

# When Being Thrifty Is Risky: A Paradox of Precaution in International Saving

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## Motivation: “save for a rainy day”

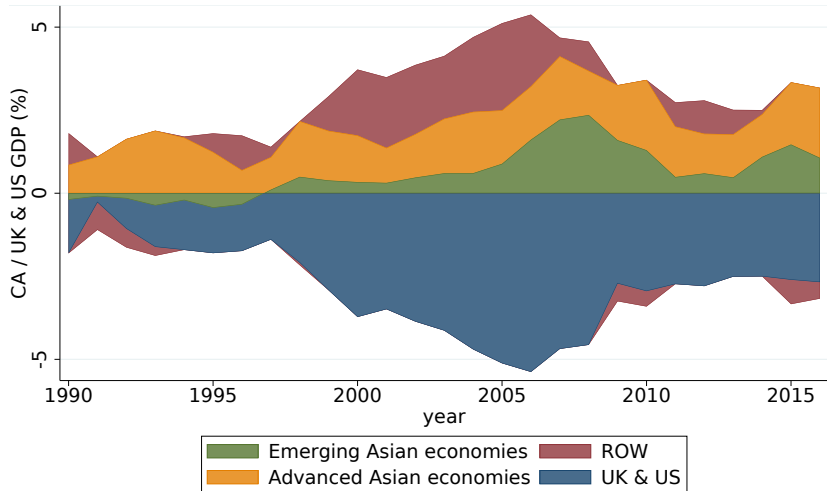


Figure: Global saving glut: surplus periphery and deficit center

## Question

- ▶ Is saving for self-insurance effective?

# Competing effects of additional savings on stability

- ▶ Direct effect (+)
  - ▶ Saver larger buffer
- ▶ GE effect (-)
  - ▶ Spillover: borrower more indebted and crisis-prone
  - ▶ Spillback: borrower's crises destabilize the saver

# Preview of results

- ▶ *Paradox of precaution*
  - ▶ Additional savings increase economic volatility
  - ▶ GE effect dominates direct effect
  - ▶ If savers large
  
- ▶ *Excessive savings and volatility*
  - ▶ Comparing to the equilibrium when savers cooperate
  - ▶ GE effect not (fully) internalized
  - ▶ If savers individually small but collectively large

## Example of GE effect

- ▶ Spillover: global imbalances contributed to the subprime crisis
  - ▶ alongside financial innovation and regulation failure
- ▶ Spillback: *Global* financial crisis

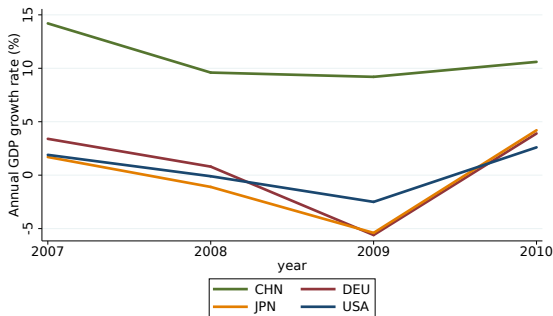


Figure: GDP Growth rate

## Literature review

- ▶ Sudden stops and macroprudential policy
  - ▶ SOE framework: Jeanne and Korinek (2010); Mendoza (2010); Bianchi (2011); Benigno et al. (2013); Jeanne and Korinek (2013)
  - ▶ This paper: two-country with GE effect.
- ▶ Global Imbalances
  - ▶ Efficient outcome from asymmetry: Caballero et al. (2008); Mendoza et al. (2009); Jin (2012),
  - ▶ This paper: excessive if GE effect not internalized.
- ▶ Paradox of global thrift
  - ▶ Zero lower bound: Caballero et al. (2016); Caballero and Farhi (2017); Fornaro and Romei (2018)
  - ▶ This paper: real

# Plan of the presentation

## 1 Quantitative model

- ▶ Production economy, TFP shocks, infinite horizon
- ▶ Calibrated to China and US

## 2 Positive analyses

- ▶ Effect of saving tax on consumption volatility
- ▶ How large is large for paradox of precaution?

## 3 Normative analyses



# 1, Quantitative model

## Quantitative model: environment

- ▶ 2-country production with occasionally-binding financial constraints
- ▶ Relaxations to the analytical model
  - ▶ Output produced from fixed land and endogenous labor
  - ▶ Infinite horizon
  - ▶ Productivity shocks
- ▶ Calibrated to reflect global imbalances
  - ▶ Foreign financial constraint tighter
  - ▶ Foreign productivity shocks more volatile

## Home consumer-entrepreneur's problem

$$V = \max \mathbb{E} \sum_{t=1}^{\infty} \beta^t \frac{\left( C_t - \chi \frac{(L_t^s)^{1+\omega}}{1+\omega} \right)^{1-\sigma} - 1}{1-\sigma}$$

s.t.

$$C_t + Q_t(K_t - K_{t-1}) + P_t B_t = W_t L_t^s + B_{t-1} + \left( Z_t K_{t-1}^\alpha (L_t^d)^\gamma - W_t L_t^d \right)$$

$$-P_t B_t + \theta W_t L_t^d \leq \phi Q_t K_t$$

$$\log(Z_t - \bar{Z}) = \rho_Z \log(Z_t - \bar{Z}) + \epsilon_Z$$

- ▶  $C_t$ : consumption,  $L_t$ : labor,  $W_t$ : wage,  $K_t$ : land,  $Q_t$ : land price,  $B_t$ : bond,  $P_t$ : bond price,  $Z_t$ : productivity.
- ▶ Total debt cannot exceed a fraction of land collateral.

## Foreign consumer-entrepreneur's problem (symmetric)

$$V^* = \max \mathbb{E} \sum_{t=1}^{\infty} (\beta^*)^t \frac{\left( C_t^* - \chi^* \frac{(L_t^{s*})^{1+\omega^*}}{1+\omega^*} \right)^{1-\sigma^*} - 1}{1-\sigma^*}$$

s.t.

$$\begin{aligned} & C_t^* + Q_t^* (K_t^* - K_{t-1}^*) + P_t (1 + \tau^*) B_t^* \\ &= W_t^* L_t^{s*} + B_{t-1}^* + \left( Z_t^* (K_{t-1}^*)^{\alpha^*} (L_t^{d*})^{\gamma^*} - W_t^* L_t^{d*} \right) + T_t^* \\ & \quad - P_t B_t^* + \theta^* W_t^* L_t^{d*} \leq \phi^* Q_t^* K_t^* \\ & \log \left( Z_t^* - \bar{Z}^* \right) = \rho_Z^* \log \left( Z_t^* - \bar{Z}^* \right) + \epsilon_Z^* \end{aligned}$$

- ▶ constant saving tax  $\tau^*$  fully rebated with transfer  $T_t^* = \tau^* P_t B_t^*$ .

## Market clearing conditions

- ▶ Labor markets clear

$$L_t^s = L_t^d$$

$$L_t^{s*} = L_t^{d*}$$

- ▶ Land markets clear

$$K_t \equiv K$$

$$K_t^* \equiv K^*$$

- ▶ International bond market clears ( $n$  the population of foreign/home)

$$B_t + nB_t^* = 0$$

# Numerical algorithm

- ▶ To deal with portfolio choice and occasionally binding constraints
  - ▶ Time iteration (Coleman, 1990).
- ▶ To deal with two occasionally binding constraints
  - ▶ Transform original complementarity slackness conditions

$$\mu X = 0, \mu \geq 0, X \geq 0$$

to

$$\mu = \max(0, \hat{\mu}^3), X = \max(0, -\hat{\mu}^3), \hat{\mu} \in (-\infty, \infty)$$

- ▶ To improve speed and accuracy
  - ▶ Adaptive grids
  - ▶ Parallelization

## Calibration: China and US in early 2010s

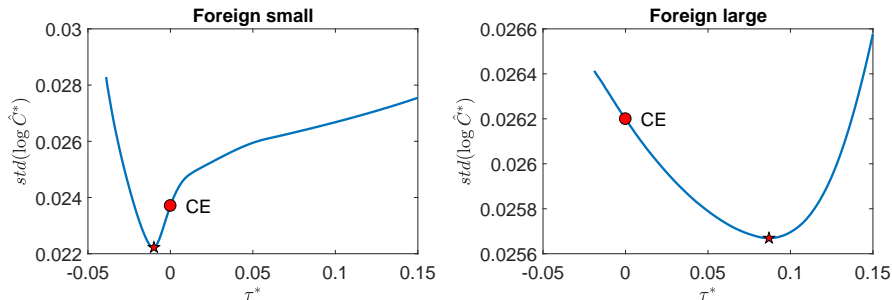
Parameter	Description	Value	Source/Target
$\theta\gamma$	working capital coefficient	0.15	cal. $M_1/GDP = 0.15$
$\theta^*\gamma^*$	working capital coefficient	0.5	cal. $M_1^*/GDP^* = 0.5$
$\bar{z}^*/\bar{z}$	mean productivity	0.25	tar. $GDP^*/GDP = 0.5$
$\phi$	pledgeability	0.29	tar. US freq. crisis 0.03
$\phi^*$	pledgeability	0.1	tar. $NIIP^*/GDP^* = 0.4$

- ▶ Independent productivity shocks for the two countries
- ▶ Rest from calibration:  $\beta, \beta^* = 0.96$ ,  $\sigma, \sigma^* = 2$ ,  $\gamma, \gamma^* = 2/3$ ,  $\omega, \omega^* = 1$ ,  $n = 4$
- ▶ Rest from targeting HP filtered  $\ln Y, \ln Y^*$ :  $\rho = 0.55$ ,  $\sigma_z = 0.012$ ,  $\rho^* = 0.79$ ,  $\sigma_z^* = 0.016$ .
- ▶ Rest from normalization:  $\chi, \chi^* = 2/3$ ,  $K, K^* = 1$ ,  $\alpha, \alpha^* = 0.05$ ,  $\bar{z} = 1$ ,

## 2, Positive analyses



## Non-monotone effect of foreign saving tax

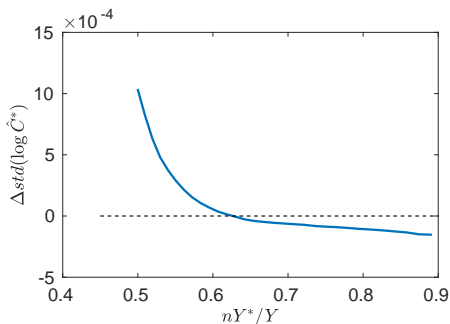


**Figure:** Effect of foreign saving tax on foreign consumption volatility.

Left panel: foreign small scenario,  $\bar{Z}^*/\bar{Z} = 0.125$  so  $nY^*/Y = 0.5$ . Right panel: foreign large scenario,  $\bar{Z}^*/\bar{Z} = 0.342$  so  $nY^*/Y = 0.8$ . Circle marker: laissez-faire equilibrium. Star marker: tax for volatility minimizing.

- ▶ Upward-sloping: Direct effect dominates w/ small global imbalances
- ▶ Downward-sloping: GE effect dominates w/ large global imbalances
- ▶ Paradox of precaution when foreign large.

## Foreign economy size and paradox of precaution



**Figure:** Effect of foreign saving tax  $\tau^* = 0.01$  on foreign consumption volatility for different relative GDP driven by mean productivity  $\bar{Z}^*/\bar{Z}$

- ▶ Saving tax improves economic stability if foreign/home GDP  $> 0.62$ .

### 3, Normative analyses

## Foreign policymaker's problem

- ▶ Continuum of identical foreign economies subject to common shocks
- ▶ Each has a policymaker.
- ▶ Policymaker  $i$  choose a constant  $\tau_i$  to maximize  $\mathbb{E}V_i^*$ 
  - ▶ Individually
  - ▶ Collectively
- ▶ Extra numerical method for acting individually
  - ▶ Two continuous state variables  $B_t^*, B_{i,t}^*$
  - ▶ To mitigate curse of dimension, place grid point at the kink

# Foreign policymaker's choice

- ▶ Individually:
  - ▶ Policymaker takes international conditions, summarized by  $P_t$ , as given.
  - ▶ It internalizes that higher savings at good time relaxes the collateral constraint ( $Q_t^*$  higher) at its bad time, which is ignored by consumer-entrepreneur.
  - ▶ Saving subsidy (conventional wisdom from SOE).
- ▶ Collectively:
  - ▶ In addition, policymaker internalizes the aforementioned GE effect.
  - ▶ In addition, policymaker exercises the monopoly supply of saving.
  - ▶ Both suggest saving tax.

## Foreign policymaker's choice

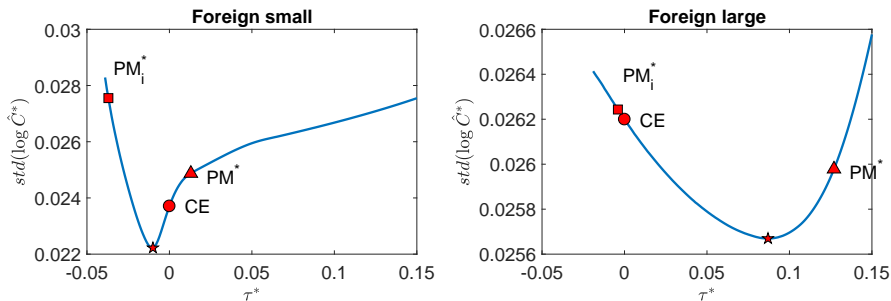


Figure: Effect of foreign saving tax on foreign consumption volatility

Square marker: individual policymaker's choice. Triangle marker: policymakers' collective choice.

# Conclusion

- ▶ GE effect (-) can overturn direct effect (+) from saving.
- ▶ Paradox of precaution increasingly likely overtime.
  - ▶ Policy: rebalance if large
- ▶ Excessive global imbalances and volatility w/o cooperation
  - ▶ Policy: cooperation
- ▶ Broader policy implications
  - ▶ Currency swaps
  - ▶ Global lender of last resort
  - ▶ Liberalization of service trade