International Reserves Before and After the Global Crisis: Is There No End to Hoarding?

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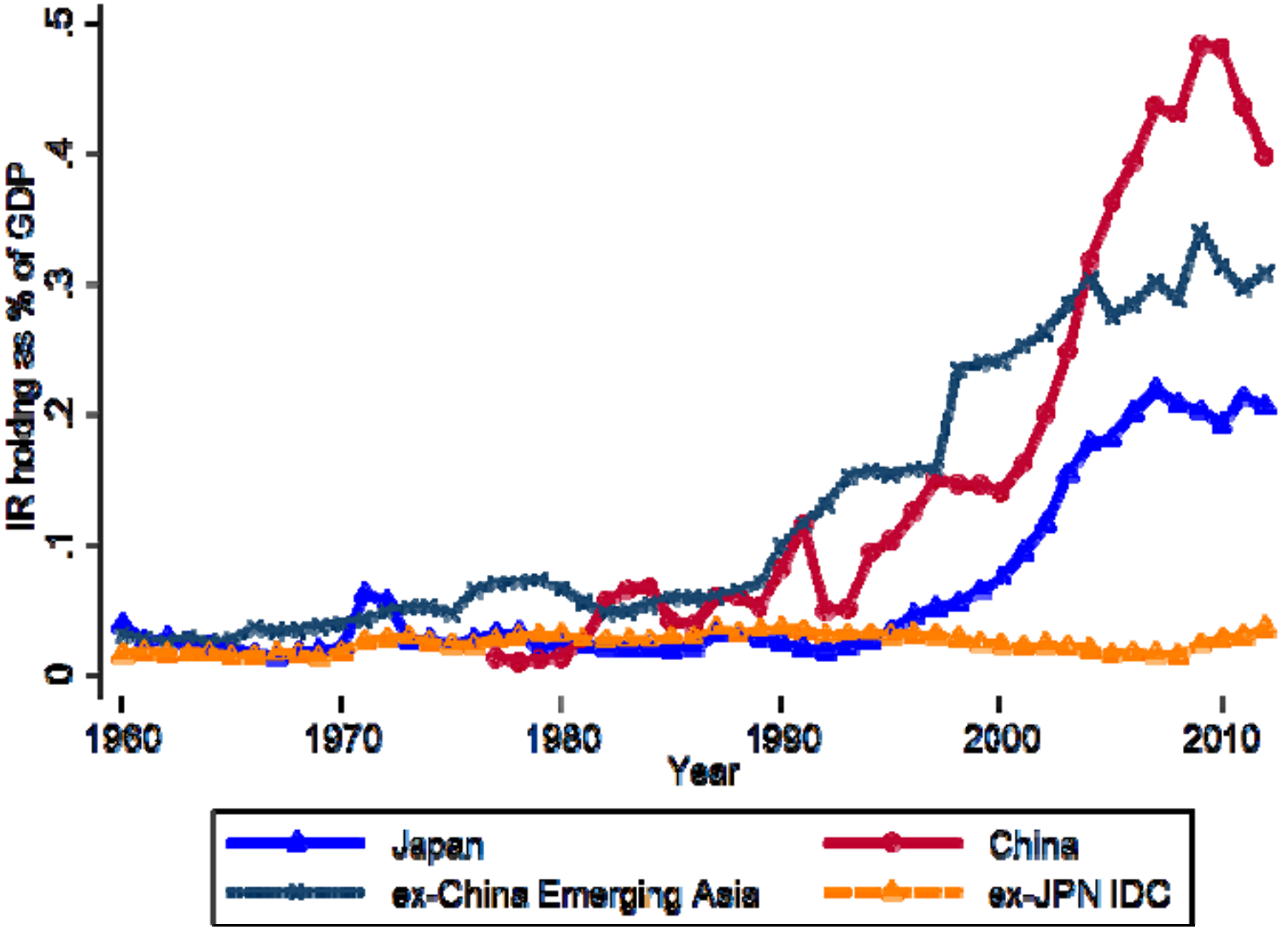
IR before and after the GFC



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Our Goals: We Evaluate

- The role of variables that had not been studied sufficiently before the GFC.
- The stability of factors accounting for international reserves over the period encompassing the GFC.
- Have the GFC and the structural changes of recent years been associated with new patterns of hoarding international reserves (IR)?
- The impact of IR adequacy on the rate of depreciation during the US ‘tapering off’ 2012-3 period.

Results II

- Gross saving is associated with higher IR in developing and emerging markets; the opposite association holds for developed countries.
- Swap agreements are associated with lower reserves.
- Macro-prudential policies complement reserves accumulation.
- Sovereign wealth funds are associated with lower international reserves.

Results III

- Negative impact of outward FDI on IR accumulation in the pre-GFC sample – a trend of diverting IR into tangible foreign assets.

In line with Aizenman-Pasricha (2013)

EMs eased outflows more in response to higher stock price appreciation, higher appreciation pressures in the exchange market, higher IR/GDP and higher REER volatility.

- Emerging market economies with ‘insufficient IR holdings’ in 2012 experienced, on average, exchange rate depreciation against the U.S. dollar when EMs adjusted to the ‘tapering QE talk’ in 2013.

Factors That Affect IR Holding Are Evolving Over Time

- Buffer stock for trade: Heller (1966), Frenkel (1974), Frenkel and Jovanovic (1981), Kelly (1970)
- Domestic money stock, “Internal drain”: Courchene and Youssef (1967), de Beaufort Wijnholds and Kapteyn (2001)
- Precautionary motive: Aizenman and Marion (2004)
- Bretton Woods II: Dooley, Folkerts-Landau, and Garber (2005, 2006, 2008)
- Mercantilist motives: Aizenman and Lee (2008)
- Self-insurance for the “Double drain”: Obstfeld, Shambaugh, and Taylor (2010)
- “Trilemma”: Aizenman, Chinn, and Ito (2010)
- Cheung and Ito (2008, 2009)

New Factors of IR Holding?

- Outward direct investment (ODI)
- Sovereign wealth funds (SWFs)
- Macro prudential policies / Prudential regulatory changes
- Swap agreements
- Saving rates
- Commodity terms of trade volatility
- Export composition (shares of fuel, commodity, services, or manufacturing exports in total exports),
- Financial exposure to gross flows
- “Keeping-up-with-the-Joneses” motives [Cheung and Qian (2009)]

Empirical Analysis

Traditional variables

- Propensity to import, trade openness, the volatility of IR holding, the opportunity cost of holding IR, and the level of economic development

Financial variables

- Domestic financial depth (M2); Net liabilities for FDI, debt, and portfolio investment; de jure financial openness

Characteristic variables

- Exchange rate regimes, geographical locations

Empirical Analysis

"New" variables

- *D (Dummy)* for SWF www.swfinstitute.org
- *D* for Currency swap agreements
- Outward direct investment; UNCTAD
- *D* for Macro prudential policies / Prudential regulatory changes; Lim, et al. (2012, 2013)
- Saving rates
- Commodity terms of trade volatility
- Fuel exports, commodity, services, or manufacturing exports
- Financial exposure to gross flows; IMF data
- "Keeping-up-with-the-Joneses" motives
- Currency or Banking crisis

Empirical Exercise

- Annual data of >100 countries from 1999 to 2012
- Subsample periods: 1999-2006 (“tranquil, G.M.”), 2007-2009 (“crisis”), 2010-2012 (“post-crisis”)
- Estimate w/ country-FE for developed and developing countries separately

$$r_{i,t} = c + X'_{i,t}\,\alpha + Y'_{i,t}\,\beta + D'_{i,t}\,\delta + Z'_{i,t}\,\gamma + \varepsilon_{i,t}$$

$r_{i,t}$: *IR / $Y_{i,t}$*

$X'_{i,t}\,\alpha$: Traditional vars

$Y'_{i,t}\,\beta$: Traditional vars

$D'_{i,t}\,\delta$: Chara. dummies

$Z'_{i,t}\,\gamma$: “New” vars

Exercise 1

- Use all the variables except for the “new” variables (Z)
- Estimate the fittest model for 1999-2006 by sequentially dropping insignificant variables
- Fit the same model to 2007-09, 2010-12, and 1999-2006

Exercise 1

Table 1: Determinants of Holdings of International Reserves -- Developing Countries

	1999-2006	2007-09	2010-12	1999-2012
Propensity to Import (t-1)	0.098	0.303	-0.117	0.107
	(0.035)***	(0.160)*	(0.060)*	(0.031)***
Reserve Volatility	-0.013	0.261	-0.147	-0.019
	(0.007)*	(0.187)	(0.212)	(0.008)**
M2 (% of GDP, t-1)	0.142	0.050	0.150	0.233
	(0.026)***	(0.145)	(0.094)	(0.022)***
Net Port. Liab.(t-1)	-0.101	0.065	-0.151	0.023
	(0.040)**	(0.127)	(0.127)	(0.035)
Constant	0.064	0.029	0.214	0.024
	(0.018)***	(0.098)	(0.072)***	(0.016)
N	441	182	154	777
# of countries	70	67	58	73
Overall R2	0.56	0.34	0.15	0.58
W/in R2	0.16	0.06	0.07	0.23

Notes: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. The estimations are conducted with country fixed effects.

- Tranquil vs. crisis times
- Determinants of the D for IR evolve over time
- 1999-2006 appears similar to 1999-2012

Exercise 2: Pursuit of "Optimal" Models

- Use all the variables including the "new" variables
- Come up with the fittest model for each of the subsample periods by sequentially dropping insignificant variables

Table 2: Determinants of Holdings of International Reserves – Developing Countries

	(1) 1999-2006	(2) 2007-2009	(3) 2010-2012	(4) 1999-2012
Propensity to Import	0.079	0.398		0.096
	(0.035)**	(0.147)***		(0.031)***
Reserve Volatility		0.353		-0.021
		(0.167)**		(0.008)***
Opportunity Cost		0.042		
		(0.024)*		
Fixed/Peg				-0.026
				(0.008)***
M2 (% of GDP)	0.096			0.152
	(0.025)***			(0.026)***
Net Portfolio Liability Pos.	-0.137			
	(0.038)***			
Net Debt Liability Pos.		0.169		
		(0.073)**		
Net FDI Liability Pos.		0.132		
		(0.081)		
Financial exposure			-0.048	0.010
			(0.017)***	(0.004)***
De jure financial openness		-0.206		
		(0.083)**		
Sovereign Wealth Funds, dummy			0.082	-0.024
			(0.033)**	(0.013)*
Bilateral swap agreements, dummy			-0.026	
			(0.015)*	
Macro Prudential Policy dummy				0.017
				(0.007)**
Gross saving	0.159	0.526	0.235	0.280
	(0.046)***	(0.202)**	(0.091)**	(0.043)***
Outward Direct Inv.	-0.170		0.536	
	(0.077)**		(0.176)***	
Joneses x Asia	1.588	-2.150		0.619
	(0.348)***	(0.894)**		(0.170)***
Joneses x Europe	0.973		-2.506	-0.672
	(0.351)***		(0.968)**	(0.302)**
Joneses x MENA			0.650	
			(0.107)***	
% of fuel export	0.113			0.182
	(0.046)**			(0.044)***
Commodity Volatility	0.065			
	(0.031)**			
% of commodity exports		0.269		
		(0.120)**		
# of Currency crisis (t-5|t-1)		0.056		
		(0.024)**		
# of Banking crisis (t-5|t-1)			-0.051	
			(0.010)***	
Constant	-0.051	-0.027	0.359	-0.024
	(0.023)**	(0.155)	(0.052)***	(0.021)
N	441	182	154	777
# of countries	70	67	58	73
Between R2	0.21	0.01	0.01	0.48
Within R2	0.27	0.35	0.47	0.35
Overall R2	0.31	0.01	0.01	0.54

Notes: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Estimated with country fixed effects. All the explanatory variables, except for reserve volatility and currency and banking crises, are lagged by one year to avoid endogeneity.

Exercise 2: Observations

1. 1999-2006: Some of the “new” variables aren’t “new”
   - Gross saving positively affect IR
   - ODI – Outward FDI
   - “Joneses effects”
2. 2007-09 crisis period: Significant variables from 1999-2006 become insignificant or display the opposite effect though IM/Y continues to be significant
3. 2010-12: “new” variables become significant – SWF (+); swap(–); g. saving (+); ODI(+)
4. 1999-2012: Results get closer to those from 1999-2006. Most of non-intuitive results disappear. The macro-prudential policy complements the IR-accumulation policy, while SWF is a negative contributor

Exercise 3: Q of IR Adequacy

- What is the appropriate or optimal level of IR? = Holding too much or too few IR?
- “It depends”
  - The empirical demand function for IR changes over time, including different sets of factors over different time periods
- Make in-sample and out-of-sample forward (but not backward) predictions, using the models from each subsample period
- One caveat: the predictions are generated without country-fixed effects

Exercise 4: Under-hoarding of IR as a sign of vulnerability?

- EMEs are nervous about the QE tapering by the Fed.
- “Fragile 5”: Brazil, India, Indonesia, S. Africa and Turkey
  - Have been experiencing economic and financial stress
  - Have experienced a noticeable depreciation of their currencies in recent years since investors anticipate K-outflow and deteriorating economy performance
- Any link between “under-hoarding of IR” and the rate of currency depreciation?

Fig. 3. Actual vs. Predicted Levels of IR Holding

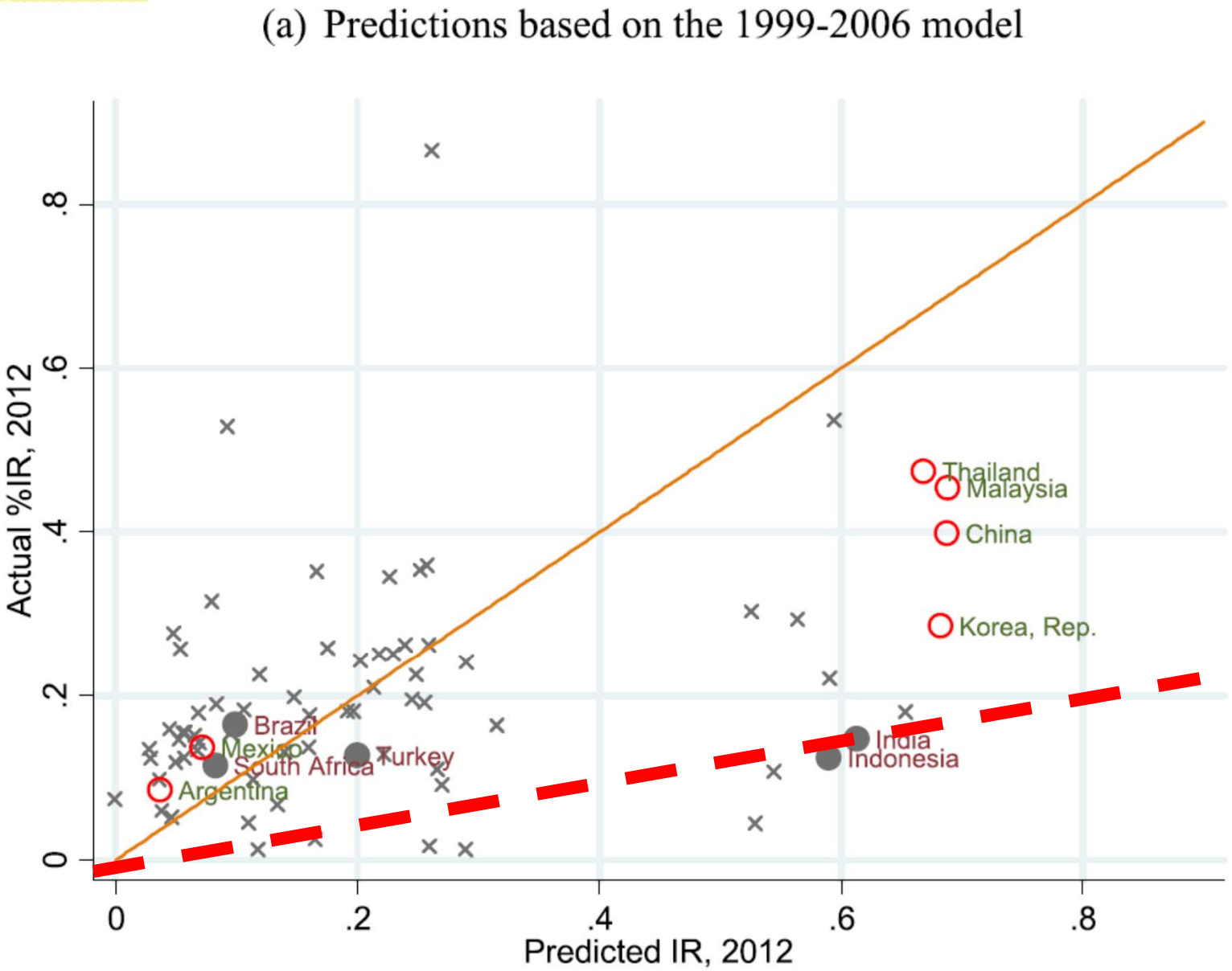
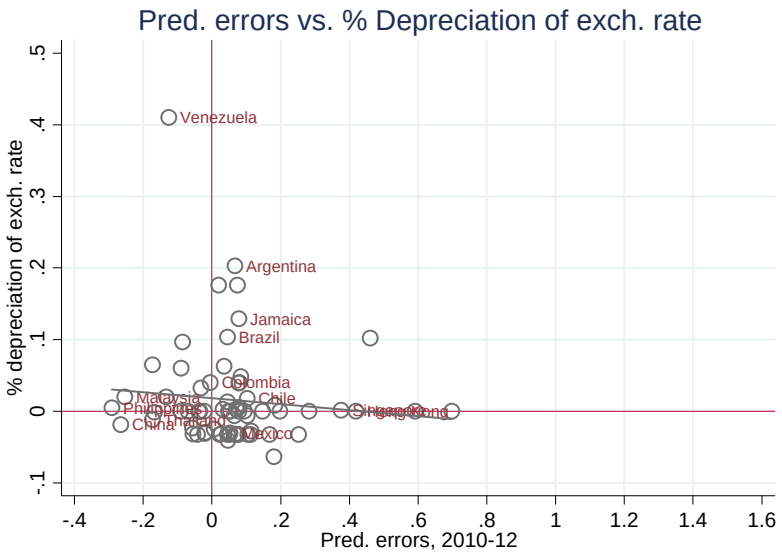
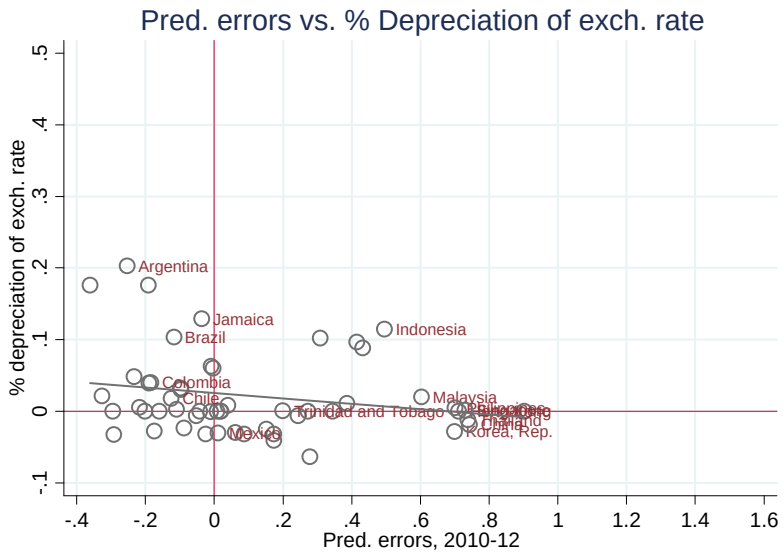


Figure 4: Over-hoarding and Exchange Rate Depreciation

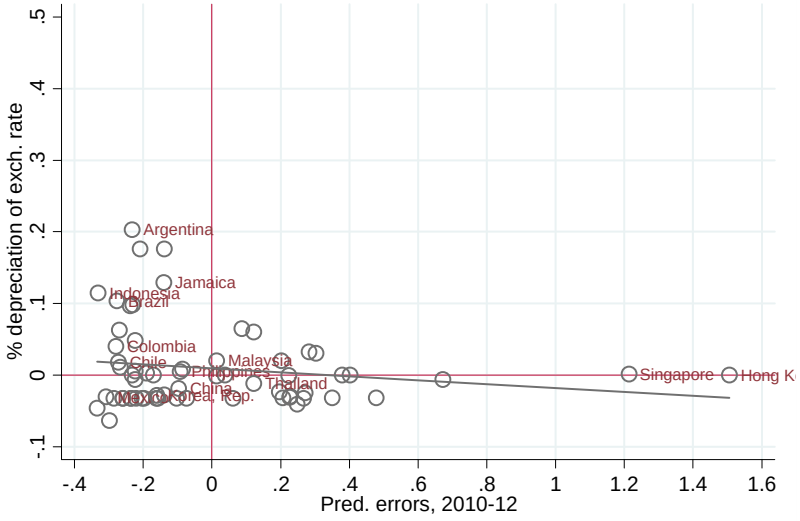
(a) 1999-2006 model



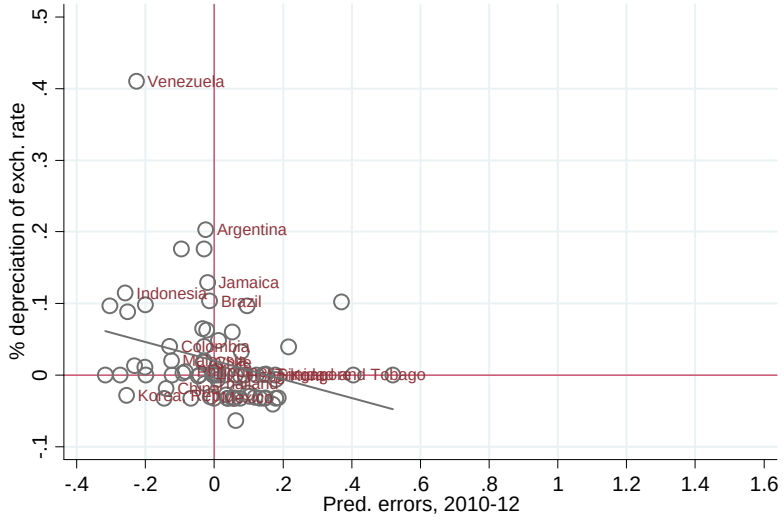
(b) 2007-09 model



(c) 2010-12 model



(d) 1999-2012 model



A country *under-hoarding* IR tends to experience currency depreciation

Table 4: The Proxy of Over-hoarding and Exchange Rate Depreciation in 2012-13

	Dep. Var.: % of Depreciation 2012-13			
	Prediction errors 2010-12			
Model	1999-2006	2007-09	2010-2012	1999-2012
	(1)	(2)	(3)	(4)
Pred. errors.	-0.065	-0.055	-0.018	-0.101
	(0.031)**	(0.032)*	(0.016)	(0.052)*
Constant	0.021	0.031	0.016	0.019
	(0.008)**	(0.011)***	(0.009)*	(0.008)**
Adjusted R2	0.03	0.06	0.00	0.05
N	75	59	68	78

Notes: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. Standard errors are robust standard errors.

Conclusions I

- Determining factors of IR holding continue to evolve with developments in the global economy.
- Factors that gained prominence in recent years: ODI, SWF, Prudential regulatory changes, Swap agreements, Saving rates, Commodity terms of trade volatility, Financial exposure, “Keeping-up-with-the-Joneses” motives, are found to be significant
- Some of the “new” variables aren’t really new –Gross saving, ODI, & Joneses are significant in 1999-2006
- The 2007–09 estimation model turns out to be unstable, reflecting the frantic market conditions (except for IMP/Y (+))

Conclusions II

The post GFC 2010–2012 results are dominated by the "new factors." e.g., swap agreements, gross saving, ODI

- Most of non-intuitive results disappeared once we pool the data from the three sample periods.

  – The macro-prudential policy complements the IR policy

- The "fragile five" countries (Brazil, India, Indonesia, South Africa, and Turkey) seem to be experiencing under-hoarding of IR in the 2010-12 period

- The correlation between the exchange rate depreciation against the U.S. dollar and the prediction errors of IR holding is negative and significant

Conclusions III

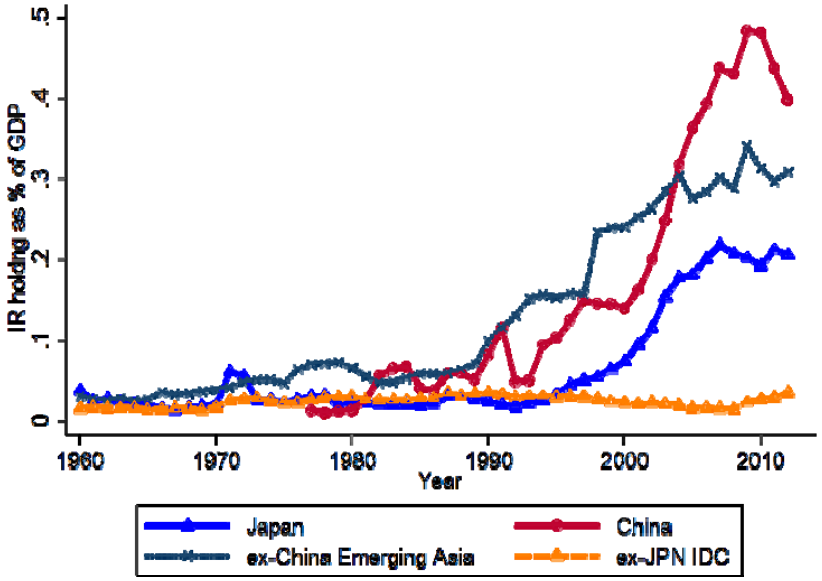
While there is no end in sight for hoarding reserves, some of the newly identified factors may mitigate eventual reserve accumulation:

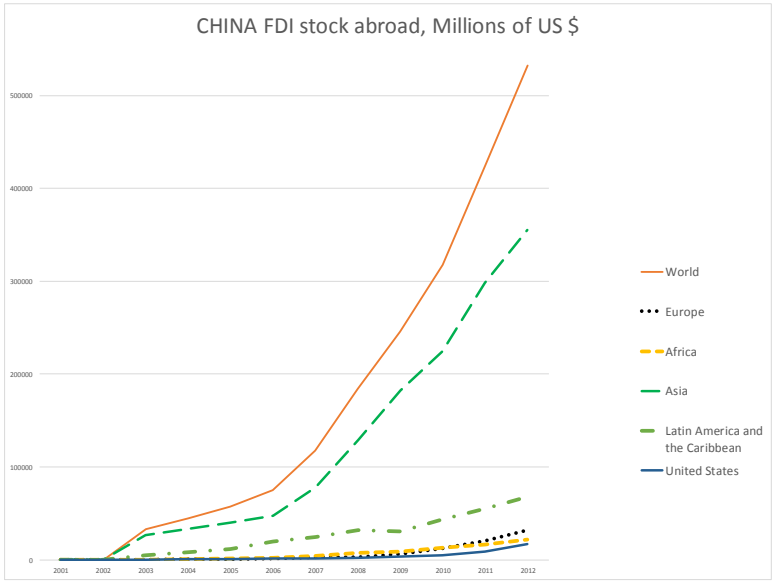
The proliferation of SWFs, swap lines and outward FDI, and possible rebalancing of emerging markets that followed aggressive export-led growth before the GFC may reduce reserve/GDP ratios of EMs.

- The robustness of the “Keeping with the Joneses” effect also suggests potential gains from regional and global steps towards deeper use of swap lines and cooperative pooling arrangements.
- Given the dynamic nature of the forces that shape the hoarding of reserves, there is no reason to expect future stability in the patterns of hoarding.

http://memegenerator.net/instance/31669615

Follow up developments: China





China eased the approval process for all but the largest Chinese investments in overseas companies and projects, a major relaxation of regulatory oversight that is aimed at encouraging Chinese firms to expand abroad

Swap lines provided by:

U.S. FED (b. $), ECB (b. Euro), PBOC (b. Yuan), 12.2007 – 10.2014
(subject to data availability)

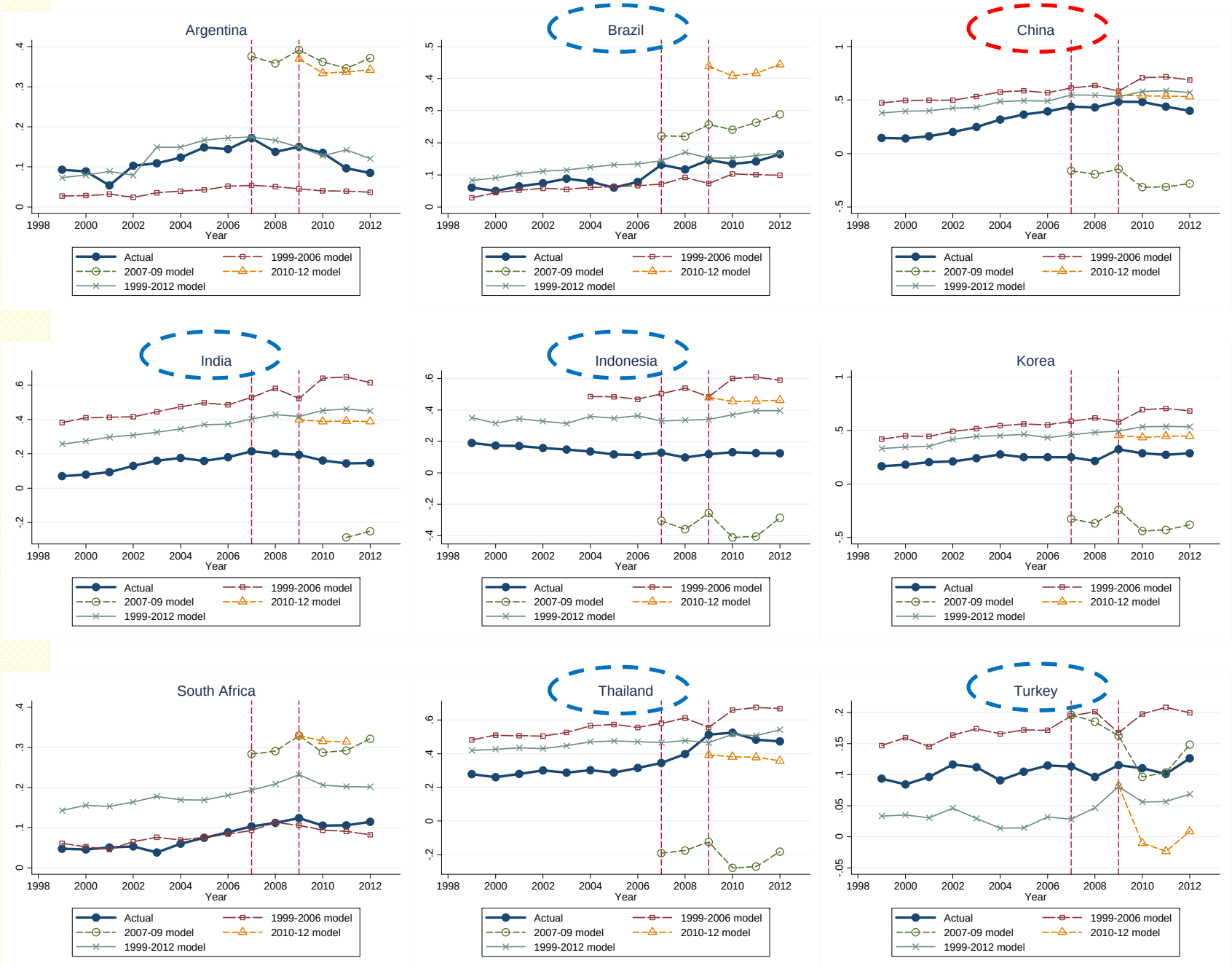
ds_code	wb_code	Country	FED_USD	ECB_EURO	PBC_CNY
AL	ALB	Albania			2
AG	ARG	Argentina			70
AU	AUS	Australia	30		200
BR	BRA	Brazil	30		190
BY	BLR	Belarus			20
CN	CAN	Canada	30, standing	standing	
DK	DNK	Denmark	15	15	
EC	ECB	ECB	300, standing		350
HK	HKG	Hong Kong			400
HN	HUN	Hungary		5	10
IC	ISL	Iceland		1.5	3.5
ID	IDN	Indonesia			100
JP	JPN	Japan	120, standing	standing	20
KZ	KAZ	Kazakhstan			7
KO	KOR	Korea	30		360
MX	MEX	Mexico	30		
MY	MYS	Malaysia			180
MG	MNG	Mongolia			10
NW	NOR	Norway	15		
NZ	NZL	New Zealand	15		25
PK	PAK	Pakistan			10
PO	POL	Poland		10	
SD	SWE	Sweden	30		
SP	SIN	Singapore	30		300
SW	CHE	Switzerland	60, standing	standing	
TH	THA	Thailand			70
TK	TUR	Turkey			1.6
UR	UKR	Ukraine			15
UA	UAE	United Arab Emirates			35
UK	GBR	United Kingdom	100, standing	standing	200
US	USA	United States		standing	
UZ	UZB	Uzbekistan			0.7

SWF and IR

- We identify a “substitution” between the roles IR and SWF - SWFs take over the buffering of the REER and the real GDP during the Great Recession and the post-Great Recession period.
- Inflation targeting (IT) matters, potentially diverting resources to the preservation of domestic price stability: IT countries seem to give up the use of reserves to buffer against CTOT shocks, possibly relegating this role to the SWFs.

Liquidity and foreign asset management challenges for LATAM countries **(with Daniel Riera-Crichton)**

Figure 2: Predictions with Different Estimation Models



Fixed effects W./W.O.

- The sample periods 2007-09 and 2010-12 are small in the time dimension, which can make the use of country fixed effects in the estimation debatable.
- Some of the results are sensitive to the choice of with or without fixed effects, though the highlights of this paper are not.
- We only report the estimation results including country fixed effects, as the GFC must have had different impacts on the sampled countries, country fixed effects could alleviate its impacts on the estimation of the average effects of the explanatory variables.