Given sector-specific shock, the overall effectiveness of the ABRR and CCB shows notable difference. Specifically, ABRR can effectively restrict the credit cycle while the CCB has distortive effects on the credit cycles of other sectors (where the shock does not hit). The reason is that ABRR can adjust the asset return of the specific sector hit by the shock, while the CCB does not offer such sector-specific treatment. This result holds, even though the capital requirement ratio reacts to sector-specific credit instead of aggregate credit.

Table 3. Comparison of the Effects of Regulations

		Static Capital Regulation (SCR)	Countercyclical Capital Buffer (CCB)	Asset-Based Reserve Requirements (ABRR)
Application method of regulation		The total capital ratio must be no lower than minimum capital requirements.	CCB requires capital ratio rises when credit-to-GDP gap above the lower threshold 2%.	ABRR imposes reserve requirements to financial institutions' asset holdings.
Smoothing effect on credit cycle fluctuation				
	Common shocks	ineffective (procyclicality of financial institutions is strong when bank capital declines)	effective	Effective
	Sector specific shocks	ineffective (procyclicality of financial institutions is strong when bank capital declines)	ineffective (unintended consequences in sectors in which no shock has occurred)	effective

Policy Implications

In this paper, we find evidence that capital flows to Korea are more sensitive to global factors (push factors). This gives an appropriate prominence to the recipient countries introducing CFMs and MPMs in response to global liquidity expansion. We have seen that the effect of interest rate spreads on capital flows vary according to the degree of volatility. Accordingly, monetary policy alone cannot address problems posed by capital flows surges. Korea introduced FX-related MPMs (macro-prudential stability levy, ceilings on foreign exchange derivatives positions of banks, and restoration of the tax on foreigners' bond investment) for improving the FX soundness of banks. Many papers suggest that MPMs in Korea are effective in controlling capital inflow and would strengthen external stability. But additional MPMs are needed in the absence of proper measures which have an effect in reducing portfolio investment sector (equity and fixed income debt) vulnerabilities. Furthermore, a broader policy package should be introduced to address the macroeconomic and financial stability risks to which capital outflow surges can give rise. In the short term, accumulation of foreign currency reserves, financial safety net, the IMF′s special drawing rights (SDR) could be effective as a first aid measure. In the medium term, expanding the scope of the application of MPMs from banks to non-banks (i.e. shadow banking) might be the way forward. KIEP

Appendix

Table A1. Effects of Volatility on the Bond Fund Flows in EMs

Model	(1)	(2)	(3)	(4)	(5)
Intercept	0.786***	0.750***	0.720***	0.729***	0.751***
	(4.54)	(4.31)	(4.15)	(4.20)	(4.30)
ΔVIX	-0.107**	-0.248**	-0.208*	-0.185**	-0.195***
	(-1.96)	(-2.38)	(-1.93)	(-2.08)	(-4.36)
$\Delta VIX \times D_{FinancialCrisis}$	-0.175*				
	(-1.69)				
$\Delta VIX \times D_{\lvert VIX-u \rvert > 0.5\sigma}$		0.097			
		(0.85)			
$\Delta VIX \times D_{VIX-u>0}$			0.029		
			(0.24)		
$\Delta VIX \times D_{VIX-u>0.5\sigma}$				-0.007	
				(-0.07)	
$\Delta VIX \times D_{VIX-u<-0.5\sigma}$					0.188
					(1.02)
$\Delta SPREAD$	-0.749	-1.666	-2.114***	-2.168***	-0.358
	(-1.43)	(-1.41)	(-2.79)	(-3.07)	(-0.76)
$\Delta SPREAD \times D_{FinancialCrisis}$	0.698				
	(0.67)				
$\Delta SPREAD \times D_{\lvert VIX-u \rvert > 0.5\sigma}$		0.872			
		(0.69)			
$\Delta SPREAD \times D_{VIX-u>0}$			1.777*		
			(1.95)		
$\Delta SPREAD \times D_{VIX-u>0.5\sigma}$				2.000**	
				(2.28)	
$\Delta SPREAD \times D_{VIX-u<-0.5\sigma}$					-2.001**
					(-1.98)
$Adj\ R^2$	0.1982	0.1880	0.2056	0.2131	0.2104

Notes: 1) t-statistics are reported in parentheses. 2) ***, **, * denotes statistical significance at the 1%, 5%, 10% level of confidence. 3) Dependent variables are the rate of changes in net inflows of bond funds in EMs. 4) Δ means differences, VIX is the Volatility Index of CBOE, and SPREAD is the difference between yields of 1yr EM's treasury bonds and yields of 1yr US treasury bonds. μ denotes the mean of VIX, σ denotes the standard deviation of VIX. 5) $D_{FinancialCrisis}$ is a dummy variable that captures the global financial crisis (from July 2008 to February 2009) 6) $D_{\lvert VIX-u \rvert > 0.5\sigma}$ is a dummy variable which value is equal to one if absolute value of VIX is above half of standard deviation (otherwise zero).

Table A2. Effects of Volatility on the Equity Fund Flows in EMs

Model	(1)	(2)	(3)	(4)	(5)
Intercept	0.321***	0.309***	0.303***	0.297***	0.284***
	(3.33)	(3.17)	(3.12)	(3.06)	(2.90)
ΔVIX	-0.178***	-0.257***	-0.209***	-0.227***	-0.131***
	(-5.81)	(-4.48)	(-3.45)	(-4.55)	(-5.74)
$\Delta VIX \times D_{FinancialCrisis}$	0.087				
	(1.63)				
$\Delta VIX \times D_{\lvert VIX-\mu\rvert > 0.5\sigma}$		0.161**			
		(2.57)			
$\Delta VIX \times D_{VIX-\mu > 0}$			0.090		
			(1.38)		
$\Delta VIX \times D_{VIX-\mu > 0.5\sigma}$				0.119**	
				(2.10)	
$\Delta VIX \times D_{VIX-\mu < -0.5\sigma}$					-0.011
					(-0.11)
$\Delta SPREAD$	-0.293	0.105	-0.677	-0.486	0.365
	(-1.02)	(0.24)	(-1.62)	(-1.35)	(1.36)
$\Delta SPREAD \times D_{FinancialCrisis}$	0.725				
	(1.03)				
$\Delta SPREAD \times D_{\lvert VIX-\mu\rvert > 0.5\sigma}$		-0.222			
		(-0.41)			
$\Delta SPREAD \times D_{VIX-\mu > 0}$			1.075**		
			(2.06)		
$\Delta SPREAD \times D_{VIX-\mu > 0.5\sigma}$				0.850*	
				(1.69)	
$\Delta SPREAD \times D_{VIX-\mu < -0.5\sigma}$					-2.182***
					(-3.09)
$Adj\ R^2$	0.2266	0.2202	0.2204	0.2286	0.2377

Notes: 1) t-statistics are reported in parentheses. 2) ***, **, * denotes statistical significance at the 1%, 5%, 10% level of confidence. 3) Dependent variables are the rate of changes in net inflows of equity funds in EMs. 4) Δ means differences, VIX is the Volatility Index of CBOE, and SPREAD is the difference between yields of 1yr EM's treasury bonds and yields of 1yr US treasury bonds. μ denotes the mean of VIX, σ denotes the standard deviation of VIX. 5) $D_{FinancialCrisis}$ is a dummy variable that captures the global financial crisis (from July 2008 to February 2009) 6) $D_{\lvert VIX-\mu\rvert > 0.5\sigma}$ is a dummy variable which value is equal to one if absolute value of VIX is above half of standard deviation (otherwise zero).

Table A3. Effects of Volatility on the Bond Fund Flows in Korea

Model	(1)	(2)	(3)	(4)	(5)
Intercept	0.772***	0.696***	1.349***	0.756***	1.426***
	(5.27)	(4.66)	(5.98)	(5.00)	(6.27)
ΔVIX	-0.083*	-0.195**	-0.181**	-0.164***	-0.078**
	(-1.68)	(-2.49)	(-2.47)	(-4.73)	(-2.01)
$\Delta VIX \times D_{Financial\,Crisis}$	-0.140**				
	(-2.06)				
$\Delta VIX \times D_{\lvert VIX-\mu \rvert > 0.5\sigma}$		0.040	0.132		
		(0.46)	(1.58)		
$\Delta VIX \times D_{VIX-\mu < -0.5\sigma}$				0.067	0.004
				(0.42)	(0.03)
$\Delta SPREAD$	-0.642	-0.978	-0.935	-0.111	-0.404
	(-0.97)	(-1.31)	(-1.34)	(-0.19)	(-0.69)
$\Delta SPREAD \times D_{Financial\,Crisis}$	1.022				
	(0.89)				
$\Delta SPREAD \times D_{\lvert VIX-\mu \rvert > 0.5\sigma}$		1.979*	1.670		
		(1.87)	(1.64)		
$\Delta SPREAD \times D_{VIX-\mu < -0.5\sigma}$				0.448	0.654
				(0.33)	(0.51)
$avgFXreturn$			1.760**		1.168
			(1.96)		(1.29)
$stdevFXreturn$			-1.294***		-1.306***
			(-3.75)		(-3.78)
$Adj\,R^2$	0.1712	0.1667	0.2755	0.1399	0.2384
Number of observations	124	124	124	124	124

Notes: 1) t-statistics are reported in parentheses. 2) ***, **, * denotes statistical significance at the 1%, 5%, 10% level of confidence. 3) Dependent variables are the rate of changes in net inflows of bond funds in Korea. 4) Δ means differences, VIX is the Volatility Index of CBOE, and SPREAD is the difference between yields of 1yr Korea's treasury bonds and yields of 1yr US treasury bonds. μ denotes the mean of VIX, σ denotes the standard deviation of VIX. 5) $D_{Financial\,Crisis}$ is a dummy variable that captures the global financial crisis (from July 2008 to February 2009) 6) $D_{\lvert VIX-\mu \rvert > 0.5\sigma}$ is a dummy variable which value is equal to one if absolute value of VIX is above half of standard deviation (otherwise zero). 7) $avgFXreturn$ is the monthly average of daily FX (KRW/USD) returns, and $stdevFXreturn$ is the standard deviation of FX returns.

Table A4. Effects of Volatility on the Equity Fund Flows in Korea

Model	(1)	(2)	(3)	(4)	(5)
Intercept	0.322***	0.319***	0.481***	0.329***	0.462***
	(4.07)	(3.97)	(3.82)	(4.10)	(3.70)
ΔVIX	-0.103***	-0.122***	-0.118***	-0.090***	-0.060***
	(-3.88)	(-2.90)	(-2.89)	(-4.86)	(-2.81)
$\Delta VIX \times D_{FinancialCrisis}$	0.030				
	(0.82)				
$\Delta VIX \times D_{VIX-u>0.5\sigma}$		0.041	0.076		
		(0.89)	(1.63)		
$\Delta VIX \times D_{VIX-u<-0.5\sigma}$				0.015	-0.016
				(0.17)	(-0.19)
$\Delta SPREAD$	-0.269	-0.146	-0.119	-0.248	-0.189
	(-0.75)	(-0.36)	(-0.30)	(-0.78)	(-0.59)
$\Delta SPREAD \times D_{FinancialCrisis}$	0.116				
	(0.19)				
$\Delta SPREAD \times D_{VIX-u>0.5\sigma}$		-0.230	-0.163		
		(-0.40)	(-0.29)		
$\Delta SPREAD \times D_{VIX-u<-0.5\sigma}$				-0.198	-0.302
				(-0.28)	(-0.43)
$avgFXreturn$			1.253**		1.182**
			(2.50)		(2.37)
$stdevFXreturn$			-0.329*		-0.262
			(-1.71)		(-1.38)
$Adj\ R^2$	0.1662	0.1670	0.2212	0.1618	0.2049
Number of observations	124	124	124	124	124

Notes: 1) t-statistics are reported in parentheses. 2) ***, **, * denotes statistical significance at the 1%, 5%, 10% level of confidence. 3) Dependent variables are the rate of changes in net inflows of equity funds in Korea. 4) Δ means differences, VIX is the Volatility Index of CBOE, and SPREAD is the difference between yields of 1yr Korea's treasury bonds and yields of 1yr US treasury bonds. μ denotes the mean of VIX, σ denotes the standard deviation of VIX. . 5) $D_{FinancialCrisis}$ is a dummy variable that captures the global financial crisis (from July 2008 to February 2009) 6) $D_{VIX-u|>0.5\sigma}$ is a dummy variable which value is equal to one if absolute value of VIX is above half of standard deviation (otherwise zero). 7) $avgFXreturn$ is the monthly average of daily FX (KRW/USD) returns, and $stdevFXreturn$ is the standard deviation of FX returns.