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Exchange Market Pressure and Absorption by International Reserves: Emerging Markets and Fear of Reserve Loss During the 2008-09 Crisis

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Abstract[*]

This paper evaluates how the global financial crisis emanating from the U.S. was transmitted to emerging markets. Our focus is on the extent that the crisis caused external market pressures (EMP), and whether the absorption of the shock was mainly through exchange rate depreciation or the loss of international reserves. Controlling for variety of factors associated with EMP, we find clear evidence that emerging markets with higher total foreign liabilities, including short- and long-term debt, equities, FDI and derivative products—had greater exposure and were much more vulnerable to the financial crisis. Countries with large balance sheet exposure -- high external portfolio liabilities exceeding international reserves—absorbed the global shock by allowing greater exchange rate depreciation and comparatively less reserve loss. Despite the remarkable buildup of international reserves by emerging markets during the period prior to the financial crisis, countries relied primarily on exchange rate depreciation rather than reserve loss to absorb most of the exchange market pressure shock. This could reflect a deliberate choice ("fear of reserve loss" or competitive depreciations) or market actions that caused very rapid exchange rate adjustment, especially in emerging markets with open capital markets, overwhelming policy actions.

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1. Introduction

International financial markets were at the heart of the world-wide financial crisis that emerged in late 2007 and reached a climax between August 2008 and February 2009. Although the crisis started with mortgage-related (sub-prime) crisis in the United States, and was closely linked to banks in Western Europe holding mortgage-backed securities and derivative products, it quickly led to global liquidity crisis that caused financial market turmoil through the rest of the world.

We focus in this paper on the extent to which the global financial shock adversely affected the external position of emerging market economies. We measure external position by looking at changes in exchange market pressure—a combination of exchange market depreciation and loss of international reserves—as well as considering these two components separately. We are interesting in two basic questions: Firstly, how was the transmission of the global shock affected by the extent of their international balance sheet exposure, financial development and financial openness?[1] Secondly, given the degree of exchange market pressure, what determines the tradeoff or choice between exchange rate depreciation and loss of international reserves in absorbing the shock? We sidestep in this paper questions regarding the root causes of the crisis. These issues are covered by growing literature dealing with the pre-crisis trends and policies that led to the buildup of financial vulnerabilities, and ultimately to the crisis in the US and it rapid transition to the global economy [see Obstfeld (2010), Obstfeld and Rogoff (2010), and the references therein].

Our main focus in on how the global financial crisis affected emerging market economies (EMs), where we define emerging market economies according to the Morgan Stanley Capital International (MSCI) Emerging Markets index (see Table 1,

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[1] See Eichengreen and Hausmann (2005) for studies on the impact of balance sheet exposure on Financial Instability.

notes for the list of EMs). The focus on emerging markets stems from several observations. First, these countries were the source of most of the pre-crisis economic growth, and most of the global population lives there. Second, the process of globalization rapidly increased the financial and trade linkages of emerging markets with the OECD countries, relative to the more limited integration of developing, non emerging market countries. Finally, the OECD countries have had elastic access to large dollar swap lines extended by the US FED (either directly or via FED's large swap line with the ECB). Thereby, the OECD countries were able to meet excess demand for dollar liquidity by borrowing dollar reserves from the FED, facilitating the adjustment and deleveraging pressures. In contrast, most emerging markets were not able to rely on borrowed reserves via swap lines, and were thereby more exposed to the need to adjust abruptly to the global crisis.

Our results highlight the importance of total external liabilities/GDP ratio (including debt, equity, FDI and derivative products) in accounting for exchange market pressures, and the short term external debt/international reserves ratio in accounting for the higher relative importance of exchange rate depreciation in accommodating the adjustment to a given degree of exchange market pressure. Our findings also corroborate that there was a systematic variation in emerging markets exposure to EMP, and in the ways to accommodate these pressures.

Section 2 overviews the response of emerging and developing economies to the global financial shock. Section 3 applies multivariate regression analysis, explaining external vulnerability to financial shocks. Section 4 explains the tradeoff between reserve loss and exchange rate depreciation, and Section 5 concludes.

2. **Response of Emerging and Developing Economies to the Global Financial Shock**

Appendix Table A1 presents the change in Exchange Market Pressure (EMP),[2] exchange rate depreciation and percentage loss of international reserves during the

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[2] See Girton and Roper (1977) and Frankel (2009) for further discussion of exchange market pressure.

height of the financial crisis, August 2008 – February 2009, and during the worst phase of the crisis: September –December 2008. The EMP measure is the sum of the percentage change in the exchange rate (positive values denote percentage depreciation) and percentage loss of reserves. High values denote greater external pressure.[3] The two components of EMP, percentage change in the exchange rate (depreciation relative to the USD) and percentage in international reserves.

It is remarkable how extreme and widespread across emerging markets were external pressures during August 2008 – February 2009, ranging from highs experienced in Poland (108%) and Russia (89%) to negative values (a combination of a net appreciation and gain in international reserves) for countries such as Hong Kong (SAR), China, Israel, Jordan and Thailand. With the exception of Venezuela, all the emerging markets with positive EMP experienced substantial depreciation of their currencies against the USD during August 2008 – February 2009. Table A1 also shows the considerable heterogeneity in their response. Poland depreciated the most, 79%, while Brazil, Korea, Mexico and Russia depreciation by about 50%. Reserves loss were more moderate, led by Russia, Poland and Malaysia (losing 37%, 28% and 27%, respectively), followed by Venezuela, Morocco, India and Korea (23%, 21%, 19% and 19%, respectively).

To put this into broader perspective, the average EMP for the full sample of all countries (independently of their income levels) was about 30%. Emerging markets and low income countries had average EMP of about 35%, while middle and high income countries had lower EMP rates at 28% and 32%, respectively. Emerging markets differ most from other country groups in the composition of exchange rate/reserve loss—emerging markets absorbed much less of the EMP by losing reserves (and experienced corresponding greater exchange rate depreciation).

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[3] A second EMP measure is the sum of the percentage change in the exchange rate and loss of international reserves as a percentage of the monetary base. This measure focuses on the potential monetary effects of reserve losses during the financial crisis. This measure gave an almost identical ranking of external market pressure and is not reported for brevity.

Specifically, the ratio of reserve loss to exchange rate depreciation is 0.32 while low income countries, with a similar EMP to emerging markets, had a ratio of 0.73. The ratio for the full sample is 0.45.

The financial crisis also hit all regions of the world, though the greatest effect was felt in Eastern Europe/Central Asia (50% EMP). This is not surprising given that the sub-prime crisis emanated from the U.S. was directly linked to financial institutions in Western Europe, and Western Europe in turn was tightly linked through banking ties with the more fragile economies of Eastern Europe. By contrast, Africa/Middle East fared best as a region with the lowest EMP, with an average of only 20%, followed closely by Latin America with 23% EMP.

Panel studies of EMP frequently normalize the exchange rate depreciation rate and reserve loss rate, focusing on the deviations from their means, normalized by the standard deviation of the relevant series (see Levy-Yeyati and Sturzenegger (2005)). As our focus is on a cross country comparison during an unprecedented global crisis, we refrain from such normalizations. As a sensitivity analysis, we compare our EMP measure and the Weighted EMP used at the IMF's World Economic Outlook (2009). The correlation between the two measures in highly significant at 0.63.

In summary, the global financial crisis affected countries across the globe in all regions, income levels and whether or not they had tight restrictions on capital flows. Exchange market pressure was intense in most countries, mainly absorbed by exchange rate depreciation but also through substantial losses of international reserves.

3. Explaining External Vulnerability to Financial Shocks

Multivariate regression analysis of the link between EMP and selected explanatory variables in emerging markets is reported in Tables 1 and 2. We define emerging market economies according to the Morgan Stanley Capital International

(MSCI) Emerging Markets index, focusing on emerging markets that experienced positive EMP and were not the recipients of IMF standby agreements, subject to data availability [see Tables 1-2, *notes* for further details]. The dependent variable is the degree of exchange market pressure (EMP) during the height of the financial crisis, September 2008 – December 2008 (table 1), and a wider 9-month window from July 2008 through February 2009 (table 2). We are focusing on our two key measures of financial vulnerability: total external liabilities/GDP and balance sheet exposure (Short term external debt/IR -1). We also include a host of control variables common in the empirical literature on currency crises. The control variables are GDP per capita, measures of trade and financial openness, the extent of capital controls, the use of swap lines, OECD membership, the rise of the real exchange rate in the years prior to the crisis (2003-2007), and international reserves/GDP.[4] Specific variable definitions and data sources are provided in the data appendix.

[Tables 1-2 about here: regressions of EMP]

We find that total external liabilities are significantly (at the 1% level) and positively related to exchange market pressure (EMP) and this result is robust to every model specification, for both the short and the longer sample period. Larger external liabilities—including short- and long-term debt, equity, FDI and derivative products-- made emerging markets more vulnerable to the global financial crisis.

During the peak of the crisis, balance sheet exposure is also positively related to exchange market pressure, but is not significant at conventional levels. OECD membership effect is positive and significant, raising the EMP, in line with the greater exposure of OECD countries to the US crisis. Access to a swap line reduces the EMP, as it allows meeting deleveraging pressure by borrowing reserves. The

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[4] These controls include the one used by Frankel and Saravelos (2010) in their study of EMP incidences during the crisis. Other variables, not reported for brevity, were also used as control variables but were never significant. In particular, we included inflation rates, interest rates, monetary independence and alternative measures of capital controls.

other variables investigated—capital account openness, trade openness—were not statistically significant different from zero. Similar results hold for both the shorter and the longer crisis window, though the OECD dummy and the access to the swap lines lose their significance in the longer crisis window.

4. The tradeoff between reserve loss and exchange rate depreciation

We observed that countries differ markedly in their response to the financial crisis in terms of whether exchange rate depreciation or losses of reserves absorb EMP. Are there discernable patterns in the loss of international reserves relative to exchange rate depreciation in emerging markets for a given degree of exchange rate pressure during the global financial crisis? This is measured as the loss of international reserves as a percentage of total exchange market pressure. Large values indicate that countries are absorbing a high percentage of the total shock by selling international reserves.

It is not clear a priori how emerging markets would respond, in terms of using exchange rates or reserves, in absorbing an EMP shock. It would seem to be related to balance sheet exposure. If emerging markets have a high degree of short-term external debt exposure, often denominated in foreign currency, then they may want to limit exchange rate depreciation that increases the real value of the foreign debt. This would suggest a positive relationship between balance sheet exposure and Reserve Loss Relative to EMP. On the other hand, balance sheet exposure by definition means that short-term external liabilities are not covered by holdings of international reserves. This makes countries more vulnerable to the global financial shock and less able to stem the external crisis by using international reserves that are relatively in short supply. This argues for a negative link between balance sheet exposure and Reserve Loss Relative to EMP.

Tables 3 and 4 report the multivariate regression analysis of the link between IR loss rate/EMP and the explanatory variables applied in Tables 1 and 2 during the height of the financial crisis, September 2008 – December 2008 (table 3), and a wider

9-months window from July 2008 through February 2009 (Table 4). Balance sheet exposure is significantly (in most cases at 5% level) and negatively associated with Reserve Loss Relative to EMP. Countries with fewer reserves relative to short-term external portfolio debt rely more on exchange rate depreciation to absorb the EMP shock. Limited reserves constrain countries in how they respond to the crisis, as is consistent with the second hypothesis discussed above.[5] By contrast, total external liabilities, trade openness, capital account liberalization and swap lines are not statistically significant. The commodity intensity of trade (commodity exports as a percentage of total exports) is positively associated with Reserve Loss Relative to EMP and is statistically significant at the 5% level at the peak of the crisis, the last quarter of 2008. It appears that emerging markets relying more on commodities in their export trade are more prone to use international reserves, and try to limit exchange rate depreciation, when faced with the global financial shock.

[Tables 3-4 about here: regressions of IR loss rate/EMP]

Countries with few reserves relative to portfolio debt are much more likely to rely on exchange rate depreciation than use scare reserves to absorb the global financial shock. By contrast, the extent of total external liabilities does not enter significantly (as it did in explaining overall EMP). This finding is an interesting contrast to the results in Tables 1 and 2, and suggests that the determinants of total vulnerability (EMP) are distinct from the factors that determine the tradeoff between using reserves or the exchange rate (Reserve Loss Relative to EMP).

Figures 1 and 2 plot the conditional association between Reserve Loss Relative to EMP and balance sheet exposure for the two sample periods, showing the strong negative association between the two variables. This association is more pronounced

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[5] The economic effect is quite large: a 10 percentage point higher pre-crisis balance sheet exposure (Sort term Debt in excess of IR) relative to IR, corresponds to up to 3.06 percentage points (3.87 percentage points) lower fraction of IR loss relative to EMP during the 4-month (the 9-months) crisis windows, respectively.

during the peak of the crisis, a period when emerging market-commodity exporters relied more heavily than other EMs on reserves depletion to cushion their adjustment to EMP.

[Figures 1-2 about here: the association of IR loss rate/EMP and Balance sheet exposure]

5. Conclusions

We found clear evidence that emerging markets with higher ratio of the total foreign liabilities/GDP were more vulnerable to the financial crisis. Higher balance sheet exposure (higher short term foreign debt relative to international reserves) is significantly associated with greater weight attached to currency depreciation and lower weight attached to losing international reserves as means of dealing with exchange market pressure during the crisis. While larger total external liabilities/GDP are clearly associated with larger EMP, higher ratio of external short term debt/international reserves is associated with higher weight on price adjustment (exchange rate depreciation) and lower weight on quantity adjustment (losing reserves) as a way to accommodate a given EMP. Despite the remarkable buildup of international reserves by emerging markets during the period prior to the financial crisis, emerging markets relied primarily on exchange rate depreciation rather than reserve loss to absorb most of the exchange market pressure shock—"fear of reserve loss."

These findings are consistent with the observations in Aizenman and Yi (2010) regarding emerging markets' switch during the crisis from the fear of floating [Calvo and Reinhart (2001)] to the fear of losing reserves during the crisis. While international reserves/GDP ratios were high in most emerging markets before the crisis relative to their levels in previous crises, they rarely were high enough to cover the entire external portfolio liabilities of the affected countries. Thus, countries opted to rely on exchange rate adjustment, refraining from fast depletion of their

international reserves. The reluctance to rely more on reserves depletion may reflect several concerns: fear that losing reserves too fast may propagate a run on the remaining reserves, and uncertainty about crisis duration may suggests keeping reserves to deal with future market pressure. Furthermore, at times of collapsing global demand, countries are more willing to engage in competitive depreciation, as the downside of higher inflation is sharply mitigated by the global recession. Interestingly, we find that emerging markets relying more on commodities in their export trade are more prone to use international reserves, and try to limit exchange rate depreciation, when faced with the global financial shock. This is consistent with the notion that commodities are priced by the global market, thus commodities exporters don't benefit from depreciation, opting instead to use their reserves to absorb exchange market pressure.

Our results are also in line with Frankel and Saravelos (2010), reporting several pre-crisis variables accounting for the 2008-09 crisis incidence. Specifically, they found that higher pre-crisis reserves/GDP and lower pre-crisis real exchange appreciation were associated with lower exchange market pressure during the crisis. Yet, our results also suggest the importance of the ratio total external liabilities/GDP in accounting for higher exchange market pressure during the crisis. Controlling for this broad exposure measure renders balance sheet exposure insignificant.

Our results corroborate the notion that globally linked national financial markets, intermediated via foreign currency markets, transmitted globally the 2008-9 financial crisis. In turbulent times, when the duration of depth of the global crisis remains unknown, emerging markets behavior has been characterized more by the fear of losing reserves, and less by the fear of floating. Despite the remarkable buildup of international reserves by emerging markets during the period prior to the financial crisis, countries relied primarily on exchange rate depreciation rather than reserve loss to absorb most of the exchange market pressure shock. This could reflect a deliberate choice, possibly to gain competitiveness at times of collapsing export demand. It may also reflect market actions that moved quickly and strongly to adjust to changing

circumstances, especially in emerging markets with open capital markets. The financial market crisis was followed by a global recession, suggesting that exchange rate depreciations attempting to improve international competitiveness can be part of the adjustment of small economies but can't resolve global collapsing demands. Our findings also confirm the key importance of balance sheet effects in explaining vulnerabilities and adjustments. Countries with higher total foreign liabilities/GDP were more vulnerable to the financial crisis. Countries with larger balance sheet exposure — higher external portfolio liabilities exceeding international reserves — responded to the global shock by allowing greater exchange rate depreciation and comparatively less reserve loss.

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Table 1: Exchange Market Pressure (EMP) and Pre-Crisis Emerging Markets Fundamentals; 4-Month Period.

Dependent Variable: Exchange Market Pressure (EMP), Sept.2008-Dec.2008

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Balance Sheet Exposure	0.027		0.049	0.035								
	(0.39)		(0.86)	(0.65)								
Tot. Liabilities (% GDP)		2.55e-07***	2.80e-07***	2.74e-07***	2.74e-07***	3.22e-07***	2.73e-07***	3.66e-07***	2.99e-07***	2.82e-07***	2.72e-07***	2.79e-07***
		(5.31)	(6.70)	(6.22)	(6.33)	(7.38)	(5.85)	(4.72)	(6.73)	(5.25)	(6.11)	(6.82)
GDP per capita	6.96E-06	7.13E-07	-5.63E-06	-5.49E-06	-5.49E-06	-6.79E-06	-5.26E-06	-8.66E-06	-4.24E-06	-5.59E-06	-5.47E-06	-6.29E-06
	(1.21)	(0.49)	(0.21)	(1.52)	(1.40)	(1.53)	(1.35)	(1.68)	(0.80)	(1.30)	(1.35)	(1.63)
OECD Member				0.108**	0.122**	0.175**	0.118**	0.174	0.135**	0.119**	0.124**	0.085**
				(2.20)	(2.88)	(2.99)	(2.49)	(1.44)	(2.74)	(2.50)	(2.69)	(2.23)
Swap Lines						-0.136**						
						(2.18)						
Reserves (%GDP)							-0.035					
							(0.16)					
Rise in REER (%, 2003-2007)								-0.285*				
								(2.42)				
Exchange Rate Stability Index									0.109			
									(1.38)			
Net FDI (%GDP)										0.035		
										(0.19)		
Capital Acct. Openness											-0.002	
											(0.18)	
Trade Openness												0.000
												(0.43)
Constant	0.135*	0.081**	0.104*	0.111**	0.097**	0.088**	0.102*	0.123**	0.041	0.089*	0.098**	0.097**
	(2.06)	(2.39)	(1.99)	(2.35)	(2.75)	(2.60)	(1.80)	(2.93)	(0.69)	(1.82)	(2.82)	(2.44)
Observations	18	18	18	18	18	18	18	10	16	18	18	16
R-squared	0.179	0.522	0.572	0.644	0.619	0.705	0.62	0.691	0.711	0.62	0.62	0.704

Notes: Robust t statistics in parentheses; *, **, *** indicate variables significant at 10%, 5%, and 1% respectively. All independent variables as of 2007, except for Swap Lines which indicate countries that received and used a swap line during the crisis period. Sample restricted to emerging markets that experience positive EMP.

We define emerging market economies according to the Morgan Stanley Capital International (MSCI) Emerging Markets index. The index includes 26 countries: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, Turkey and Venezuela. We exclude Hungary because it received its first substantial IMF disbursement of approximately $6.4 billion during our sample period significant affecting its foreign exchange reserve position and potentially the level of exchange rate depreciation. We also exclude Taiwan due to insufficient data. We construct our sample from the remaining emerging market economies which experienced positive EMP: 18 during the 4-month time window and 20 during the 9-months window. These are: Argentina, Brazil, Chile, Colombia, Czech Republic, Egypt, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Turkey and Venezuela.

Table 2: Exchange Market Pressure (EMP) and Pre-Crisis Emerging Markets Fundamentals; 9-Month Period.

Dependent Variable: Exchange Market Pressure (EMP), July 2008-Feb.2009

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Balance Sheet Exposure	0.094 (0.84)		0.135 (1.35)	0.135 (1.32)								
Tot. Liabilities (% GDP)		4.33e-07*** (5.31)	4.72e-07*** (4.89)	4.73e-07*** (4.77)	4.42e-07*** (5.93)	4.94e-07*** (6.04)	4.42e-07** (5.84)	5.06e-07*** (2.98)	4.21e-07*** (4.68)	4.70E-07 (5.02)	4.25e-07*** (5.42)	5.16e-07*** (7.61)
GDP per capita	20.6e-06** (2.76)	13.3e-06* (1.80)	8.85e-06* (2.05)	8.52E-06 (1.17)	8.52E-06 (1.57)	1.04E-05 (1.27)	9.30E-06 (1.43)	1.04E-05 (0.69)	1.17E-05 (1.43)	1.42E-05 (1.48)	1.04E-05 (1.53)	1.06E-05 (0.87)
OECD Member				0.006 (0.05)	0.05 (0.37)	0.108 (0.55)	0.052 (0.37)	0.04 (0.11)	0.022 (0.14)	0.034 (0.25)	0.075 (0.59)	-0.011 (0.13)
Swap Lines						-0.162 (0.95)						
Reserves (%GDP)							0.013 (0.05)					
Rise in REER (%, 2003-2007)								-0.206 (0.42)				
Exchange Rate Stability Index									0.016 (0.07)			
Net FDI (%GDP)										0.138 (0.39)		
Capital Acct. Openness											-0.036 (1.28)	
Trade Openness												0.001 (1.16)
Constant	0.286*** (3.42)	0.173*** (3.22)	0.240*** (3.62)	0.241*** (3.40)	0.179*** (3.10)	0.171** (2.84)	0.178** (2.47)	0.202* (1.96)	0.178 (1.30)	0.151* (2.06)	0.187*** (3.43)	0.138** (2.39)
Observations	20	20	20	20	20	20	20	12	17	20	20	18
R-squared	0.369	0.577	0.654	0.655	0.581	0.605	0.581	0.575	0.538	0.584	0.61	0.771

Notes: Robust t statistics in parentheses; *, **, *** indicate variables significant at 10%, 5%, and 1% respectively. All independent variables as of 2007, except for Swap Lines which indicate countries that received and used a swap line during the crisis period. Sample restricted to emerging markets that experience positive EMP.

We define emerging market economies according to the Morgan Stanley Capital International (MSCI) Emerging Markets index. The index includes 26 countries: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, Turkey and Venezuela. We exclude Hungary because it received its first substantial IMF disbursement of approximately $6.4 billion during our sample period significant affecting its foreign exchange reserve position and potentially the level of exchange rate depreciation. We also exclude Taiwan due to insufficient data. We construct our sample from the remaining emerging market economies which experienced positive EMP: 18 during the 4-month time window and 20 during the 9-months window. These are: Argentina, Brazil, Chile, Colombia, Czech Republic, Egypt, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Turkey and Venezuela.

Table 3: Reserve Loss Relative to EMP and Pre-Crisis Emerging Markets Fundamentals; 4-Month Period.

Dependent Variable: Reserve Loss Relative to EMP, Sept.2008-Dec.2008

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Balance Sheet Exposure	-0.284**	-0.280*	-0.246	-0.306**	-0.642***	-0.283*	-0.296*	-0.250
	(2.20)	(2.08)	(1.45)	(2.64)	(4.62)	(2.07)	(1.86)	(1.50)
Tot. Liabilities (% GDP)		0.056	0.198	0.35	-0.101	0.075	0.034	0.136
		(0.12)	(0.35)	(0.87)	(0.31)	(0.16)	(0.07)	(0.26)
GDP per capita			0.000					
			(0.39)					
Commodity Exports				4.176**				
				(2.32)				
Trade Openness					0.001			
					(0.29)			
Capital Acct. Openness						-0.026		
						(0.47)		
Swap Lines							0.159	
							(0.83)	
OECD Member								-0.083
								(0.38)
Constant	0.309***	0.274	0.268	-4.029*	0.118	0.272	0.266	0.259
	(3.80)	(1.08)	(1.04)	(2.11)	(0.56)	(1.07)	(1.02)	(0.98)
Observations	18	18	18	17	16	18	18	18
R-squared	0.244	0.245	0.263	0.508	0.481	0.254	0.267	0.255

Notes: Robust t statistics in parentheses; *, **, *** indicate variables significant at 10%, 5%, and 1% respectively. All independent variables as of 2007, except for Swap Lines which indicate countries that received and used a swap line during the crisis period. Sample restricted to emerging markets that experience positive EMP.

We define emerging market economies according to the Morgan Stanley Capital International (MSCI) Emerging Markets index. The index includes 26 countries: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, Turkey and Venezuela. We exclude Hungary because it received its first substantial IMF disbursement of approximately $6.4 billion during our sample period significant affecting its foreign exchange reserve position and potentially the level of exchange rate depreciation. We also exclude Taiwan due to insufficient data. We construct our sample from the remaining emerging market economies which experienced positive EMP: 18 during the 4-month time window and 20 during the 9-months window. These are: Argentina, Brazil, Chile, Colombia, Czech Republic, Egypt, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Turkey and Venezuela.

Table 4: Reserve Loss Relative to EMP and Pre-Crisis Emerging Markets Fundamentals; 9-Month Period.

Dependent Variable: Reserve Loss Relative to EMP, July 2008-Feb.2009

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Balance Sheet Exposure	-0.188**	-0.224**	-0.251**	-0.232**	-0.387***	-0.222**	-0.222**	-0.174
	(2.44)	(2.32)	(2.33)	(2.60)	(3.17)	(2.25)	(2.14)	(1.53)
Tot. Liabilities (% GDP)		-0.523	-0.610	-0.100	-1.073*	-0.467	-0.520	-0.389
		(1.11)	(1.02)	(0.24)	(1.93)	(1.04)	(1.06)	(0.82)
GDP per capita			0.000					
			(0.54)					
Commodity Exports				2.461				
				(1.73)				
Trade Openness					0.003			
					(1.60)			
Capital Acct. Openness						-0.043		
						(1.01)		
Swap Lines							-0.016	
							(0.15)	
OECD Member								-0.134
								(0.94)
Constant	0.228***	0.539*	0.532*	-2.199	0.555*	0.518*	0.539*	0.512*
	(3.08)	(1.88)	(1.89)	(1.53)	(1.94)	(1.85)	(1.83)	(1.81)
Observations	20	20	20	18	18	20	20	20
R-squared	0.127	0.246	0.258	0.331	0.472	0.28	0.246	0.277

Notes: Robust t statistics in parentheses; *, **, *** indicate variables significant at 10%, 5%, and 1% respectively. All independent variables as of 2007, except for Swap Lines which indicate countries that received and used a swap line during the crisis period. Sample restricted to emerging markets that experience positive EMP.

The index includes 26 countries: Argentina, Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, Turkey and Venezuela. We exclude Hungary because it received its first substantial IMF disbursement of approximately $6.4 billion during our sample period significant affecting its foreign exchange reserve position and potentially the level of exchange rate depreciation. We also exclude Taiwan due to insufficient data. We construct our sample from the remaining emerging market economies which experienced positive EMP: 18 during the 4-month time window and 20 during the 9-months window. These are: Argentina, Brazil, Chile, Colombia, Czech Republic, Egypt, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Russia, South Africa, Turkey and Venezuela.

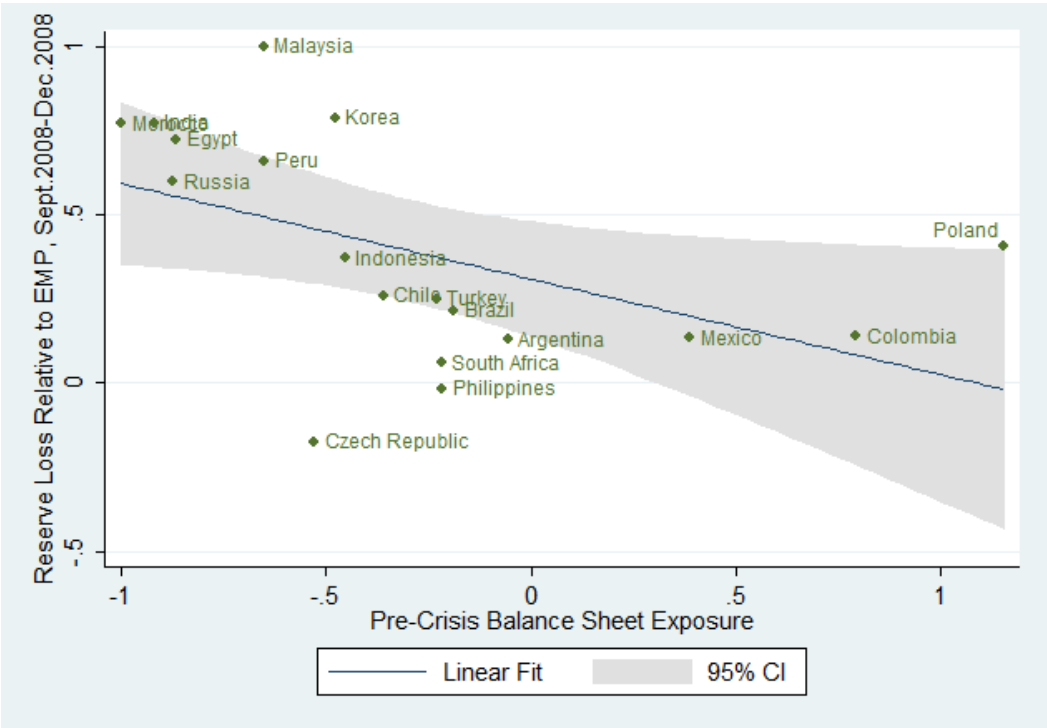Figure 1: Reserve Loss Relative to EMP and Pre-Crisis Balance Sheet Exposure (4-month window)

Figure 2: Reserve Loss Relative to EMP and Pre-Crisis Balance Sheet Exposure (9-month window)
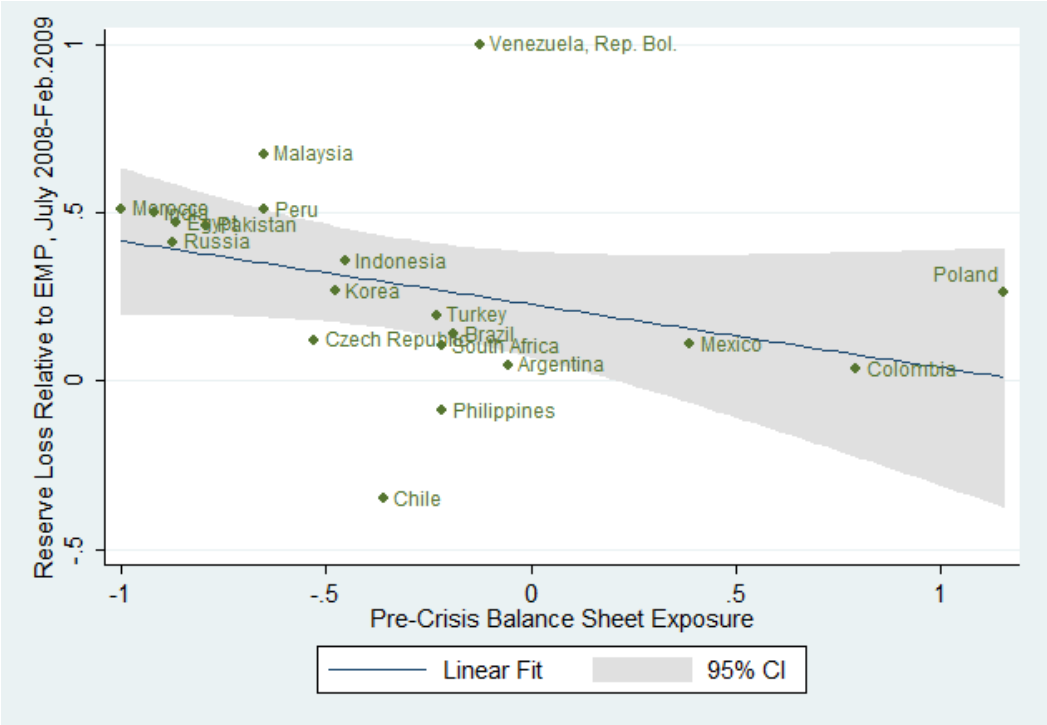
Table A1: Exchange Market Pressure and Components by Country and Sample Period.

Country	9-Month Sample (July 2008 - Feb. 2009)			4-Month Sample (Sept. 2008 - Dec. 2008)		
	Exchange Rate Depreciation	Reserve Loss	Exchange Market Pressure	Exchange Rate Depreciation	Reserve Loss	Exchange Market Pressure
Argentina	17.55%	0.86%	18.41%	9.94%	1.46%	11.40%
Brazil	51.59%	8.25%	59.84%	22.51%	6.18%	28.69%
Chile	18.49%	-4.80%	13.69%	13.87%	4.86%	18.73%
China	0.00%	-3.63%	-3.63%	0.15%	-2.12%	-1.98%
Colombia	42.56%	1.55%	44.11%	1.08%	0.18%	1.25%
Czech Republic	45.05%	6.26%	51.30%	12.17%	-1.80%	10.37%
Egypt	5.47%	4.84%	10.31%	0.92%	2.41%	3.33%
India	19.39%	19.33%	38.72%	3.24%	11.07%	14.31%
Indonesia	31.39%	17.29%	48.68%	16.76%	9.90%	26.66%
Israel	19.88%	-24.98%	-5.10%	11.11%	-17.13%	-6.02%
Jordan	0.00%	-13.09%	-13.09%	0.00%	-1.52%	-1.52%
Korea	51.55%	18.70%	70.25%	4.35%	16.18%	20.53%
Malaysia	13.19%	27.46%	40.65%	0.00%	16.92%	16.92%
Mexico	48.41%	5.93%	54.34%	25.49%	3.93%	29.42%
Morocco	19.67%	20.65%	40.33%	2.53%	8.52%	11.05%
Pakistan	11.72%	10.09%	21.81%	1.36%	-30.09%	-28.73%
Peru	15.66%	16.29%	31.95%	5.37%	10.41%	15.78%
Philippines	7.59%	-0.62%	6.97%	3.94%	-0.07%	3.87%
Poland	79.51%	28.47%	107.98%	24.89%	16.98%	41.87%
Russia	52.32%	36.95%	89.27%	16.36%	24.29%	40.65%
South Africa	37.11%	4.31%	41.42%	12.58%	0.80%	13.38%
Thailand	7.53%	-8.10%	-0.58%	2.65%	-8.42%	-5.77%
Turkey	45.69%	11.10%	56.78%	24.39%	8.11%	32.50%
Venezuela	0.00%	22.89%	22.89%	0.00%	-15.53%	-15.53%

Table A2: Variable descriptions and sources

	Description	Time Period	Source	Notes
Trade and GDP				
GDP per capita	GDP (Millions $ U.S.)/Population	2007	National Accounts Data, International Financial Statistics, IMF	GDP in domestic currency pre-divided by per-$ U.S. exchange rate
Trade Openness	[Import + Exports (Millions $ U.S.)]/GDP (Millions $ U.S.)	2007	International Financial Statistics, IMF	
Commodity Exports	Commodity Exports (Millions $ U.S.)/Total Exports (Millions $ U.S.)	2007	Commodity Trade Statistics Database, UNSD	
Financial Factors				
Balance Sheet Exposure	[Short-Term Debt (Millions $ U.S.) - International Reserves (Millions $U.S)] / International Reserves (Millions $ U.S)	2007	International Investment Position Data, International Financial Statistics, IMF	Short-term debt proxied with portfolio investment debt liabilities
Tot. Liabilities (% GDP)	Total financial account liabilities including direct investment, portfolio debt and equity liabilities, and financial derivatives (Stock, % GDP)	2007	International Investment Position Data, International Financial Statistics, IMF	
Reserves (%GDP)	Foreign Exchange Resereves (Millions $ U.S.)/GDP (Millions U.S)	2007	International Financial Statistics, IMF	
Net FDI (%GDP)	[FDI in Rep. Economy (Millions $ U.S.) - FDI Abroad (Millions $ U.S.)]/GDP(Millions $ U.S.)	2007	International Investment Position Data, International Financial Statistics, IMF	
Rise in REER (%, 2003-2007)	% Change in CPI based real exchange rate, 2003 to 2007	2007	International Financial Statistics, IMF	
Exchange Rate Stability Index	0.01/[0.01+stdev(Δlog(exchange rate))]; index based on monthly changes	2007	http://web.pdx.edu/~ito/trilemma_indexes.htm	A threshold is applied to the index to chacterize fixed eachagne rates: monthly absolute changes within 0.33 percent
Capital Acct. Openness	Chinn-Ito Capital Account Opennes Index	2007	http://web.pdx.edu/~ito/Chinn-Ito_website.htm	For details see: http://web.pdx.edu/~ito/Readme_kaopen2007.pdf
Crisis Measures				
Exchange Market Pressure (EMP)	(% Δ Exchange Rate) -(% Δ Foreign Exchange Reserves)	July 2008 - Feb. 2009	International Financial Statistics, IMF	Exchange Rate: Local Currency / $ U.S.
Reserve Loss Relative to EMP	(-% Δ Foreign Exchange Reserves)/EMP	July 2008 - Feb. 2009	International Financial Statistics, IMF	