The prudential use of capital controls and foreign currency reserves

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Theory and practice

- Capital flow management has become part of accepted policy toolbox
- Growing literature on second-best use of capital controls:
  - Pecuniary externalities: Caballero-Krishnamurthy (2003), Bianchi (2011), Korinek (2018)
  - Aggregate demand externalities: Farhi-Werning (2016) Schmitt-Grohe-Uribe (2016)
- Focus on “prudential use”
- Similar role of reserve accumulation

This paper

- Revisit literature using a unified model
- A few themes:
  - Monetary policy dilemmas for emerging economies
  - Capital controls ex ante and ex post
    - Role of a “vertical” view of crises
    - Capital controls and crisis managament
  - Two interpretation of reserves (a reconciliation)
  - Role of fear of floating

Reserves

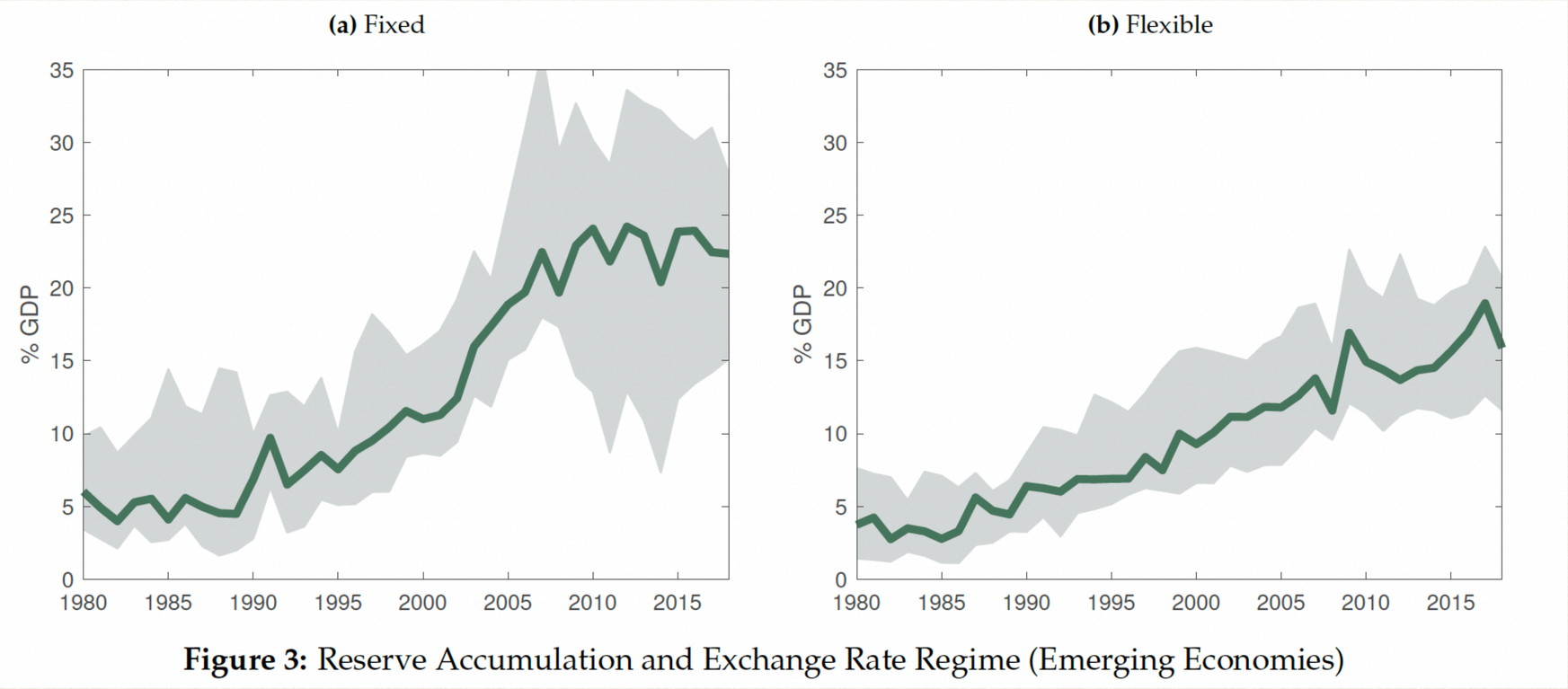


Figure 3: Reserve Accumulation and Exchange Rate Regime (Emerging Economies)

This paper

- Model ingredients:
  - T endowment, NT production (Schmitt-Grohe and Uribe 2016)
  - Sticky wages
  - Upward sloping supply of funds from international investors (Gabaix and Maggiori, 2015)
  - Fear of floating
- Related to unifying framework in Basu, Boz, Gopinath, Roch, and Unsal (2020)

Model

- Infinite horizon, representative consumer, preferences:

$$\mathbf{E}\sum_{t=0}^{\infty}\beta^{t}U\left(c_{t}^{T},c_{t}^{N}\right)$$

$$U\left(c_{t}^{T},c_{t}^{N}\right)=\frac{1}{1-\sigma}\left(\phi^{\rho}\left(c_{t}^{T}\right)^{1-\rho}+\left(1-\phi\right)^{\rho}\left(c_{t}^{N}\right)^{1-\rho}\right)^{\frac{1-\sigma}{1-\rho}}$$

- Endowment process for (notice some similarity with DCP): y_t^T
- Technology to produce N goods

$$y_{t}^{N}=n_{t}$$

Model

Model (continued)

- Budget constraint

$$\frac{1}{1+i_t}a_{t+1} + \frac{1}{1+i_t^*}e_t a_{t+1}^* - \frac{1}{1+\hat{i}_t^*}e_t b_{t+1}^* + p_t^T c_t^T + p_t^N c_t^N = e_t y_t^T + w_t n_t + a_t + e_t\left(a_t^* - b_t^*\right)$$

- Position in pesos a_t
- Long position in dollars a_t^*
- Borrowing in dollars b_t^*

Nominal rigidity

- Inelastic supply of labor $\bar{n}$
- Non walrasian equilibrium

$$n_t \leq \bar{n}, \quad w_t \geq \underline{w}$$

- With one equality

Supply of loans

- Two period lived international investors
- Face quadratic cost Φ of taking dollar position in the country
- Objective maximize

$$\mathbf{E}_t \left[b^*_{t+1} - \frac{1 + i^*_t}{1 + \hat{i}^*_t} b^*_{t+1} \right] - \frac{1}{\omega_t} \Phi \left(\frac{b^*_{t+1}}{1 + \hat{i}^*_t} \right)$$

Supply of loans (continued)

- Simple linear supply

$$\frac{b^*_{t+1}}{1+\hat{i}^*_t} = \omega_t \left(\hat{i}^*_t - i^*_t \right)$$

- Shocks to ω_t (and possibly to i^*_t)

Time line

t-1

Ex ante:
Prudential interventions
Reserve accumulation

t

Ex post:
Crisis: low realization of ω_t
Tools:

- Monetary policy
- Currency interventions
- Capital flow management
- Administrative interventions

t+1

Long run:
$\omega_{t+1} = \infty$
$i^*_{t+1} = 1 - 1/\beta$
Flex wages

Monetary policy dilemma

Time t: crisis

- Separable case ($\sigma = \rho$)
- Labor market eq. conditions + 3 equations

$$D(\hat{i}_t^*, a_t^* - b_t^*) = \omega_t \left(\hat{i}_t^* - i_t^* \right)$$ international loan market

$$\frac{e_{t+1}}{e_t}(1 + \hat{i}_t^*) = 1 + i_t$$ domestic/international loans indifference

$$n_t = \frac{1 - \phi}{\phi} \left(\frac{w_t}{e_t} \right)^{-\frac{1}{\rho}} C^T(\hat{i}_t^*, a_t^* - b_t^*)$$ domestic demand

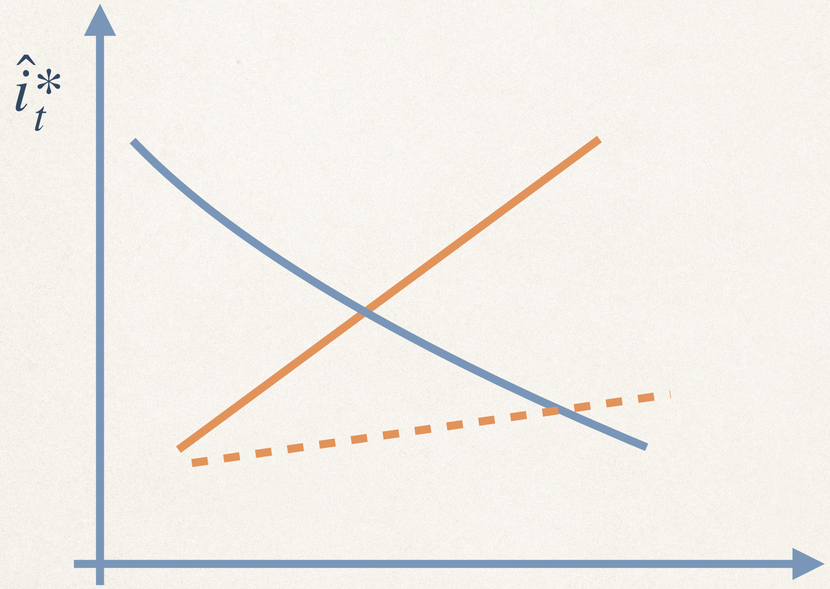
Objective function

- Assume policy maker's objective is

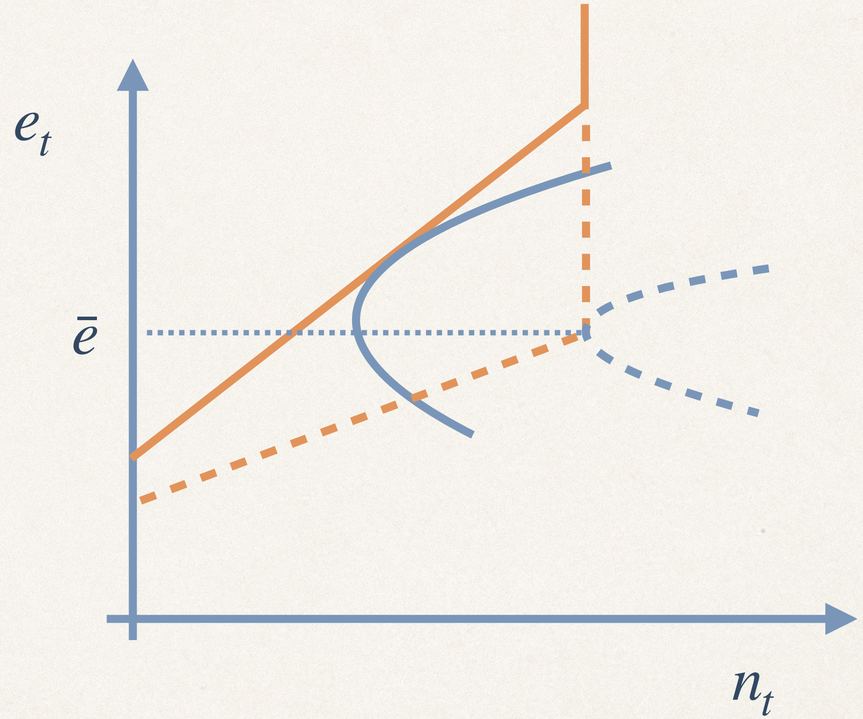
$$\left(1-\beta\right)\left(U\left(c_t^T, c_t^N\right) - \Psi\left(e_t\right)\right) + \beta U\left(c_{t+1}^T, c_{t+1}^N\right)$$

- Term $\Psi\left(e_t\right)$ captures fear of floating (later on micro foundations)

Monetary policy dilemma



International loan market



Domestic policy menu

If FOF strong can even lead to pro-cyclicality

Do ex post capital controls help?

- Not quite
- Ex post trade off: would like to stimulate c_t^T to increase demand also for N
- But facing upward sloping supply means paying higher borrowing premium
- Optimality

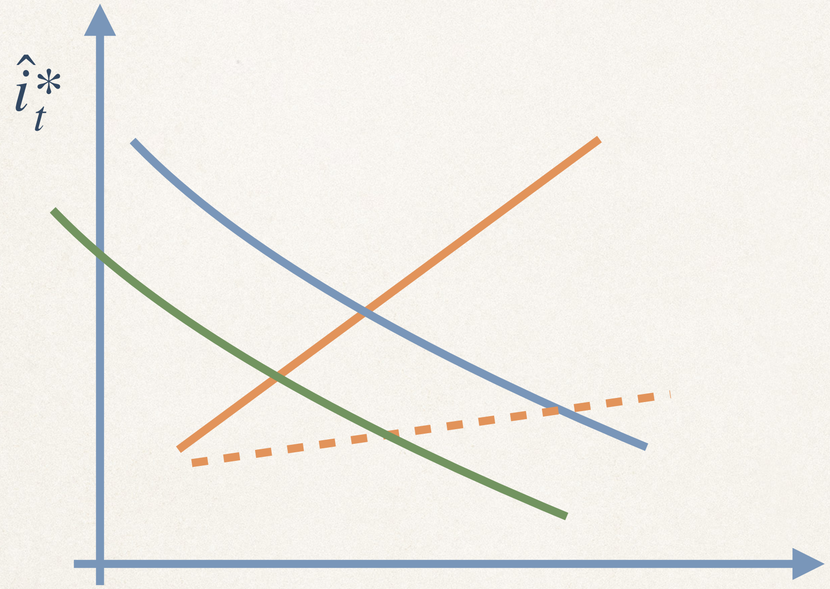
AD externality

Borrowing premium extern.

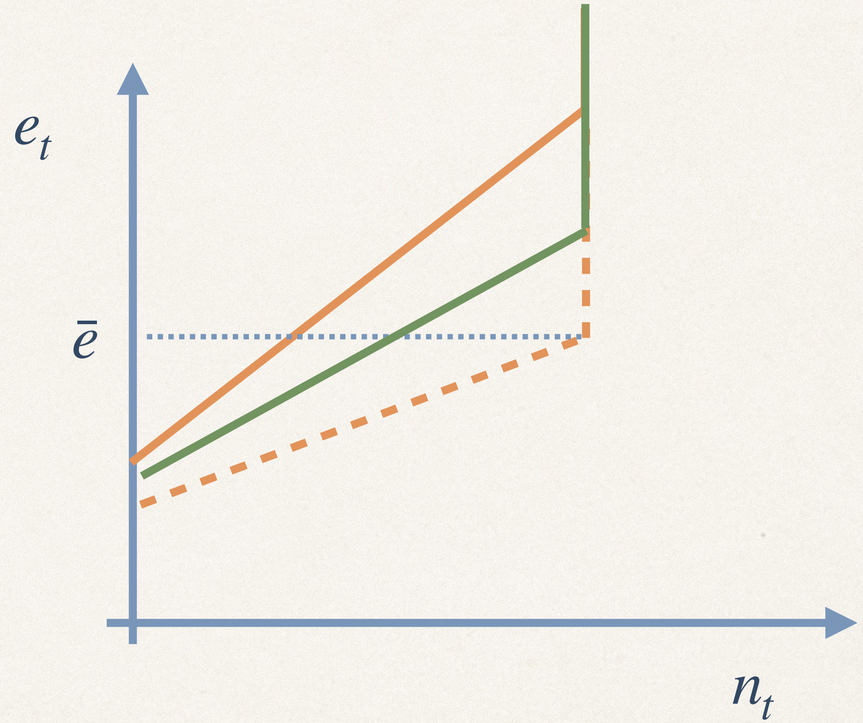
$$U_T\left(c_t^T, c_t^N\right) + U_N\left(c_t^T, c_t^N\right)\frac{c_t^N}{c_t^T} = \beta U_T\left(c_{t+1}^T, \bar{n}\right)\left(1 + \hat{i}_t^* + \frac{1}{\omega_t}\frac{b_{t+1}^*}{1+\hat{i}_t^*}\right)$$

Prudential policy

Effect of initial conditions



International loan market



Domestic policy menu

Green lines: higher value of $a_t^* - b_t^*$

Optimal choice of b_t^*

- Benefits of lower b_t^*: lower borrowing costs + higher demand (better policy menu)

$$U_T\left(c_{t-1}^T, \bar{n}\right) = \beta\left(1 + \hat{i}_{t-1}^* + \frac{1}{\omega_{t-1}}\frac{b_t^*}{1+\hat{i}_{t-1}^*}\right) E_{t-1}\left[U_T\left(c_t^T, c_t^N\right) + \iota_{n_t<\bar{n}} U_N\left(c_t^T, c_t^N\right)\frac{c_t^N}{c_t^T}\right]$$

- Ex ante both externalities go in same direction

Connections

- AD externalities with fixed exchange rates central in Farhi Werning (2012,) and Schmitt-Grohe Uribe (2016)
- In Costinot et al (2014) and FW (2014) flexible ex. rates, capital controls motivated by term-of-trade externalities (multiple goods)
- Here emphasis on pecuniary ext. in borrowing cost: less symmetry between ex ante and ex post (weaker case for ex post role of controls)
- “Vertical view” matters

Reserves: two views

- Two views of reserve accumulation
  - Precautionary view: need them to protect domestic spending if there's a crisis
  - Exchange rate management view: need them for currency interventions to prevent excessive fluctuations in exchange rate
- First view explored in models with various views of financial crises Arce Bengui Bianchi (2019), Davis, Devereux, Yu (2020), Kim and Zhang (2020)
- Second view needs currency interventions to matter
- Ilzetzki, Reinhart, and Rogoff (2019)

Benefits of reserves

- Having higher a_t^*
  - allows you to intervene in currency markets and prevent a large depreciation
  - allows the country to have more spending capacity (keep domestic rate lower, stimulate consumption and spending)

$$U_T\left(c_{t-1}^T, \bar{n}\right) = \beta\left(1 + \hat{i}_{t-1}^* + \frac{1}{\omega_{t-1}}\frac{b_t^*}{1+\hat{i}_{t-1}^*}\right) E_{t-1}\left[U_T\left(c_t^T, c_t^N\right) + \Psi'\left(e_t\right)\rho\frac{e_t}{c_t^T}\right]$$

$$U_T\left(c_{t-1}^T, \bar{n}\right) = \beta\left(1 + \hat{i}_{t-1}^* + \frac{1}{\omega_{t-1}}\frac{b_t^*}{1+\hat{i}_{t-1}^*}\right) E_{t-1}\left[U_T\left(c_t^T, c_t^N\right) + \iota_{n_t<\bar{n}} U_N\left(c_t^T, c_t^N\right)\frac{c_t^N}{c_t^T}\right]$$

Two sides of same coin!

Cost of reserves

- Budget constraint

$$\frac{1}{1+i^*_{t-1}}(A^*_t + a^*_t) - \frac{1}{1+\hat{i}^*_{t-1}} b^*_t + c^T_{t-1} = y^T_{t-1}$$

- Gov't reserve accumulation is not neutral if in equilibrium with no intervention $b^*_t > 0 = a^*_t$
- However effect on net position $A^*_t - b^*_t$ is less than 1:1
- Moreover there is opportunity cost $\hat{i}^*_{t-1} - i^*_{t-1}$
- Related to fiscal cost of reserve accumulation in Amador, Bianchi, Bocola, Perri (2020) and Fanelli, Straub (2021)

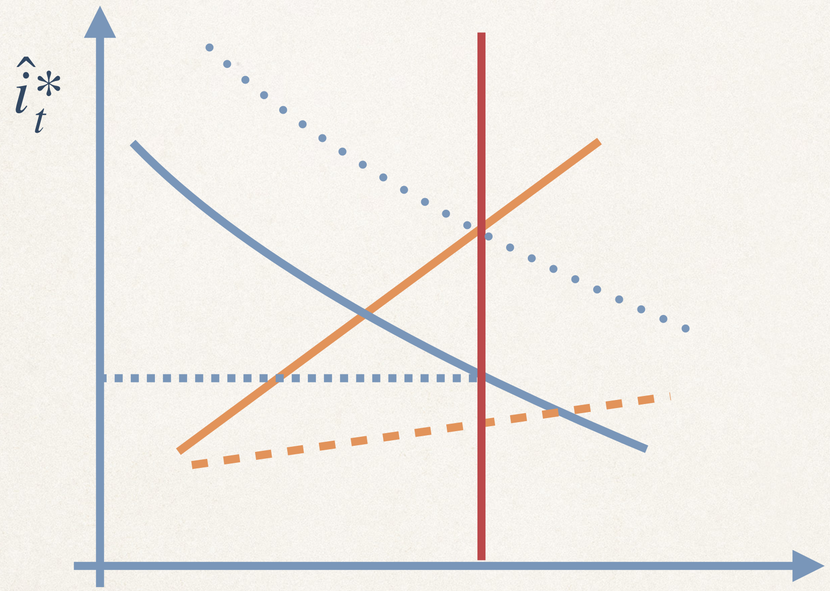
Administrative controls

Administrative controls

- Harder form of capital controls
- Foreign investors cannot repatriate a fraction of loans made at date t
- Constraint on foreign investors

$$b_{t+1} \geq \Lambda_t b_t$$

Administrative controls



International loan market

- Allows expanding c_t^T without the added borrowing cost
- With heterogeneous domestic agents similar outcome from preventing flight of domestics
- More similar to extreme measures as Malaysia 1997 or Iceland 2008
- Costly ex ante (if constraint anticipated adds cost to lending)

Fear of floating

Costs of depreciations

- Standard sticky prices don’t work (Egorov-Mukhin 2021)
- Balance sheet effects
- Feedback to spending in(possible backward bending IS)
- Credibility

Balance sheet effects

- Borrowing constraint that depends on price of N

$$\frac{b^*_{t+1}}{1+i^*_t} \leq \kappa \left(\frac{p^N_t}{e_t} \right)$$

- Example real estate prices

Contractionary devaluation

- Extreme case
- Non-monotone IS (De Long, 2001, Cespedes, Chang, Velasco 2002)

$$c_t^N = \frac{1-\phi}{\phi}\left(\frac{w_t}{e_t}\right)^{-\frac{1}{\rho}}\left[y^T - b_t^* + \kappa\left(\frac{w_t}{e_t}y_t^N\right)\right]$$

- In some region demand and employment may be decreasing in e_t
- Different mechanism in HANK: Auclert Rognlie Souchier Straub 2021

Trade off

- Even if employment is increasing in e_t trade off still present
- As depreciation reduces T consumption

$$c_t^N = \frac{1-\phi}{\phi}\left(\frac{w_t}{e_t}\right)^{-\frac{1}{\rho}}\left[y^T - b_t^* + \kappa\left(\frac{w_t}{e_t}y_t^N\right)\right]$$

$$c_t^T = y^T - b_t^* + \kappa\left(\frac{w_t}{e_t}y_t^N\right)$$

- This more similar to our Φ

Credibility/commitment

- Various dimensions: limited anchoring or reputation ($\pi_t = ky + \mathbf{E}\pi_{t+1}$)
- Here we explore a financial version of a commitment problem
- Think of country at *t-1* attracting flows in pesos from intermediaries
- Intermediaries now have SDF m

$$\frac{1}{e_{t-1}}\frac{b_t}{1+i_{t-1}} = \omega_{t-1}\mathbf{E}\left[m_{t|t-1}\left[\frac{e_{t-1}}{e_t}\left(1+i_{t-1}\right)-\left(1+i^*_{t-1}\right)\right]\right]$$

Optimal exchange rate volatility

- Consider equilibrium in which country borrows in pesos and holds dollar reserves
- Net position $a_t^* - a_t/e_t$
- Now using volatility of exchange rate provides insurance against shocks
- Depreciation has two benefits: state contingency and employment in N
- Cost from term in Lagrangian (under commitment)

$$+\lambda_{t-1}\omega_{t-1}\pi\left(s_t\right)m_{t|t-1}\frac{e_{t-1}}{e_t}\left(1+i_{t-1}\right)$$

Connections

- Growing literature on risk premia and UIP deviations (Hassan, Mertens, Zhang 2020)
- Optimal monetary policy with portfolios. Fanelli (2019)

Conclusions

- Growing literature to understand role of non-standard policy tools as precautionary tools against crises
- Aggregate demand and pecuniary externalities will keep playing central role
- Some areas with many interesting open questions:
  - Where is fear of floating coming from?
  - Connection to frictional portfolio adjustment (why upward sloping supply? risk premia)