Short-Term External Debt and Fear of Losing International Reserves[*]

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During the global financial crisis of 2008 and 2009, some emerging market economies abstained from using their international reserves and allowed their currencies to depreciate despite large international reserve holdings.   Applying the difference in differences approach to the sample of 18 emerging market economies, we investigate the factors that contributed to fear of losing reserves.   The result shows that while emerging market economies in general did not show fear of losing reserves during normal times, those with relatively high short term external debt compared to their international reserve holdings became reluctant to rely on using reserves during the global financial crisis period, implying that short term external debt was the key factor for the reluctance to use international reserves displayed by some emerging market economies.   In this regard, countries with high short term external debt should adopt adequate measures such as establishing international financial safety nets and introducing capital flow management measures in addition to building up international reserves in order to maintain foreign exchange stability against sudden stops of capital flows.

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1. INTRODUCTION

The Asian currency crisis of 1997-1998 highlighted the importance of the role of international reserves in emerging markets economies (EMEs) as the first defense against sudden reversal of capital flows. Since then, EMEs have accumulated huge amount of international reserves. Between 2000 and 2007, international reserve holdings of EMEs increased more than five-fold to reach 4.3 trillion dollars covering about 63% of the global international reserve holdings.

Despite the relatively abundant international reserve (IR) holdings, however, many EMEs could not avoid large fluctuations in their exchange rates and financial turmoil during the global financial crisis of 2008-2009. As is well documented by Aizenman and Hutchison (2010), 23 out of the 26 EMEs included in the MSCI Emerging Markets Index experienced substantial depreciation of their currencies against the USD between July 2008 and February 2009.[1] Poland experienced the largest depreciation, followed by Russia, Brazil and Korea with more than 50% depreciation of their currencies.

What is ironical about this phenomenon is that despite massive IR holdings many EMEs showed reluctance to use their IR. According to Aizenman and Sun (2009) only about half of these economies relied on drawing down their IR as a part of their external adjustment mechanism. Besides, these economies stopped using their IR and allowed their currencies to depreciate after depleting less than one third of their IR holdings during the earlier phase of the global financial crisis.   Aizenman and Sun argue that this phenomenon reflects the EMEs' concern that losing reserves too fast may propagate a run on the remaining reserves and named this sentiment as "fear of losing IR" in contrast to "fear of floating".

Naturally, attempts have been made to identify the factors that are responsible for making EMEs reluctant to rely on IR depletion.   Aizenman

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[1] Three exceptions were China, Hungary and Jordan.

and Sun (2009) find that EMEs in which financial factors played more important roles than trade factors in accumulating IR during the period prior to the global financial crisis tended to refrain from using IR.

Aizenman and Hutchison (2010) find that EMEs with larger balance sheet exposure in terms of excess of short-term external debt over IR tend to rely more heavily on exchange rate depreciation to absorb the external pressure. Aizenman and Hutchison, however, use cross-country data and as a result do not tell if economies with high short-term debt show reluctance to rely on IR during normal periods as well as crisis periods.   In order to find an answer to this question, we use cross-country time-series panel data covering the period prior to the global financial crisis as well as the crisis period.

In particular, we employ the difference-in-differences (DD) methodology, which enables us to get a direct view on whether a selected group shows a distinct performance during a particular period (Wooldrige, 2007).   In our case, the selected group is EMEs with high short-term external debt and the particular period is the global financial crisis period.

Our empirical analysis highlights the role of short-term external debt relative to IR in explaining the EMEs' attitude toward using IR as well as the buildup of exchange market pressure during the global financial crisis.   Pre-crisis condition of higher short-term external debt not only made the currencies of EMEs more vulnerable to the global financial crisis but made EMEs reluctant to use their IR in response to the mounting pressure of currency depreciation.   Unlike the previous studies that simply demonstrated a negative relationship between IR loss and short-term external debt in EMEs during the global financial crisis period, our difference-in-differences analysis is capable of finding if the change in the attitude toward using IR during the global financial crisis differs between the high short-term debt group and the other group.

The rest of the paper proceeds as follows.   Section 2 presents some evidence of the fear of losing reserves and discusses the related literature. Section 3 presents the DD model and the data.   Section 4 discusses the estimation results and section 4 concludes.

2. FEAR OF LOSING RESERVES:
## EVIDENCE AND LITERATURE

Currencies crises or financial crises in EMEs are usually accompanied by an abrupt stop of capital inflows and a subsequent reversal of inflows to large outflows of capital, which is termed sudden stops. These sudden stops sometimes create huge depreciation pressure on their currencies.   In response, EMEs in general intervene in the foreign exchange market to prevent sharp depreciation of their currencies and lose a large amount of their international reserves in the process.

During the global financial crisis of 2008-2009, EMEs also suffered from sudden stops and considerable loss of international reserves.   However, the degree of IR depletion during the financial crisis of 2008-2009 was much smaller than that during prior crises. Table 1 compares the average IR depletion rate of the EMEs during the global financial crisis with those during previous crisis episodes.   According to table 1, the average IR depletion rate of EMEs during the global financial crisis was only 16.3% while the rate was 33.6% during the Russian Moratorium and 40.0% during the Asian currency crisis.   The fact that the global financial crisis originated from advanced economies rather than EMEs may be responsible for the lower IR depletion rate.   However, there could be other explanations.

Table 1   Financial Crises and IR Usage

|	Rate of IR Depletion = (max-min)/max	Number of EMEs which experienced IR depletion
Asian Currency Crisis (1997)	40.0%	5
Russian Moratorium (1998)/ LTCM Crisis (1998)	33.6%	8
Global Financial Crisis (2008)	16.3%	11

Source: The Bank of Korea (2009).

Figure 1   IR Loss of EMEs during the Global Financial Crisis of 2008-09
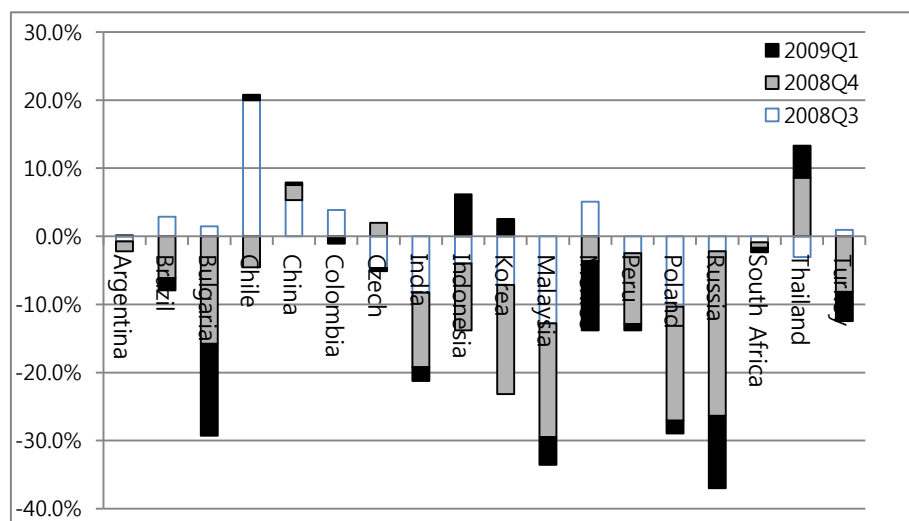
Source: IMF, International Financial Statistics.

Figure 1 presents the reserve depletion rates for 18 EMEs during height of the global financial crisis. As we can see from the figure, only Malaysia and Russia experienced rates of reserve depletion in excess of 30%． The figure also shows that many EMEs displayed a similar pattern of reserve usage, depleting reserves fast during the third quarter and the fourth quarter of 2008 and then abstaining from using reserves during the first quarter of 2009. In particular, several EMEs including Argentina, Brazil, Czech Republic, Indonesia, Mexico, South Africa and Turkey abstained from using reserves and instead allowed their currencies to depreciate substantially. Brazil, Mexico and Turkey even added up their IRs by a small amount during the third quarter of 2008 by allowing depreciation of their currencies. In addition, during the fourth quarter of 2008 Turkey absorbed the large depreciation pressure by large depreciation of its currency (24%).

Figure 2 shows decomposition of the exchange market pressure into absorption by reserve change and absorption by currency depreciation in each quarter of 2008 and 2009 for selected EMEs. In the figure, the bar represents the size of the exchange market pressure.   If the bar is above the

Figure 2   IR Loss vs. Currency Depreciation

Argentina	Brazil	Czech Republic

Indonesia	South Africa	Turkey
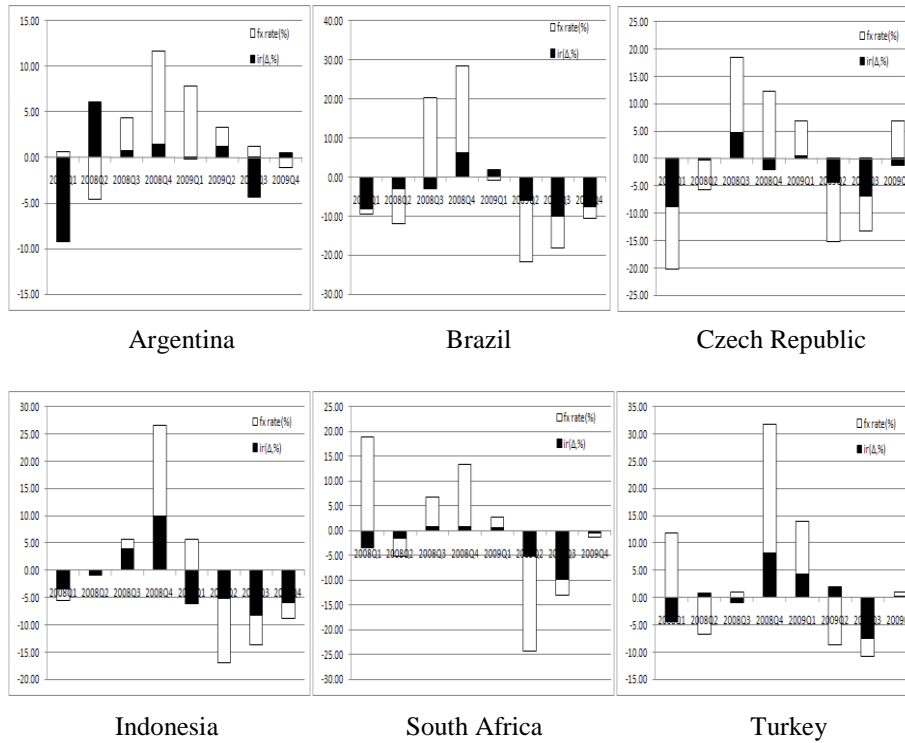
Source: IMF, International Financial Statistics.

horizontal axis, it means existence of currency depreciation pressure during the quarter.   The black portion of the bar represents absorption by reserve loss, measured by the percentage change in IR holdings.   A large positive value for this measure implies that the economy tried to defend its currency by intervening in the foreign exchange market.   The white portion of the bar shows the degree of currency depreciation.   A large positive value for this measure implies that the economy allowed its currency to depreciate against the USD.

As we can observe from the figure, most of these EMEs depended heavily on reserve use during the early stage of the global financial crisis as the positive black bars above the horizontal line demonstrate.   Starting from the

first quarter of 2009, most of these EMEs stopped intervening in the foreign exchange market and allowed their currencies to depreciate as the long white bars above the horizontal line indicate.

It seems that reluctance to use IR commonly observed in EMEs during the global financial crisis is at odds with the fact that these EMEs had accumulated IR in excess of the level that is deemed to be adequate even by the standards based on precautionary motives.

Before the Asian currency crisis of 1997-1998, the three-month-import suggested by IMF had been the traditionally acknowledged criterion for international reserve adequacy. Experience of currency crises in Latin American countries and East Asian countries, however, raised recognition that capital account factors as well as current account factors must be taken into account in designing the criteria of reserve adequacy.

Accordingly, attempts have been made to establish the criterion for the optimal level of IR based on precautionary motives to maintain foreign exchange market stability against sudden stops of capital inflows. For example, the Greenspan-Guidotti rule demands that international reserves should cover short term external debt maturing within a year and yearly current account deficit, which is equivalent to the full potential 12-month need for international liquidity. Wijnholds and Kapteyn (2001) proposed a criterion of IR accumulation based on the short-term external debt and a portion of the broad money with the weight on the broad money determined by the exchange rate regime and the country risk. Aizenman and Lee (2005) tested the importance of precautionary motive against mercantilist motive in accounting for the hoarding of international reserves by EMEs and concluded that overall the empirical results are in line with the precautionary motive.

Recent attempts on the criterion for reserve adequacy adopted a model based approach. Jeanne and Ranciere (2006) derived a formula for the optimal level of reserves for a small economy that is vulnerable to sudden stops in capital inflows. Applying this formula, they found the buildup of reserves in Asia since Asian currency crisis of 1997 seemed to be in excess of what would be implied by the precautionary motive against sudden stops.

IMF (2011) recently proposed a criterion for reserve adequacy based on a two-stage "risk-weighted" approach. In the first stage, relative risk is measured for different potential sources of foreign exchange pressure based on the observed amount of outflows during crisis episodes. Then, in the second stage, the amount of reserves needed to cover the potential amount of outflows is estimated using the risk measure computed in the first stage. According to the criteria, in a floating exchange rate regime, the adequate level of IR should cover at least 100-150% of the sum of 30% of short term external debt, 10% of other portfolio liabilities, 5% of M2 and 5% of exports.[2] Applying this new metric to EMEs, this study found that as of 2009 many EMEs held international reserves in excess of the amount deemed adequate by the new metric.

Thus, a few studies including Aizenman and Marion (2003), IMF (2003) and Jeanne and Ranciere (2006) applied the criteria for reserve adequacy based on precautionary motives to EMEs and showed that EMEs including most of the EMEs in Asia had accumulated IR in excess of the level deemed adequate by these criteria since the Asian currency crisis of 1997-1998. Yet, many EMEs showed reluctance to use their IR during the global financial crisis. Consequently, a few attempts have been made to identify the factors that made EMEs reluctant to rely on IR depletion.

Aizenman and Sun (2009) investigated trade related factors and financial market factors as potential explanatory variables for the difference in the pattern of IR changes in EMEs. Through a regression analysis using a sample of 21 EMEs included in the MSCI and FTSE emerging market list, they found that there existed clear difference in the pre-crisis motive to build up IR between the EMEs that were willing to spend a sizable amount of their IR and the EMEs that showed reluctance to use their IR during the early phase of the global financial crisis. In the EMEs that spent a sizable amount of their IR, trade related factors seemed to have played an important role in the buildup of their IR. On the contrary, in the EMEs that showed fear of

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[2] Including the exports factor in the criteria reflects the potential loss that could arise from a - drop in external demand or a terms-of-trade shock.

losing reserves, financial factors played a significant role as the motive to accumulate their IR.

Aizenman and Hutchison (2010) used the exchange market pressure to measure the degree of reluctance to rely on international reserves as an external adjustment mechanism to explain the difference in the pattern of reserve loss in EMEs during the global financial crisis.   Using a sample of 21 EMEs, they found that EMEs with larger balance sheet exposure in terms of higher total financial liabilities including short-term and long-term debt, equities, FDI and derivatives in excess of IR tended to rely more heavily on exchange rate depreciation to absorb the external pressure.

3. MODEL AND DATA

3.1. The DD Model

Following Aizenman and Hutchison (2010) and Aizenman, Lee, and Sushko (2010), we use international reserve absorption (IRA) to measure the degree of fear of losing reserves.   IRA is defined as the loss of IR as a percentage of total exchange market pressure (EMP), which is calculated as the sum of percentage change in exchange rates and percentage change in IR.[3][4]

$$IRA = \frac{-\Delta IR / IR}{EMP} = \frac{-\Delta IR / IR}{\Delta E / E - \Delta IR / IR}. \tag{1}$$

In equation (1), E denotes the exchange rate against the USD. A lower

[3] A higher value for EMP indicates existence of greater pressure for a currency to depreciate.
[4] There are other ways to define and measure the EMP.   One is to use the inverse of the standard deviation of the reserve loss rate and the currency depreciation rate as the weight for each component.   We ran the DD analysis using the EMP measured in this way but the results in general were robust to the measurement of the EMP.   Another way to measure the EMP is to compute the weight using the estimates for the money demand function in each economy (Weymark, 1995; Park, 1998).

value for IRA indicates that a country relies less on foreign exchange market intervention and allows her currency to depreciate in order to absorb a shock on the exchange market, which in turn implies that the country shows a higher degree of fear of losing IR.

Employing the DD methodology, the following model is chosen to investigate the determinants of fear of losing IR:

$$IRA_{it} = \delta_0 + \delta_1 DS_i + \delta_2 DS_t + \delta_3 DS_i \times DC_t + X_{it}\beta + e_{it}, \qquad (2)$$

where *DS* is a dummy variable that takes the value of one if the sample economy belongs to the group of high short-term external debt and zero otherwise.   This dummy variable captures possible difference in the degree of reliance on IR depletion as the response to large exchange market pressure between the group with high short-term external debt and the other group with relatively low short-term external debt during the entire sample period. The dummy variable *DC* is equal to one during the global financial crisis. The coefficient of our interest, δ_3, measures if there was difference between group of EMEs with high short-term external debt and the group with low short-term external debt in the change of attitude toward using reserves when they were hit by the global financial crisis.   A significantly negative value for δ_3 can be interpreted to indicate that EMEs with high external exposure showed stronger fear of losing reserves when they were hit by the global financial crisis.

X is the vector of other explanatory variables such as the portfolio investment holdings by foreigners (PFR), the trade deficit for recent four quarters (TDR), the inflation rate (Inflation) and the degree of capital market openness (KAOPEN).   PFR and TDR are measured as a ratio of IR.

3.2. Data

We use a quarterly, cross-country panel data.   Among the EMEs comprising the MSCI Emerging Market Index, 18 countries are selected

Table 2   Descriptive Statistics

	2007:3Q-2009:4Q			2008:3Q-2009:1Q		
	Mean	S.D.	Median	Mean	S.D.	Median
EMP (exchange market pressure)	−1.055	14.717	−4.622	11.663	11.781	10.924
IRA (IR absorption)	0.534	4.221	0.602	1.169	5.226	0.386
STR (short-term external debt/IR)	0.464	0.272	0.338	0.480	0.301	0.357
PFR (foreign portfolio/IR)	0.943	0.681	0.818	0.822	0.616	0.747
TDR (trade deficit/IR)	−0.084	0.419	−0.153	−0.030	0.374	−0.131

based on availability of quarterly short-term external debt data. These countries include Argentina, Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, India, Indonesia, Korea, Malaysia, Mexico, Peru, Poland, Russia, South Africa, Thailand and Turkey.

Our full sample period runs from 2007:Q3 to 2009:Q4 and we identify the "global financial crisis period" as the period from 2008:3Q to 2009:1Q during which all of 18 EMEs were faced with substantial pressure of currency depreciation.

The data on international reserves (minus gold), exchange rates against the USD, trade balances, GDP and CPI are obtained from the IMF International Financial Statistics and the foreign portfolio investment holdings data are attained from the IMF Coordinated Portfolio Investment Survey. The gross short-term external debt data are obtained from the Quarterly External Debt Statistics database, provided jointly by the IMF and the World Bank. For the degree of capital market openness, we use the KAOPEN index provided by Ito and Chinn (2007).

The group with high external exposure in terms of short-term external debt is identified based on the ratio of short-term external debt to IR (STR) as of the end of 2008:2Q. Eight countries whose STR is higher than the sample

average are selected as "the high STR group," which includes Bulgaria, Poland, Czech Republic, South Africa, Chile, Argentina, Turkey and Korea. The STR of the high STR group ranges from 0.69 to 0.95 and that of the low STR group ranges from 0.15 to 0.37.   A few descriptive statistics for key variables are presented in table 2.

4. EMPIRICAL RESULTS

4.1. Determinants of Exchange Market Pressure

   It is likely that policy makers pay attention to the movement of the factors that have significant contribution to the buildup of the exchange market pressure when they determine whether to use their IR to stabilize the foreign exchange rate.   Thus, before estimating the DD model for IR absorption, we investigate the factors that contributed to the surge in exchange market pressure in EMEs during the global financial crisis.   In particular, we focus on short-term external debt, portfolio investment holdings by foreigners and trade deficit.

   It should be clear why we focus on external positions like short-term external debt and portfolio investment holdings rather than investment outflows as the determinants of exchange market pressure.   First of all, a large investment outflow can happen only when foreigners are holding a large investment position beforehand.   Secondly, when large negative economic shocks like the Asian currency crisis of 1997-1998 and the global financial crisis of 2008-2009 occur, alarmed investors usually look at external positions to sort out economies with potential problems.

   The sample consists of 18 EMEs covering the period from the third quarter of 2008 to the first quarter of 2009, which is regarded as the height of the global financial crisis.

   Although it is likely that the amount of investment outflows caused by negative economic shocks will be larger when the amount of domestic equity

and bond holdings by foreigners is larger, that does not necessarily mean a larger amount of domestic bond holdings by foreigners always results in a larger exchange market pressure. On the contrary, during the period of tranquility in international financial markets, the foreign exchange market may remain stable even though foreigners hold a considerable amount of domestic equities and bonds.   As a result, the effect of larger domestic bond holdings by foreigners on the exchange market pressure is likely to show up only during periods of great economic turbulence.

For this reason, we focus on the global financial crisis period to investigate if larger portfolio holdings of foreigners lead to larger exchange market pressure. We identify the global financial crisis period as the period from 2008:3Q to 2009:1Q during which most of the emerging market economies were faced with substantial pressure of currency depreciation.

We estimate the model with country fixed effects and allow for cross-country heteroskedasticity.[5]   In order to avoid the problem of endogeneity, we use the previous quarter data for STR, PFR and TDR.   The results are presented in table 3.   In table 3, Swap is a dummy variable that equals one when country i has a dollar liquidity swap arrangement with the Federal Reserve System in period t.   Among our sample economies, only Brazil, Korea and Mexico established temporary liquidity swap facilities with the Federal Reserve System on October 29, 2008.   Growth and Inflation are measured by the rate of change in gross domestic product and consumer price index, respectively.   We use the KAOPEN index provided by Ito and Chinn (2007) for the variable KAOPEN.

Estimates in column (1) demonstrate that all three variables, STR, PFR and TDR contributed to adding up the pressure of currency depreciation during the height of the global financial crisis.   Columns (2), (3), (4) and (5), however, show that this result is not robust to inclusion of other explanatory variables.   When other explanatory variables such as Inflation, Growth and KAOPEN are included, PFR and TDR become no longer significant.   The only variable that remains significant throughout all five models is STR,

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[5] The Hausman test rejects the random effect model in favor of the fixed effect model.

Table 3 Panel Estimation Results for Determinants of Exchange Market Pressure

	(1)	(2)	(3)	(4)	(5)
Constant	−16.81* (9.65)	−21.17** (8.64)	−16.23* (9.73)	−22.20* (12.23)	−23.03* (12.48)
STR(t–1)	47.90** (20.43)	53.76*** (18.61)	47.28** (20.44)	54.32** (24.59)	55.29** (21.94)
PFR (t–1)	8.92* (4.93)	6.19 (5.15)	6.23 (5.46)	5.27 (6.45)	4.49 (6.71)
TDR(t–1)	37.42*** (11.67)	35.02*** (11.61)	25.69* (15.17)	23.43** (17.65)	20.97 (18.51)
Swap(t)	−14.03*** (5.53)	−14.42*** (5.46)	−14.62*** (5.53)	−15.01** (6.35)	−15.59** (6.54)
Inflation(t)	-	0.50 (0.40)	-	0.65 (0.90)	0.65 (0.91)
KAOPEN(t)	-	-	2.62 (2.28)		-0.14 (0.50)
Growth(t)	-	-	-	−0.05 (0.46)	1.82 (3.63)
R-square	0.79	0.82	0.79	0.72	0.72
Number of obs.	54	54	54	54	54

Note: *, ** and *** indicate significance at the level of 10%, 5% and 1% respectively. Standard errors are reported in the parentheses.

which implies that high short term external debt relative to international reserves was the key factor in intensifying the depreciation pressure for EME currencies during the height of the global financial crisis.

Table 4 demonstrates that our results are quite robust to the choice of the sample period. As we can see from table 4 that presents the estimation results for exchange market pressure for slightly different sample periods, short-term external debt consistently maintains statistical significance in all of the estimation results.

Table 4 also shows that in addition to short-term debt, inflation rate and growth rate also had significant influence on the exchange market pressure experienced by EMEs especially when the sample period identified as the global financial crisis is extended.

**Table 4   Determinants of Exchange Market Pressure
with Different Sample Periods**

	2008.3Q-2009.1Q(1)	2008.3Q-2009.2Q(2)	2008.1Q-2009.1Q(3)	2008.1Q-2009.2Q(4)
Constant	−22.20*	−43.20**	−35.78**	−39.27***
	(12.23)	(14.65)	(14.96)	(12.86)
STR(t–1)	54.32**	92.78***	74.79***	65.73***
	(24.59)	(28.55)	(25.08)	(21.45)
PFR(t–1)	5.27	−18.34**	−4.31	−8.70
	(6.45)	(8.66)	(6.91)	(7.01)
TDR(t–1)	23.43	46.91***	5.90	10.33
	(17.65)	(17.44)	(13.48)	(10.29)
Swap(t)	−15.01**	−29.67***	−16.77**	−24.56***
	(6.35)	(5.59)	(7.69)	(5.86)
Inflation(t)	0.65	3.67***	1.88**	3.18***
	(0.90)	(0.45)	(0.73)	(0.64)
Growth(t)	−0.05	−0.16	−1.55***	−1.12***
	(0.46)	(0.54)	(0.44)	(0.38)
R-square	0.72	0.69	0.50	0.48
Number of Observations	54	72	90	108

Note: *, ** and *** indicate significance at the level of 10%, 5% and 1% respectively. Standard errors are reported in the parentheses.

4.2. Determinants of IR Absorption

Table 5 shows the result of the DD analysis on the determinants of IR absorption.   Although we use a panel data, the model is estimated without any fixed effects since the two dummy variables, *Dummy_STR* and *Dummy_Crisis*, do not allow us to add fixed effect dummy variables.   If we look at the result provided in columns (1) and (2), the coefficient of *Dummy_STR* is statistically insignificant but the coefficient of the product of *Dummy_STR* and *Dummy_Crisis* is significantly negative.   Such a result can be interpreted to indicate that while high short-term external debt did not necessarily make EMEs reluctant to use IR during normal times, it made them reluctant to use IR during the global financial crisis.   In the meantime, the significantly positive coefficient of *Dummy_Crisis* means that EMEs in general relied more on IR absorption during the global financial crisis than they did during normal times.

Table 5   Estimation Results for IR Absorption (IRA)

Dependant Variable:
IR Loss Relative to Exchange Market Pressure (IR Absorption), 2007.3Q-2009.4Q

	(1)	(2)	(3)	(4)
Constant	0.56 (0.38)	0.25 (0.40)	0.22 (0.63)	–0.04 (0.64)
Dummy_STR	–0.64 (0.51)	0.07 (0.60)	–0.79 (0.56)	–0.09 (0.64)
Dummy_Crisis	0.89* (0.55)	1.95** (0.73)	1.03* (0.58)	2.07*** (0.75)
Dummy_STR·Dummy_Crisis		–2.38** (1.10)	-	–2.34** (1.11)
PFR(*t*–1)			0.55 (0.41)	0.54 (0.40)
TDR(*t*–1)			–0.34 (0.68)	–0.27 (0.68)
Inflation(*t*)			–0.04 (0.07)	–0.05 (0.07)
KAOPEN(*t*)			0.17 (0.21)	0.17 (0.21)
R-square	0.02	0.05	0.04	0.06
Number of Observations	180	180	180	180

Note: *, ** and *** indicate significance at the level of 10%, 5% and 1% respectively. Standard errors are reported in the parentheses.

Columns (3) and (4) verify that this conclusion is robust to inclusion of other explanatory variables including portfolio investing holdings by foreigners, trade deficit, inflation rate and capital market openness.   In particular, columns (3) and (4) demonstrate that neither portfolio investment holdings of foreigners nor trade deficits had any significant influence on the degree of EMEs' reliance on IR.

IMF (2000) pointed out that a country can withstand a simplified stress test when its reserve to short-term debt ratio is at least 130%.   Applying this

criterion, we can classify 6 countries instead of 8 countries as high STR countries.   They are Bulgaria, Poland, Czech Republic, South Africa, Chile and Turkey and their STR ranges from 0.77 to 0.95.   In order to see if our results are robust to the choice of the criterion for group classification, we estimated the DD model using these six economies as the high-STR group. Estimation results using the new high STR group, however, are similar to those presented in table 5.[6]

In order to further investigate the influence of portfolio investment holdings and trade deficits on the reluctance of losing IR during the periods of turbulence, we applied the DD analysis using the portfolio investment holdings by foreigners relative to IR (PFR) and the trade deficits relative to IR (TDR) as the criterion to distinguish between the treatment group and the control group.

Columns (PRF-1) and (PFR-2) in table 6 present the results when PFR is used as the group classification criterion.   In this table, *Dummy_PFR* is a dummy variable that is equal to one when the economy belongs to the group with relatively high portfolio investment holdings by foreigners.   The economies that belong to the high PFR group are South Africa, Mexico, Brazil, Korea, Turkey, Indonesia, Chile, India and Poland.   The economy with the lowest PFR in this group is Poland with the PFR of 1.13.   As we can see from table 6, neither *Dummy_PFR* nor the product of *Dummy_PFR and Dummy_Crisis* has a significant effect on IR absorption, implying that there existed no difference between economies with a high PFR and those with a low PFR in the attitude toward using IR during the global financial crisis.   The only significant variable is *Dummy_Crisis* in column (PFR-1). The significantly positive coefficient estimate implies that EMEs in general tended to rely on IR during the global financial crisis.

Columns (TDR-1) and (TDR-2) in table 6 display the results when TDR is used as the group classification criterion.   In this table, *Dummy_TDR* is a dummy variable that is equal to one when the economy belongs to the group

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[6] We do not report the estimation results separately because the results are qualitatively identical to those presented in table 5.

Table 6   DD Analysis with Groups Classified by PFR or TDR

DependantVariable:
IR Loss Relative to Exchange Market Pressure (IR Absorption), 2007.3Q-2009.4Q

	(PFR-1)	(PFR-2)	(TDR-1)	(TDR-2)
Constant	0.62 (0.67)	0.84 (0.70)	0.96 (0.68)	1.14 (0.68)
Dummy_Crisis	1.04* (0.57)	0.37 (0.76)	1.18** (0.57)	0.61 (0.69)
Dummy_PFR	0.64 (0.52)	0.20 (0.62)	-	-
Dummy_PFR·Dummy_Crisis	-	1.52 (1.12)	-	-
Dummy_TDR	-	-	1.45** (0.66)	0.91 (0.75)
Dummy_TDR·Dummy_Crisis	-	-	-	1.78 (1.16)
$STR(t-1)$	−1.13 (1.04)	−1.12 (1.05)	−2.62** (1.11)	−2.66** (1.10)
$TDR(t-1)$	−0.26 (0.70)	−0.30 (0.71)	-	-
$PFR(t-1)$	-	-	0.25 (0.43)	0.29 (0.43)
$Inflation(t)$	−0.04 (0.07)	−0.05 (0.07)	−0.07 (0.07)	−0.07 (0.07)
$KAOPEN(t)$	0.14 (0.21)	0.15 (0.21)	0.20 (0.21)	0.21 (0.21)
R-square	0.04	0.05	0.06	0.08
Number of Observations	180	180	180	180

Note: *, ** and *** indicate significance at the level of 10%, 5% and 1% respectively.
      Standard errors are reported in the parentheses.

with relatively high trade deficits relative to international reserves.   The
economies that belong to the high TDR group are Turkey, Bulgaria, Poland,
Indonesia, South Africa and Mexico.   The average TDR of the high TDR
group is 0.36 while the average for the low TDR group is –0.29.   As we can
see from table 6, the product of *Dummy_TDR* and *Dummy_Crisis* does not
have any significant effect on IR absorption, implying that there existed no

difference between economies with a high TDR and those with a low TDR in the attitude toward using IR during the global financial crisis. On the contrary, columns (TDR-1) and (TDR-2) of table 6 demonstrate that when STR is included as an additional explanatory variable, its coefficient is significantly negative.

The results presented in table 6 demonstrate that neither high portfolio investment holdings by foreigners nor high trade deficits played a significant role in determining the attitude of EMEs toward IR depletion. It was the short-term debt relative to their IR that determined the attitude of EMEs toward using IR as an external adjustment mechanism.

5. CONCLUSION

Our empirical analysis demonstrates that larger short-term external debt, higher foreign portfolio investment position and larger trade deficit relative to IR made EMEs more vulnerable to external shocks and that given the foreign exchange market pressure EMEs with a larger short-term external debt tended to refrain from using IR during the global financial crisis of 2008-2009 although they had accumulated IR in excess of the level deemed adequate by the criteria based on precautionary motives.

The findings of our study imply that unless adequate measures are taken, fear of losing IR is likely to motivate EMEs to build up even larger IR holdings. Accumulating and maintaining a large amount of IR, however, are costly to EMEs since IR is usually invested in safe and liquid assets with low yields.   In addition, the effort of EMEs to build up larger IR is likely to intensify the global imbalances and destabilize the international financial system.

One of the measures that could help EMEs maintain foreign exchange market stability without building up enormous IR is to establish and strengthen international financial safety nets for EMEs.   Efforts have already been made to strengthen international financial safety nets by

improving the IMF loan facilities and by establishing regional swap arrangements including the CMIM.

Another measure is to adopt capital flow management measures to manage short-term external debt.   Some EMEs have already introduced capital flow management measures to cope with massive inflows of capital after the global financial crisis.   One of the implications of this paper for these EMEs is that while it is important to build up a sufficient level of IR, they had better focus on monitoring and managing the size short-term external debt in their efforts to manage inflows of capital.   In this regard, the macro-prudential measures introduced by the Korean government to restrict expansion of external liabilities of domestic banks were adequate and effective in bringing about the compositional change of external liabilities away from short-term external debt.

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