Systematic Managed Floating

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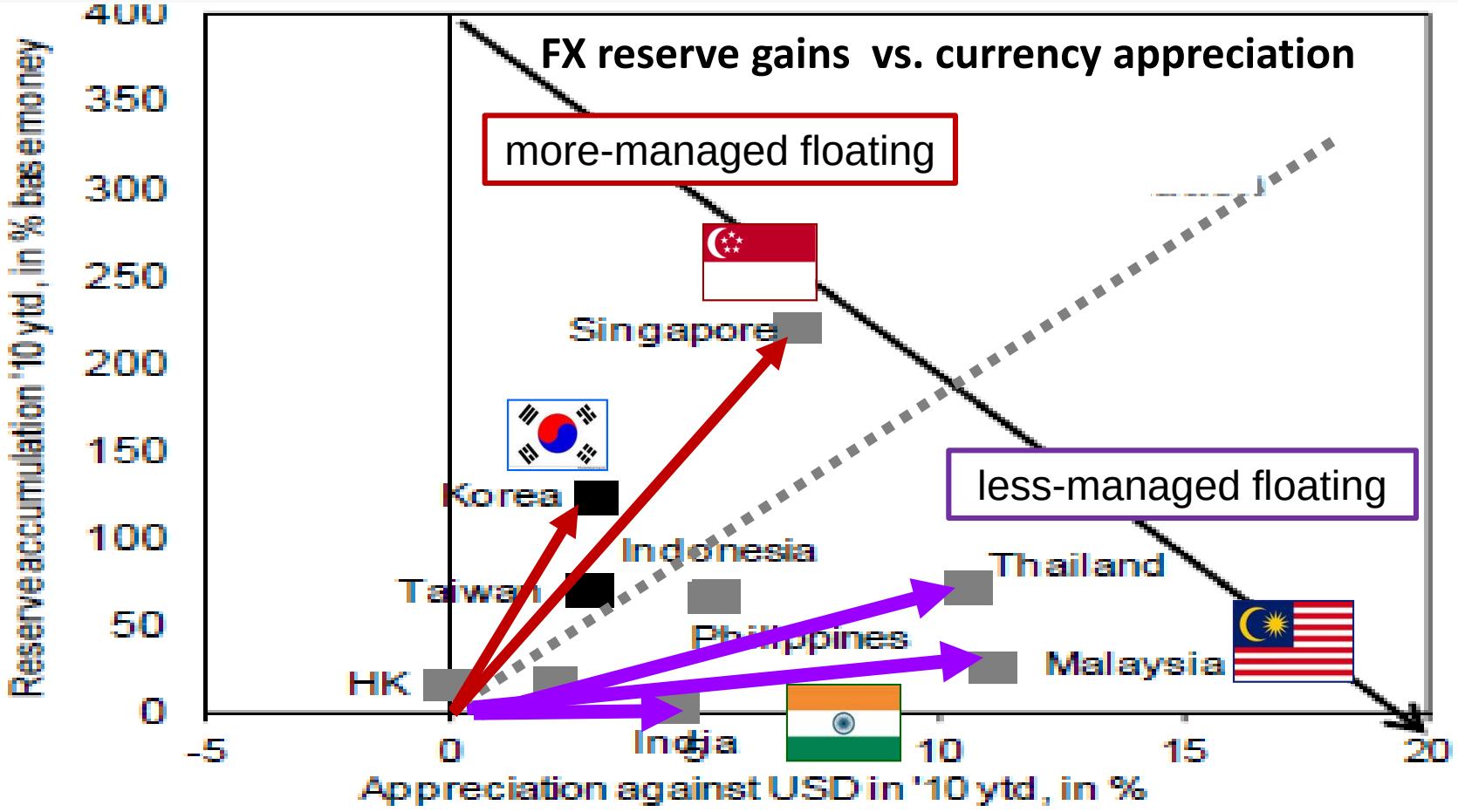
Countries' choice of exchange rate regimes

- A majority neither freely float nor firmly peg.
- Intermediate exchange rate regimes, then.
  - But, in practice, they also seldom obey well-defined target zones or basket pegs. Many are "murky" or "flaky."
  - Proposed: a regime of "systematic managed floating," where the central bank regularly responds to changes in total exchange market pressure
    - by allowing some fraction to be reflected as Δ exchange rate,
    - and the remaining fraction to be absorbed as Δ FX reserves.
- Introductory motivation:
  - Consider the external shocks hitting EMEs since 2003.

Asian central bank reactions to 2010 inflows:

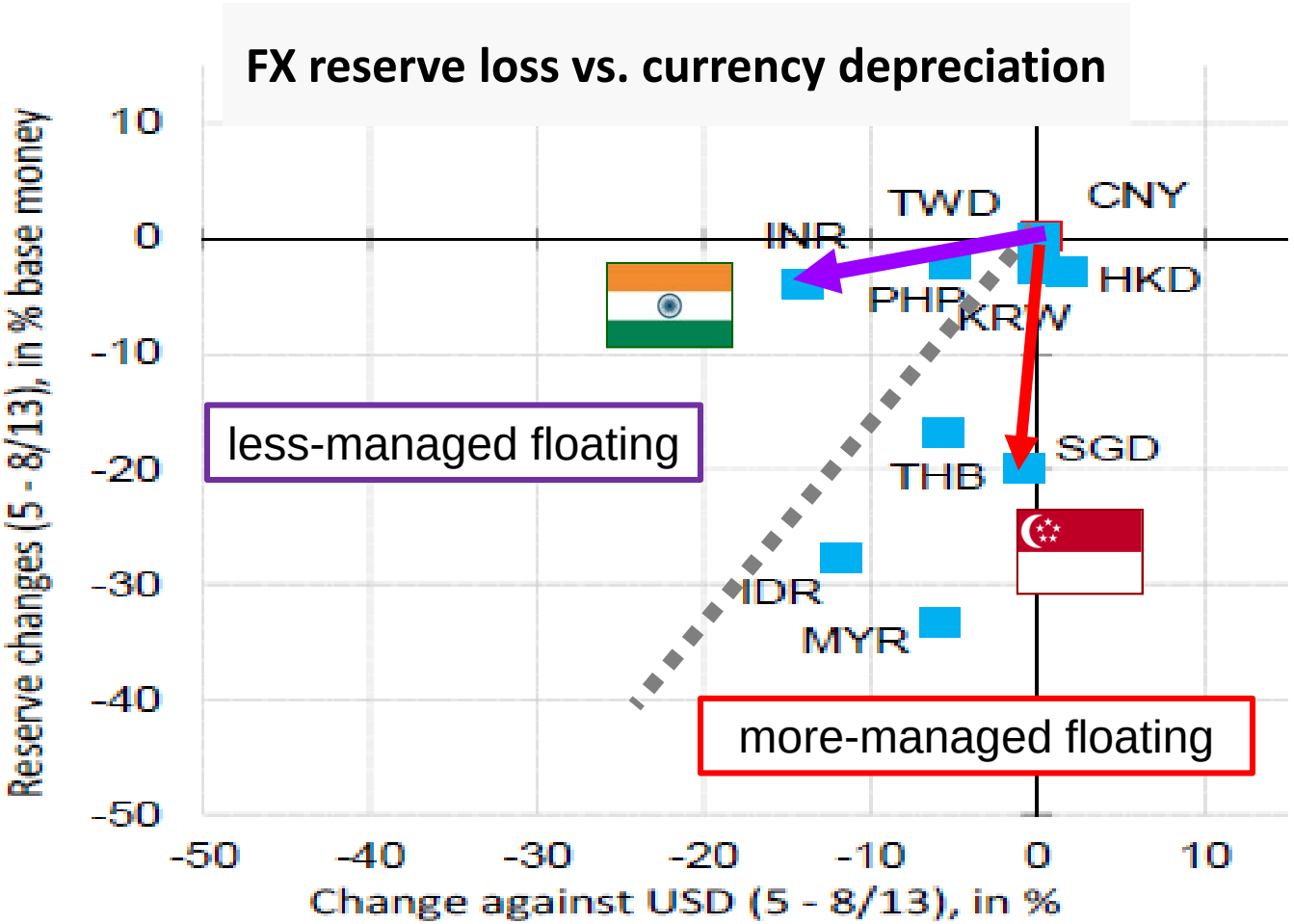
Korea & Singapore mostly took them in the form of reserve gains, while India & Malaysia mostly took them in the form of currency appreciation.



Source: GS Global ECS Research, Goldman Sachs ,10/13/2010. Data: Haver Analytics and Bloomberg

Reactions to outflows in “Taper Tantrum,” May-Aug., 2013.

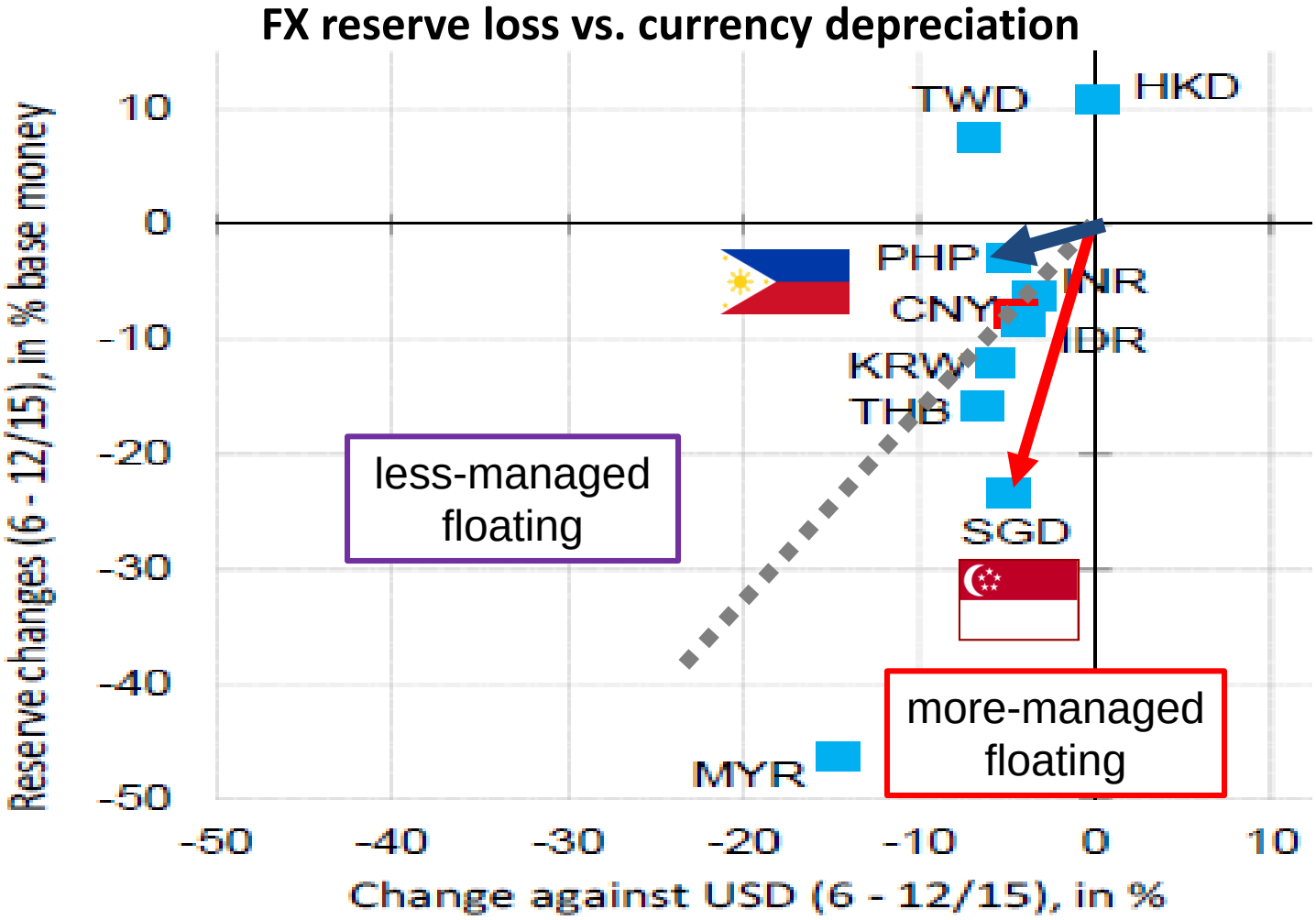
Again Singapore intervened, India & Philippines mostly depreciated.



Source: Goldman Sachs Global Investment Research.

Reactions to outflows in “China Tantrum,” July-Dec. 2015.

Again, Singapore mostly gave up FX reserves.
& the Philippines mostly depreciated.



Source: Goldman Sachs Global Investment Research.

Why choose a systematically managed float?

- Textbook view: intermediate regimes allow an intermediate degree of monetary independence, including freedom from external shocks, in return for an intermediate degree of exchange rate flexibility.

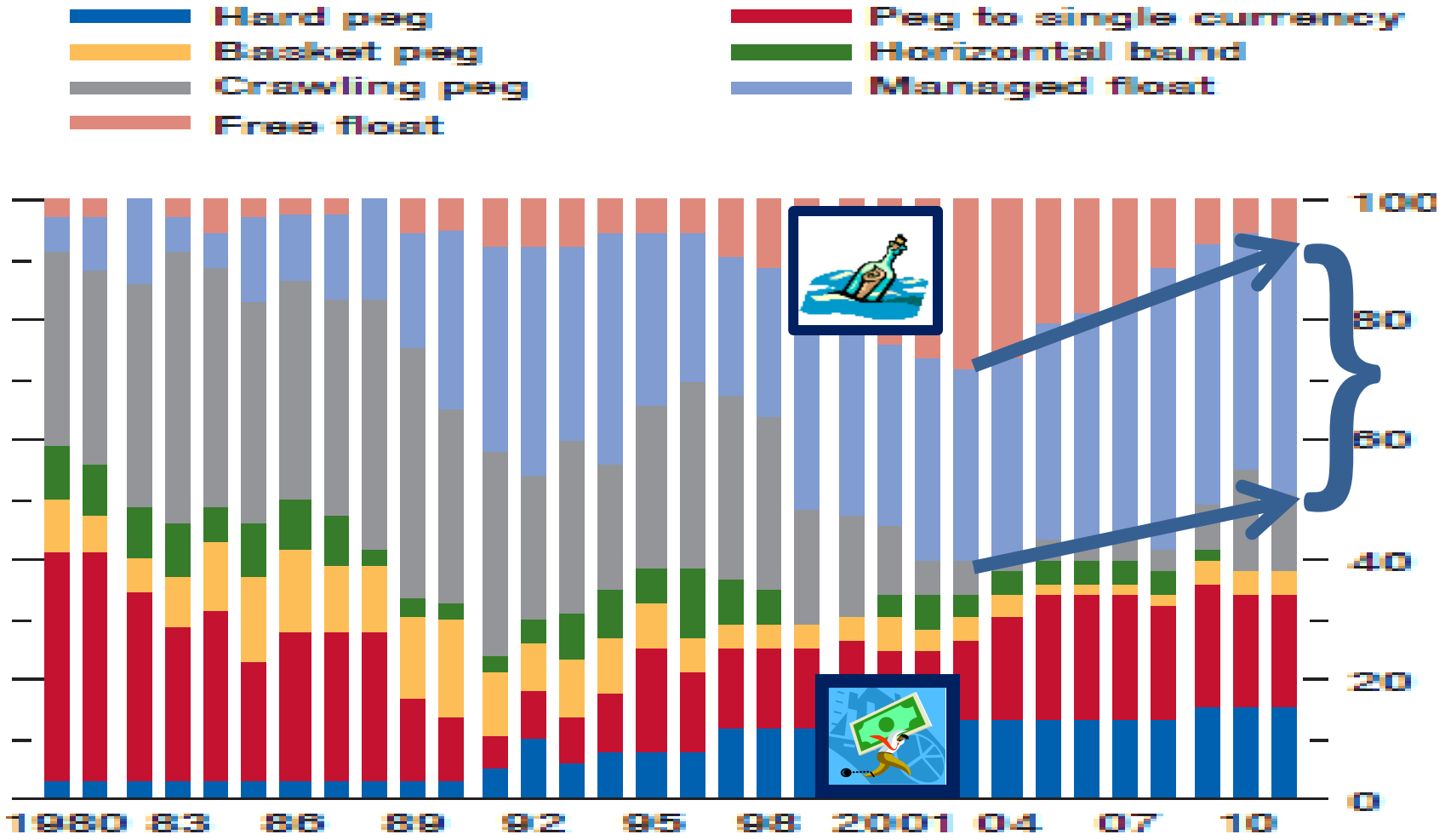
- But -- four challenges:
  - (a) "the corners hypothesis,"
  - (b) "dilemma vs. trilemma,"
  - (c) "intervention ineffectiveness" and
  - (d) "exchange rate disconnect."

Challenge (a): Corners Hypothesis

- "Intermediate regimes are increasingly unviable."
  - "Countries are forced to move to corners: free float or firm fix."
- An impressive pedigree,
  - including: Eichengreen (1994), CFR (1999), Summers (1999), Meltzer (2000), and Fischer (2001).
- But,
  - theoretically, there are perfectly well-developed theories of intermediate regimes,
    - e.g., target zones: Krugman (1991); and
  - empirically, "managed floats" are now the biggest category
    - though many of them remain murky.
    - Ghosh, Ostry, & Qureshi (2015).
    - Ilzetzki, Reinhart and Rogoff (2017).

“Managed floats” have been rising as a share of EM exchange rate regimes

Distribution of Exchange Rate Regimes in Emerging Markets, 1980-2011 (% of total)

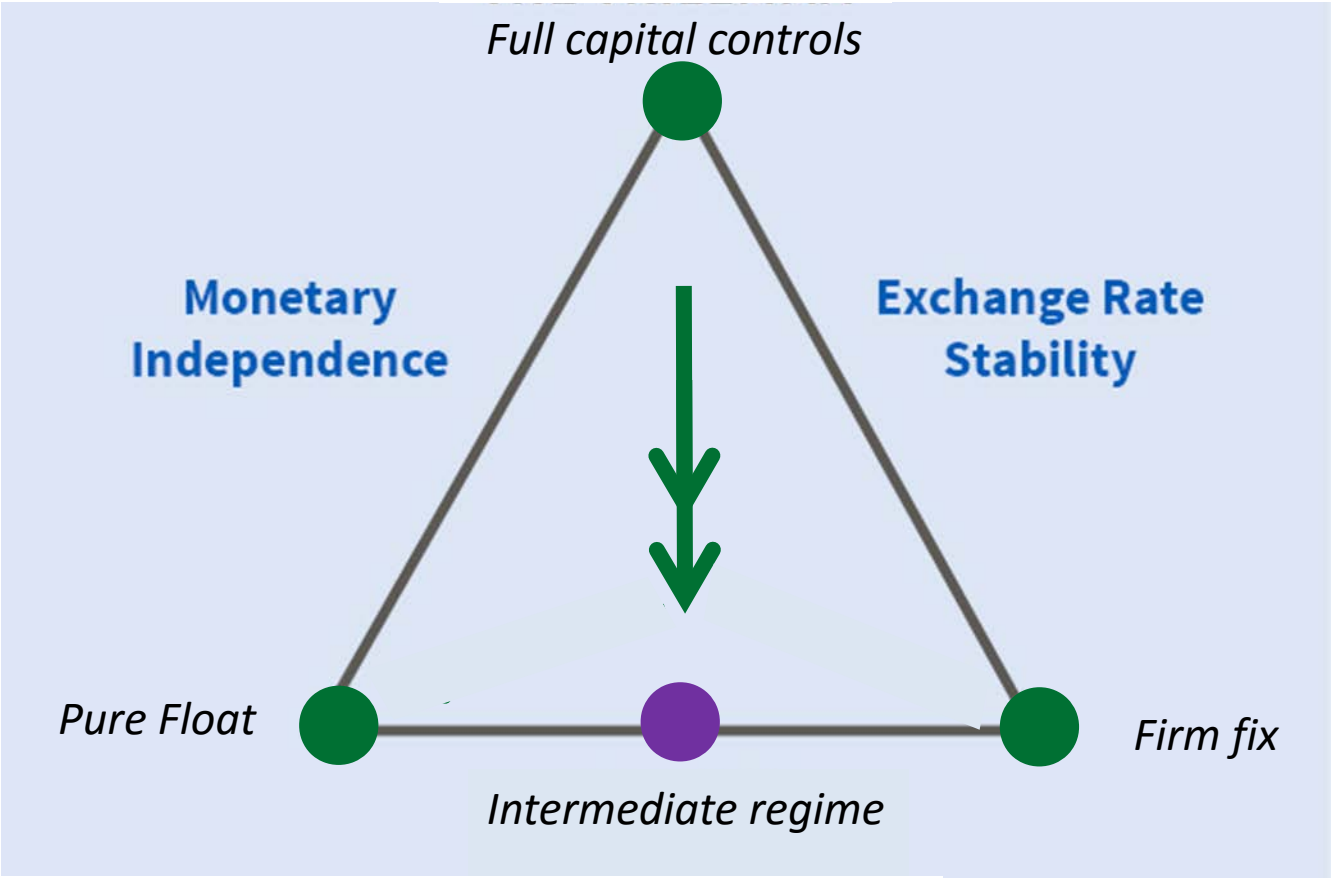


Ghosh, Ostry & Qureshi (2015)

The Trilemma or "Impossible Trinity"

At each corner of the triangle, it is possible to obtain 2 attributes.

But not all 3.



=> (a) Forced to choose between corners? No. Triangles have sides!

Challenge (b): "Dilemma not trilemma"

- Challenge to trilemma from Rey (2014)
  - and Agrippino & Rey (2014), Farhi & Werning (2014), Edwards (2015).
- Claim: Floating *rates* don't offer insulation from external shocks
  - such as VIX↑.
- The triangle collapses into a single line segment, running from "monetary independence via controls" to "open capital markets,"
  - with the choice of exchange rate regime not relevant.

- But floating *does* allow some monetary independence:
  - Aizenman, Chinn, & Ito (2010, 2011), Di Giovanni & Shambaugh (2008), Klein & Shambaugh (2012, 2015), Obstfeld (2015), Obstfeld, Shambaugh & Taylor (2005), Shambaugh (2004), and Frankel, Schmukler & Servén (2004).

Challenge (c): "FX intervention is powerless to affect nominal exchange rates"

- "unless it is non-sterilized,
  - in which case it is just another kind of monetary policy."
- These days, G-7 countries don't intervene.
- But major EMEs do have managed floats.
  - Studies of EMEs tend to show intervention has effects:
    - Fratzscher et al (2016), Adler, Lisack & Mano (2015), Adler & Tovar (2011), Blanchard, Adler, & de Carvalho Filho (2015), Daude, Levy-Yeyati & Nagengast (2014), and Disyatat & Galati (2007). Survey by Menkhoff (2013).

Challenge (d): “Exchange rate disconnect”

- Claim: The nominal exchange rate has no implications for real economic factors such as the real exchange rate, trade, or output.
- Empirical studies often fail to find correlations between nominal exchange rates and real fundamentals.
    - E.g., Flood & Rose (1999), Devereux & Engel (2002) and Rose (2011).
- Many theoretical models say that shocks have the same effect on the real exchange rate
  - regardless whether the currency floats,
    - in which case the shock appears in the nominal exchange rate,
  - or is fixed,
    - in which case the same shock shows up in price levels instead.
  - E.g., Real Business Cycle models.
- We will see if we can reject the null hypothesis that the exchange rate regime doesn’t matter for the real exchange rate.

Classification of de facto exchange rate regimes

- It is well-established that de facto regimes need not correspond to de jure.
  - What a country does in practice often differs from what it says it does officially.
  - Consider countries that say they fix their exchange rate.
    - Often in practice they adjust it when under pressure.
    - "The mirage of fixed exchange rates," Obstfeld & Rogoff (1995).
  - Consider countries that say they float.
    - Often can't refrain from intervening in the market.
    - "Fear of floating," Calvo & Reinhart (2002).

The discrepancies have led to studies that attempt to estimate and report the true de facto regimes.

- Some prominent de facto classification schemes:
  - Ghosh, Gulde, & Wolf (2000), Reinhart & Rogoff (2004), Bénassy-Quéré, Coeuré, & Mignon (2004), Levy-Yeyati & Sturzenegger (2001, 2003, 2005), and Ilzetzki, Reinhart & Rogoff (2017).

- Surveys of the literature on classification include:
  - Klein & Shambaugh (2012),
  - Rose (2011),
  - and Tavlas, Dellas & Stockman (2008).

But the de facto classification schemes, though designed to get at the "true answer," disagree among themselves.

- Frankel (2004):
  - 3 prominent schemes coincided with the IMF de jure classification only 50.4% of the time.
  - But they coincided with each other even less, only 38.6% of the time!
- Bénassy-Quéré, et al (2004):
  - 3 de facto schemes correlated .69 with the IMF de jure scheme,
  - but only .63 with each other.
- Shambaugh (2007):
  - 3 de facto schemes agreed 80 percent with the de jure listings,
  - but only 78 per cent among themselves.
- Klein & Shambaugh (2011):
  - 3 de facto schemes coincided with the IMF classification 62 %
  - and coincided with each other also 62 % of the time.

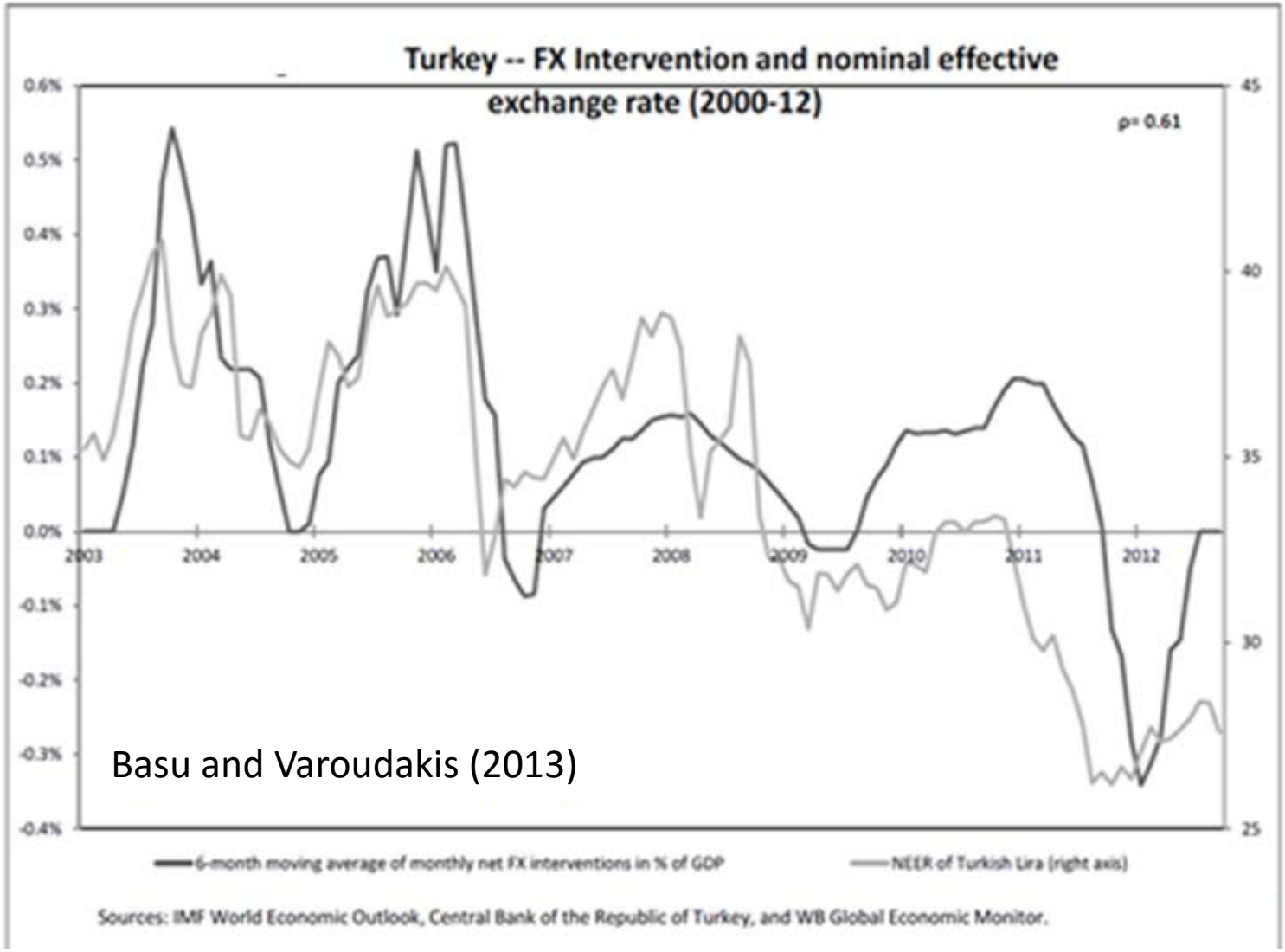
Why do classification schemes give such different answers?

- 1. Differences in de facto regime estimation methodology.
  - Some work off of official classifications, re-classifying when necessary,
  - while other approaches estimate from observed data alone.
  - Some look simply at the variability of the exchange rate,
  - while others compare it to the variability of reserves,
    - recognizing that high variability may just result from big shocks.
    - E.g., In Figure 1, the Sing. $ appreciated more in 2010 than the rupee, but this was because it experienced a bigger shock (total exchange market pressure), not because its regime has higher flexibility.
- 2. Frequent changes in parameters or even in regime,
  - e.g., once a year, even among the transparent cases.
  - To cope with frequent changes:
    - Estimate equations for short sub-periods or
    - use Bai-Perron technique to allow for estimation of structural breaks.
  - A country that follows no systematic regime for longer than a year at a time should perhaps be treated as having no systematic regime at all.
- 3. Murkiness of true regimes.

Three approaches to identifying which countries are systematic managed floaters

- 1) Regressions to estimate CB reaction function for intervention
  - An advantage of using data from Turkey:
    Can compare the use of intervention data vs. reserve changes.
- 2) Frankel-Wei-Xie regression of Δs against ΔEMP
  where ΔEMP ≡ Exchange Market Pressure ≡ ($\Delta s + \Delta Res / MB$).
  - An advantage: allows anchor to have whatever reference currency or basket of currencies the data support.
- 3) Simple-minded correlation (Δs, $\Delta Res/MB$),
  - where s ≡ log (value of currency); Res ≡ FX reserves; MB ≡ monetary base
  - Advantages:
    - Very easy
    - No need to presume anything about direction of causality.
- An advantage of all 3: Look at both Δs and ΔRes to figure regime,
  - not just Var(Δs).

(1) Case study: Turkey's intervention data have been found to support a systematic reaction function

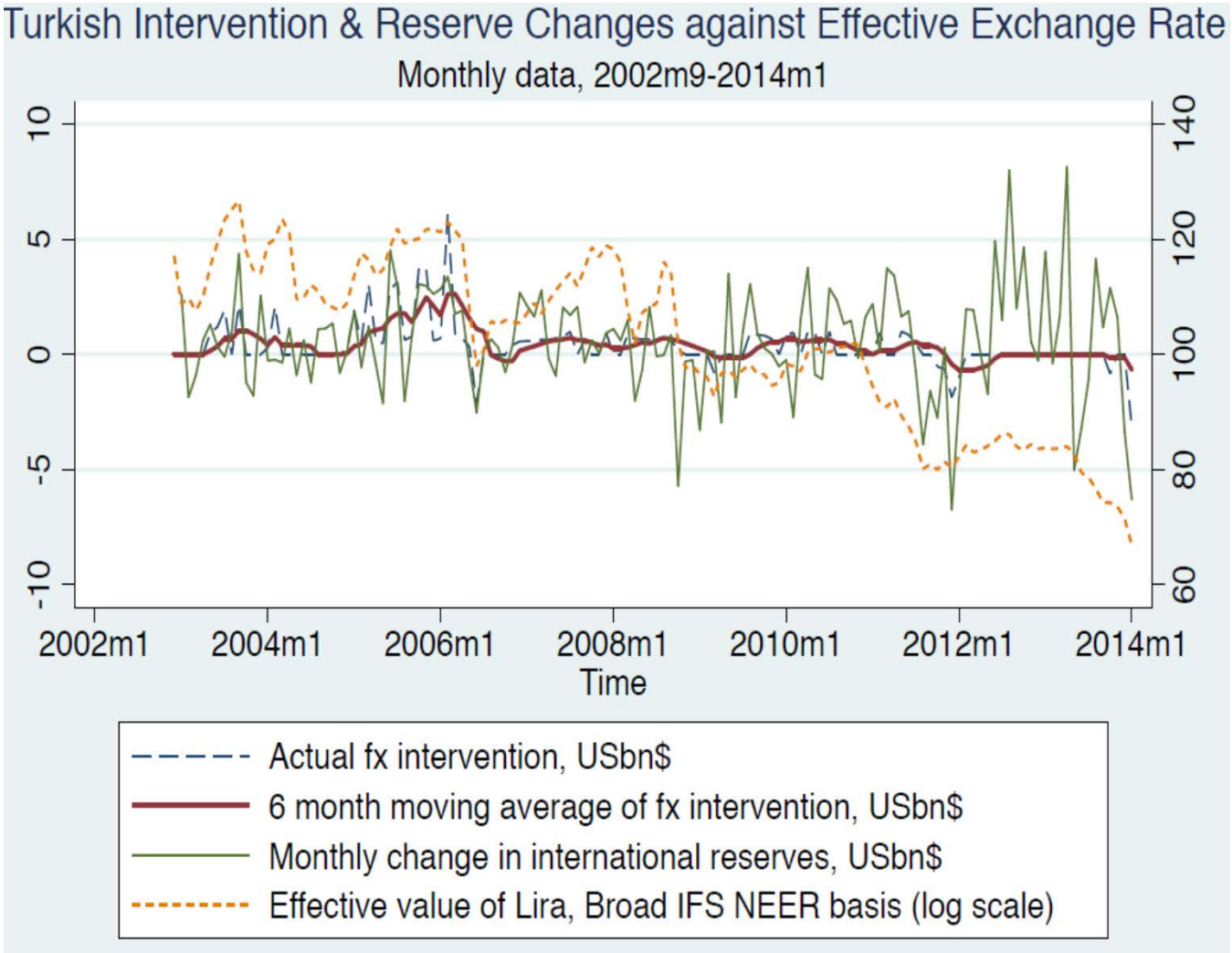


Basu and Varoudakis (2013)

Also Frömmel and Midiliç (2016)

The two separate measures of intervention differ, though highly correlated.

Figure 5: Foreign Exchange Actions by Turkey: Intervention Data vs. Reserve Changes



Check that Turkey CB reaction to exchange rate is systematic, whether using intervention data or Δ FX reserves.

FX acquisition =

$$c + a\,(s_t - s_{trend}) + ß\,(s_t - s_{t-1}) + \delta\,(Res/GDP)_t + \psi\,(inflation - target).$$

The dependent variable, "FX acquisition,"
is measured first by FX intervention data and then by changes in FX reserves.

Regression to estimate reaction function of Turkey's central bank				
t-statistics are reported	Measure of FX Reserve Accumulation			
Independent Variable	Intervention			Δ Reserves
$s_t - s_{trend}$	3.6 ***	2.7 **	2.7 ***	1.8*
$s_t - s_{t-1}$	2.3 **		1.6	4.5 ***
Reserves/ GDP		-2.9 ***	-2.6 ***	1.2
constant	4.3 ***	3.4 ***	3.1 ***	-0.8

Table 4.3. 133 monthly observations: 2003m1-2014m1

t-statistic significant at: *** 1% level ** 5 % level * 10 % level

(2) Technique to estimate flexibility parameter and currency weights at the same time

from Frankel & Wei (1994, 2008, 09) & Frankel & Xie (2011, 17):

$$\Delta \log H_t = c + \sum_{j=1}^{k} (w_j \, \Delta \log X_{j,t}) + \beta \, \Delta EMP_t + u_t \qquad (2)$$

- where $H \equiv$ value of the home currency (measured in SDR);
- $X_j \equiv$ value of the $, €, yen, RMB, or other foreign currencies j that are candidates for components of the basket,
- $w_j \equiv$ basket weights to be estimated;
- $\Delta EMP_t \equiv$ Exchange Market Pressure $\equiv \Delta \log H_t + (\Delta Res)/MB_t$,
- and $\beta \equiv$ flexibility coefficient to be estimated.

If $\beta=1$ => pure float;

$\beta=0$ & high R^2 => fixed exchange rate;

$0<\beta<1$ & high R^2 => systematic managed float.

India shows systematic managed float in sub-periods

$$\Delta \log H_t = c + \sum_{j=1}^{k}(w_j \, \Delta \log X_{j,t}) + \beta \, \Delta EMP_t + u_t \qquad \text{where } EMP_t \equiv \Delta \log H_t + (\Delta Res)/MB_t$$

Table 3. Identifying Break Points in India's Exchange Rate Regime (M1:2000-M5:2009)

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	1/14/2000-10/27/2000	11/3/2000-6/17/2001	6/24/2001-12/31/2001	1/14/2002-9/23/2003	9/30/2003-2/25/2007	3/4/2007-5/6/2009
US dollar	0.77***	0.92***	0.66***	0.91***	0.72***	0.59***
	(0.06)	(0.04)	(0.08)	(0.04)	(0.06)	(0.10)
Euro	0.12***	0.10***	0.23***	0.03	0.06	0.32***
	(0.03)	(0.03)	(0.07)	(0.03)	(0.05)	(0.07)
Jpn yen	0.09***	0.04*	0.05	0.03	0.24***	0.02
	(0.02)	(0.02)	(0.05)	(0.02)	(0.06)	(0.07)
ΔEMP	0.44***	0.04	0.46***	0.06	0.15***	0.37***
	(0.06)	(0.04)	(0.10)	(0.04)	(0.05)	(0.07)
Observations	42	32	28	88	172	109
R^2	0.98	0.98	0.98	0.98	0.86	0.78
Br. Pound	0.02	-0.06	0.06	0.03	-0.01	0.08

*** p<0.01, ** p<0.05, * p<0.1 (Robust s.e.s in parentheses.) All data are weekly.

Thailand shows systematic managed float throughout.

Table 2. Identifying Break Points in Thailand's Exchange Rate Regime (M1:1999-M5:2009)

	(1)	(2)	(3)	(4)
VARIABLES	1/21/1999-8/5/2001	8/12/2001-9/9/2006	9/16/2006-3/25/2007	4/1/2007-5/6/2009
US dollar	0.62***	0.61***	0.80***	0.70***
	(0.09)	(0.04)	(0.28)	(0.05)
Euro	0.26***	0.17***	-0.08	0.19***
	(0.08)	(0.06)	(0.59)	(0.04)
Jpn yen	0.15***	0.25***	0.16	0.04
	(0.04)	(0.03)	(0.30)	(0.03)
ΔEMP	0.20***	0.06***	0.50***	0.03**
	(0.05)	(0.02)	(0.17)	(0.01)
Constant	-0.00**	0.00	-0.01	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)
Observations	129	257	27	108
R^2	0.66	0.76	0.64	0.90
Br. Pound	-0.02	-0.04	0.12	0.07

*** p<0.01, ** p<0.05, * p<0.1 (Robust s.e.s in parentheses.) All data are weekly.

Updated estimates through 2017 for 4 countries

- All 4 qualify for systematic managed floats,
  - though with many small structural breaks.
- India:
  - Flexibility parameter higher during Mar. 2008 – Feb. 2017: ≈ .9.
- Singapore
  - Flexibility higher during Mar. 2013 – Feb. 2017: ≈ .7-.8.
- Korea
  - Flexibility parameter has been up & down, between ≈ .5 - .9.
- China:
  - managed float starts July 2005;
  - weight on dollar has declined from 0.9 to 0.5.
  - Flexibility parameter higher Oct. 2010-Apr. 2017: ≈ .96
  - No major parameter changes on the post-2014 downside.

(3) Simple-minded Correlation (Δs, $\Delta Res\ /MB$)

- A truly fixed exchange rate => Correlation = 0,
  - because the exchange rate by definition never changes.
- A pure float => again, Correlation = 0,
  - because reserves by definition never change.
- Haphazard interveners should also show low correlation.
- Only systematic managed floaters show high correlations.
  - We arbitrarily set the threshold at > 0.25.
- In the hypothetical case of a perfectly systematic managed float, correlation = 1 and the relationship is proportionate:

$$\phi \equiv \frac{\Delta s}{\Delta Res\ /MB}$$

$$\equiv \frac{\beta}{(1-\beta)}$$

where β was the coefficient on ΔEMP in the Frankel-Wei-Xie regressions.

Table 1: Simple-minded correlation between Δ*s* and (Δ*Res*)/*MB*. (Jan.1997 - Dec.2015)

Asia/Pac. commodity-exporters	
Australia	0.176
Bahrain	0
Brunei	0.045
Indonesia	-0.006
Kazakhstan	0.151
Kuwait	-0.103
Mongolia	0.189
New Zealand	0.220
PNG	0.241
Qatar	0
Saudi Arabia	-0.032
UAE	0.044

Other Asian economies	
Hong Kong	0.045
India	0.445
Korea, Rep.	0.553
Malaysia	0.269
Philippines	0.302
Singapore	0.607
Thailand	0.264
Turkey	0.295
Vietnam	0.114

Other commodity exporters	
Brazil	0.288
Canada	0.102
Chile	0.101
Colombia	0.210
Peru	0.276
Russia	0.264
South Africa	0.274

Corr. > 0.25: Systematic managed floaters

Corr. < 0.25: firm fixers, & free floaters, & miscellaneous.

The final exercise: Does the regime choice matter?

- Does it make a difference for the real exchange rate?
- Null hypothesis:
  Shocks produce the same real exchange rate regardless:
  - They show up in nominal exchange rate under floating,
  - in price level if exchange rate is fixed.
- Alternative hypothesis: A positive external shock
  - will lead to real appreciation, under floating;
  - the same under systematic managed floating, though less;
  - no real appreciation, if nominal exchange rate is fixed.
- Our econometric tests use two external shock measures
  - For emerging markets: the VIX;
  - For commodity exporters: a country-specific index of 5 global prices for the basket of oil, minerals, and agricultural products it exports.

Effects of Shocks on Real Exchange Rates

Adverse shock => **real depreciation, for all 7 systematic managed floaters;**
but not for the firm fixer, Hong Kong.

A: Effect of VIX Shocks on Real Exchange Rates among Asia Non-Commodity-Exporters

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	H Kong	India	Korea, R	Malaysia	Philippines	Singapore	Thailand	Turkey
Log of VIX	0.002	-0.006*	-0.047***	-0.009*	-0.011***	-0.005***	-0.011***	-0.019***
	(0.004)	(0.003)	(0.009)	(0.005)	(0.003)	(0.002)	(0.003)	(0.006)
REER Lag	0.993***	0.987***	0.874***	0.935***	0.996***	0.997***	0.970***	0.955***
	(0.008)	(0.012)	(0.027)	(0.028)	(0.007)	(0.005)	(0.024)	(0.016)
Constant	0.027	0.080	0.703***	0.326**	0.053	0.028	0.171	0.254***
	(0.035)	(0.056)	(0.141)	(0.126)	(0.033)	(0.026)	(0.112)	(0.077)
Observatns	227	227	227	227	227	227	227	227
R2	0.990	0.968	0.928	0.904	0.986	0.992	0.954	0.956

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

A majority of firm-fixers show no effect on the RER, including oil-exporters:

P: Effect of Commodity Shocks on RERs among Firm-fixing Oil-Exporters

	(13)	(14)	(17)	(18)	(20)	(9)
VARIABLES	Bahrain	Brunei †	Kuwait	Qatar	Saudi A.	UAE
Commodity Price Indices	-0.002	0.004***	0.003*	0.002	0.004**	-0.030
	(0.004)	(0.001)	(0.002)	(0.003)	(0.002)	(0.020)
REER Lag	0.979***	0.980***	0.996***	1.001***	1.015***	0.942***
	(0.021)	(0.008)	(0.010)	(0.013)	(0.010)	(0.049)
Constant	0.100	0.094**	0.022	-0.003	-0.069	0.273
	(0.095)	(0.039)	(0.049)	(0.059)	(0.048)	(0.233)
Observatns	227	227	227	156	227	107
R2		0.982	0.976	0.978	0.980	0.936

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

† Brunei is an exception: a highly significant effect, perhaps because its hard peg is to Singapore.

All four floaters show significant RER effects of commodity prices.

C: Effect of Commodity Shocks on RERs among Asia/Pacific Commodity-Exporters

	(1)	(2)	(10)	(11)	(16)	(21)
VARIABLES	Australia	New Zeald	Indonesia	Papua NG	Kazakhstan	Mongolia
Commodity Price Indices	0.038***	0.086**	0.091***	0.025***	0.014***	0.044***
	(0.015)	(0.042)	(0.033)	(0.006)	(0.005)	(0.015)
REER Lag	0.944***	0.955***	0.890***	0.963***	0.958***	0.946***
	(0.019)	(0.022)	(0.041)	(0.013)	(0.018)	(0.025)
Constant	0.269***	0.244**	0.535***	0.187***	0.198**	0.264**
	(0.092)	(0.114)	(0.197)	(0.062)	(0.084)	(0.118)
Observations	226	226	227	227	227	227
R2	0.983	0.975	0.908	0.973	0. 965	0.968

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Among other commodity exporters,

Commodity shocks have no significant RER effect in the firm-fixer (Ecuador)

but do in most of the managed floaters.†

B: Effect of Commodity Shocks on RERs among Non-Asia Commodity-Exporters

	(4)	(3)	(6)	(7)	(8)	(5)	(15)	(19)
VARIABLES	Brazil	S. Africa	Colombia	Ecuador	Peru	Chile	Canada	Russia
Commodity Price Indices	0.144***	0.000	0.011	0.010	0.008**	0.012*	0.013***	0.033**
	(0.052)	(0.010)	(0.008)	(0.010)	(0.004)	(0.006)	(0.004)	(0.016)
REER Lag	0.952***	0.970***	0.981***	0.965***	0.970***	0.960***	0.939***	0.926***
	(0.017)	(0.021)	(0.016)	(0.036)	(0.013)	(0.014)	(0.019)	(0.028)
Constant	0.229***	0.138	0.091	0.170	0.138**	0.170***	0.279***	0.349***
	(0.079)	(0.095)	(0.077)	(0.170)	(0.059)	(0.064)	(0.086)	(0.130)
Observatns	227	227	227	227	227	227	227	227
R2	0.973	0.928	0.963	0.935	0.965	0.949	0.984	0.974

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

† South Africa is an exception. But it shows a positive effect in IV regressions on the BoP.

Summary of conclusions

- The paper offers the idea of a "systematic managed float,"
  - defined as intervention that is systematic as a proportion of total Exchange Market Pressure: $\Delta EMP_t \equiv \Delta s_t + (\Delta Res)/MB_t$
- identified as countries with
  Correlation between Δs and $(\Delta Res)/MB > 0.25$;
  - supplemented by regression of Δs against Δ EMP,
    - a technique which allows baskets as anchors, not just $.
  - and by regression of fx intervention against *s* for Turkey,
    - which allows a check on Δ FX Reserves vs. intervention data.
- 7 examples of systematic managed floaters in Asia:
  India, S.Korea, Malaysia, Philippines, Singapore, Thailand & Turkey
- 4 more among commodity-exporters:
  Brazil, Peru, Russia & South Africa.

The choice of exchange rate regime matters.

- Null hypothesis:
  external shocks like the VIX and global commodity prices lead to the same Real Exchange Rate regardless of regime.
- Alternative hypothesis:
  - External shocks are reflected in the RER for systematic managed floaters, more often than for firm-fixers,
  - and more often for free-floaters than for managed floaters.
  - Note: The paper offers no hypothesis about murky others.
- Qualifications are needed,
  - including a need for refinement of time series estimation
  - and results that are not uniformly consistent…
- But the findings generally support the alternative hypothesis:
  - Systematic managed floating allows partial accommodation of shocks.

Systematic Managed Floating

Jeffrey Frankel

4th Asian Monetary Policy Forum

Appendix: Updated estimates for 4 Asian countries, using the Frankel-Wei-Xie technique

INDIA	(1)	(2)	(3)	(4)	(5)
VARIABLES	11/3/2008 -9/9/2009	9/10/2009- 11/22/2012	11/23/2012- 10/1/2013	10/2/2013- 4/7/2015	4/8/2015- 2/28/2017
USA $	0.472***	0.416***	0.440***	0.461***	0.480***
	(0.016)	(0.005)	(0.007)	(0.012)	(0.004)
eur	0.349***	0.360***	0.379***	0.356***	0.330***
	(0.021)	(0.004)	(0.006)	(0.010)	(0.004)
jpn	0.099***	0.128***	0.086***	0.065***	0.080***
	(0.012)	(0.004)	(0.003)	(0.009)	(0.003)
Δ emp	0.901***	0.988***	0.994***	0.964***	0.983***
	(0.024)	(0.005)	(0.003)	(0.010)	(0.006)
t	-0.000***	0.000***	0.000***	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.017***	-0.001***	-0.019***	0.007***	0.000
	(0.005)	(0.000)	(0.001)	(0.001)	(0.000)
Observations	214	804	214	377	474
R2	0.973	0.993	0.998	0.982	0.997
gbp	0.080	0.096	0.095	0.117	0.109

(Robust standard errors in parentheses.) *** p<0.01, ** p<0.05, * p<0.1

CHINA	(1)	(2)	(3)	(4)	(5)
VARIABLES	6/8/2011-1/2/2013	1/3/2013-9/3/2013	9/4/2013-2/3/2015	2/4/2015-4/1/2016	4/4/2016-4/28/2017
USA $	0.448***	0.501***	0.457***	0.509***	0.484***
	(0.007)	(0.014)	(0.010)	(0.008)	(0.005)
Eur €	0.345***	0.328***	0.358***	0.316***	0.331***
	(0.006)	(0.010)	(0.007)	(0.006)	(0.005)
Jpn ¥	0.099***	0.078***	0.066***	0.069***	0.078***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)
Δ emp	0.951***	0.895***	0.961***	0.926***	0.972***
	(0.012)	(0.025)	(0.014)	(0.013)	(0.012)
t	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.002***	-0.013***	-0.003***	-0.005***	-0.002***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Observations	393	168	354	290	269
R^2	0.997	0.998	0.995	0.996	0.999
Gbp £	0.108	0.093	0.118	0.106	0.108

(Robust standard errors in parentheses.) *** p<0.01, ** p<0.05, * p<0.1