Accumulation of Foreign Currency Reserves and Risk Taking

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What Do We Do:

- Did reserves accumulation lead to increased risk taking in Asia-Pacific?

- Country-level event study:
  - What happens to the price of taking on exchange rate risk around the dates of official announcements of FX reserves stocks?
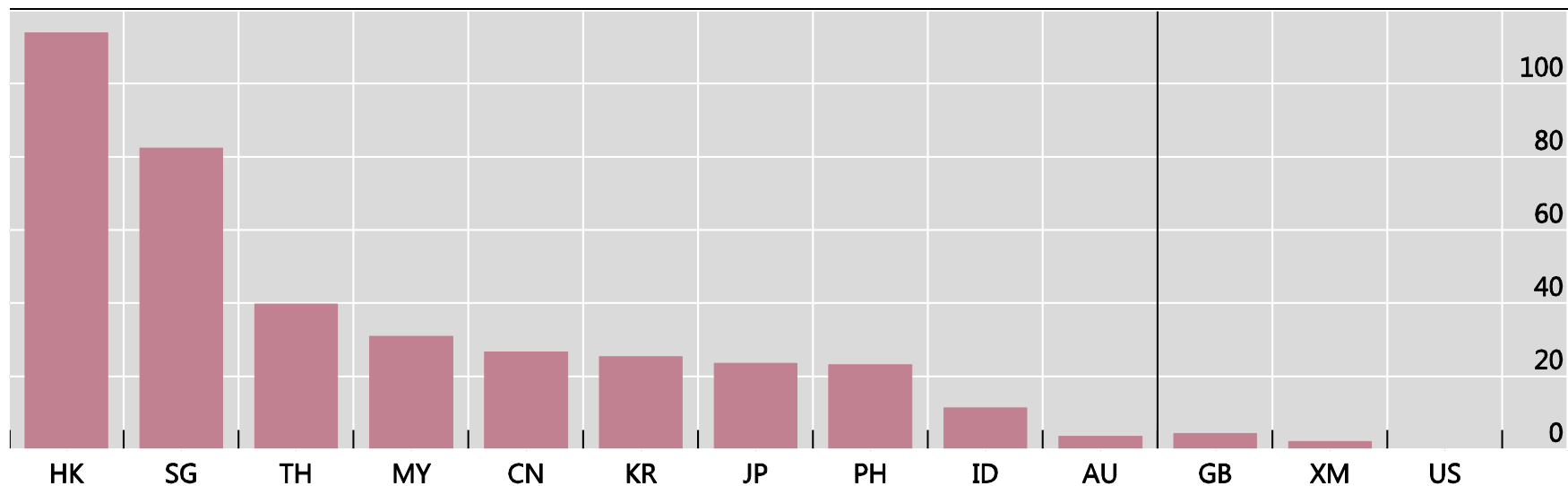
- Answer: not very much!

Background:

- Massive accumulation of reserves across Asia-Pacific region:
  - Large, in both absolute and relative terms
  - Reserves exceed 20% of GDP for eight regional economies, and exceed 80% of GDP for Singapore and Hong Kong

Foreign exchange reserves

2016 Q4, as a percentage of nominal annualized GDP

Graph 1

AU= Australia; CN = China; GB = United Kingdom; HK = Hong Kong SAR; ID = Indonesia; JP = Japan; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; US = United States; XM = euro area.

Sources: CEIC; Datastream; IMF *International Financial Statistics*; national data.

Background:

- Massive accumulation of reserves across Asia-Pacific region:
    - Large, in both absolute and relative terms
    - Reserves exceed 20% of GDP for eight regional economies, and exceed 80% of GDP for Singapore and Hong Kong
- Accumulation of reserves accounts for most of changes in the overall size of central bank balance sheets

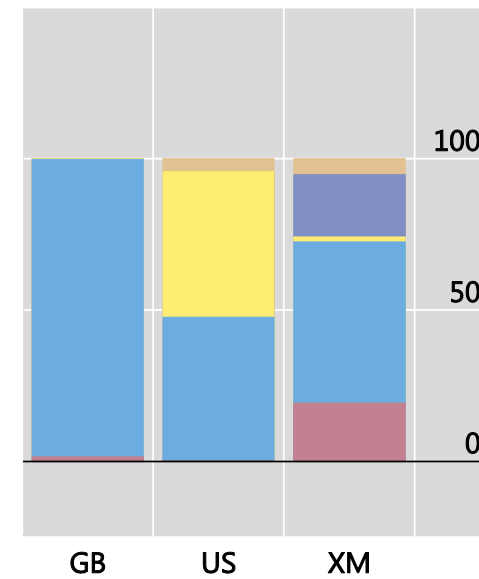# Change in the composition of central bank assets in ACC economies, 2006–16

As a percentage of change in total assets

Graph 2

ACC economies
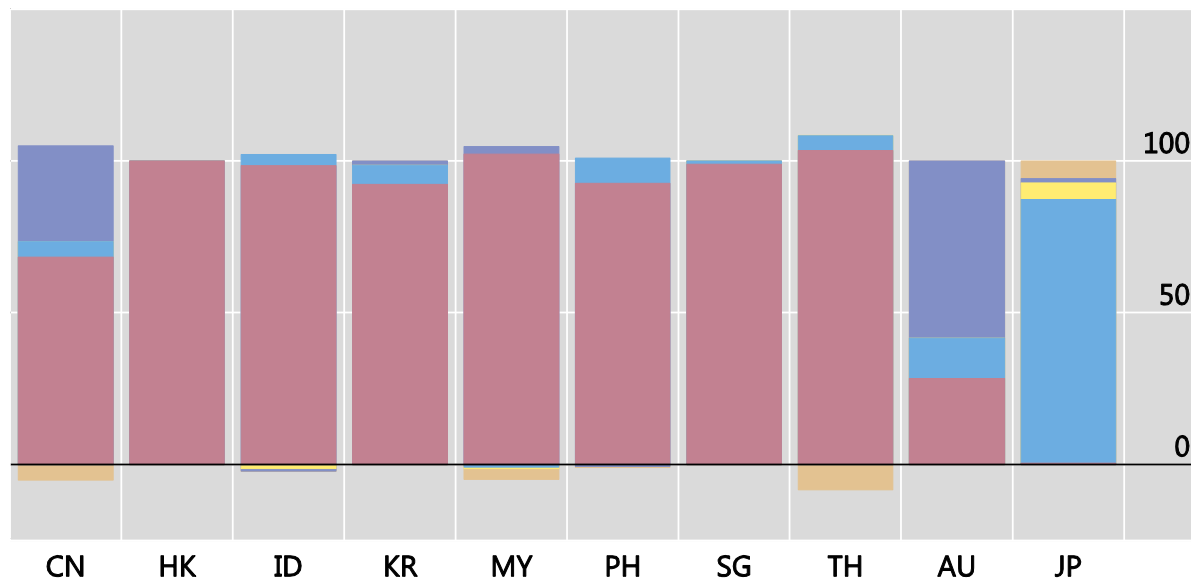
Memo: other economies[1]

Legend:
- Foreign assets
- Claims on government and public enterprises
- Claims on private sector
- Claims on banks
- Claims on other financial sector entities

AU = Australia; CN = China; GB = United Kingdom; HK = Hong Kong SAR; ID = Indonesia; JP = Japan; KR = Korea; MY = Malaysia; PH = Philippines; SG = Singapore; TH = Thailand; US = United States; XM = euro area.

[1] For United Kingdom, *net* claims on central government instead of claims on government and public enterprises.

Source: IMF *International Financial Statistics*.

Motivation:

- Holding large FX reserves may be costly:
  - Sterilization costs
  - Difficulties in implementing monetary policy
  - Inflationary pressures
  - Capital losses
  - Asset bubbles
  - Overinvestment
  - Increased risk taking

Motivation:

- Holding large FX reserves may be costly:
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  - **Increased risk taking**

How can reserves increase risk-taking?

- Reserves are seen as providing insurance:
  - More reserves => large depreciation less likely
  - More reserves => FX debt bailout more likely
- More reserves = moral hazard:
  - More willing to take on unhedged FX risks
  - Especially if CB history of LOLR of foreign currency liquidity
  - eg use of reserves / proceeds of swaps with US Fed during 2007-2009 crisis to reduce mis-matches in foreign currency market

Related literature

- Reserves provide banks with insurance against exchange rate shocks: equity prices less sensitive to exchange rates fluctuations (Cook and Yetman 2012)

- Reserve accumulation increases currency risk in the corporate sector in Latin America (Sengupta 2010)

- Increase in reserves is associated with less sovereign CDS trading (Ismailescu and Phillips 2015)

Empirical Analysis:

- Event study methodology similar to Fatum (2000); Fatum and Hutchison (2003)
- PROS:
  - Very general test of very specific hypothesis
  - No specification assumptions
  - No distributional assumptions
  - High frequency: minimal confounding effects
- CONS:
  - ???

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Event study methodology:

- Define the event of interest:

  Reserves announcements c.f.

  - **Previous announcement**
  - **Predicted reserves from simple projection model**
  - **Survey expectations (CN)**

- Identify time-periods (event windows) within which to examine response variables:

  1/2/3 days after vs before announcement

- Define the response variables (proxies for risk taking):

  - **Implied vol of 1 and 12 month call and put currency options vis-à-vis USD**
  - **CDS spreads for USD denominated sovereign bonds**
  - **Equity prices**

Look at puts and calls separately:

- Imp Vol of Calls = cost of insuring against exchange rate appreciation:
    - Increased reserves => central bank actively intervening against exchange rate appreciation => may be likely to continue doing so in future => cost of insuring against appreciation may fall
- Imp Vol of Puts = cost of insuring against exchange rate depreciation:
    - Increased reserves => central bank has larger stock of reserves to intervene against depreciations => large depreciations are less likely => cost of insuring against depreciation may fall

The events: reserves announcements

Reserves announcement data.

	First observation	Number of announcements	Average days between announcements	Average reserves (USD bn)
Australia	2006	126	30.5	46.7
China	2003	66	66.4	2202.6
Hong Kong SAR	2003	163	30.6	230.4
Indonesia	1999	456	14.5	46.4
Japan	2003	167	30.4	1042.6
Korea	2002	169	30.4	270.8
Malaysia	2001	377	15.3	90.5
Philippines	2005	134	30.4	59.0
Singapore	1999	197	32.1	172.5
Thailand	2000	873	7.1	105.9

Source: Bloomberg.

Data: synchronisation

- All variables are date and time stamped
- Need to adjust some series by one day to ensure that "event" falls into the post-event window
- Adjust also for daylight savings time (US and AU time-stamped data)

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Test 1:

Direction criterion:

- Does the response variable move in the direction consistent with the announcement during the post-event window?

  - H_0: movement is random

  - H_A: increased reserves increases risk-taking

$$P(x) = \frac{n!}{x!(n-x)!} \, p^x (1-p)^{(n-x)} \qquad p = 0.5$$

$$\text{p-value} = \sum_{y=x}^{n} P(x)$$

Test 2:

Reversal criterion:

● Does the response variable move in the direction consistent with the announcement during the post-event window in cases where it was moving in the opposite direction before?

  ▪ H_0: probability of changes in direction following events is the same as when there are no events

  ▪ H_A: probability of changes in the direction predicted by the event is greater than for non-events

$$P(x) = \frac{n!}{x!(n-x)!} p^x (1-p)^{(n-x)}$$ p from non-events

Test 3:

Smoothing criterion:

- Does the **change** in the response variable in the post-event window c.f. the pre-event window move in the direction consistent with the announcement if it was moving in the opposite direction before?
  - H_0: probability of "smoothing" following events is the same as following non-events
  - H_A: probability of "smoothing" in the direction predicted by the event is greater than for non-events

Test 4:

Information criterion:

- Are changes in the post-event window larger than in the pre-event window?

  - H_0: $\left|\text{post}\right| - \left|\text{pre}\right| = 0$
  - H_A: $\left|\text{post}\right| - \left|\text{pre}\right| > 0$

Baseline results: Thailand; implied volatility, 1-day windows

Test		Implied vol 1 month call		Implied vol 1 month put		Implied vol 12 month call		Implied vol 12 month put	
		Events	Non	Events	Non	Events	Non	Events	Non
1	Yes								
	No								
	p-val								
2	Yes								
	No								
	p-val								
3	Yes								
	No								
	p-val								
4	Yes								
	No								
	p-val								

Results:

- Overall baseline results:
  - 0 rejections: CN, HK, ID, JP, MY, PH, SG
  - 1 rejection: AU, TH
  - 3 rejections: KR
  - Across all tests/economies: 3% rejection rate at 5% significance
- Next: 6 alternatives:
  - 1,2,3 day windows; "event" in post-event window or excluded
  - 96 tests per economy (except 32 for TH)

Implied volatility meta-analysis results

	1m call	1m put	12m call	12m put	1m call	1m put	12m call	12m put
Test	**Australia**				**China**			
1	0	2	0	0	0	0	0	0
2	0	0	0	0	0	0	1	0
3	0	0	2	0	0	0	0	0
4	0	0	0	1	0	0	0	1
Test	**Hong Kong**				**Indonesia**			
1	0	0	0	1	0	0	0	0
2	0	1	2	2	0	1	1	0
3	0	0	0	0	0	0	1	0
4	0	0	0	0	1	1	2	2
Test	**Japan**				**Korea**			
1	0	0	0	0	1	0	0	0
2	0	0	0	0	0	0	2	1
3	0	0	0	0	0	0	0	0
4	0	0	0	2	0	0	0	1
Test	**Malaysia**				**Philippines**			
1	0	0	0	0	0	0	0	0
2	0	0	1	1	1	1	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	1
Test	**Singapore**				**Thailand**			
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	1	1	1
3	0	0	0	0	0	0	0	0
4	1	0	0	0	1	0	0	0

Extensions

- CDS swaps (for USD denominated sovereign debt):
  - Stronger evidence overall (13% rejection rate at 5% level)
- Equity indices: 8% rejection at 5% level
- Reserves relative to expectations (for CN):

Test	1m call	1m put	12m call	12m put	CDS	Equity
1	0	0	0	0	1	0
2	0	0	1	0	5	2
3	0	0	0	0	4	0
4	0	0	0	0	0	0

- Opposite results:
  - Combining 6 response variables, almost identical rejection rate in favour of "opposite" results (7%) than primary results (6%)!!!

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Robustness

- Post-IFC sample (2010–):
  - Fewer significant rejections (4% overall)
- Reserves relative to projections:

$$x_t = \alpha + \beta x_{t-1} + \varepsilon_t$$

$$\Rightarrow x_t = \frac{\alpha(1 - \beta^j)}{1 - \beta} + \beta^j x_{t-j} + \sum_{l=0}^{j-1} \beta^l \, \varepsilon_t$$

  - Similar overall result (6% rejection rate), although some variation across countries and variables c.f. previous results
- Reserves increases vs decreases for Test 1: little difference
- Event regressions: little evidence of any relationship

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Conclusions

- Little evidence of a link between reserves accumulation and risk-taking

- Implications for running down reserves in future – also weak?

- Caveats:

    - Imperfect proxies for risk-taking

    - Effects at sectoral / industry level could be more important

    - Is daily frequency high enough?