Can Reserve Accumulation be Counterproductive?

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Overview

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2. Research Question
3. Basic Assumptions and Stylized Facts
4. Model
5. Next Steps

Extent of Foreign Exchange Intervention

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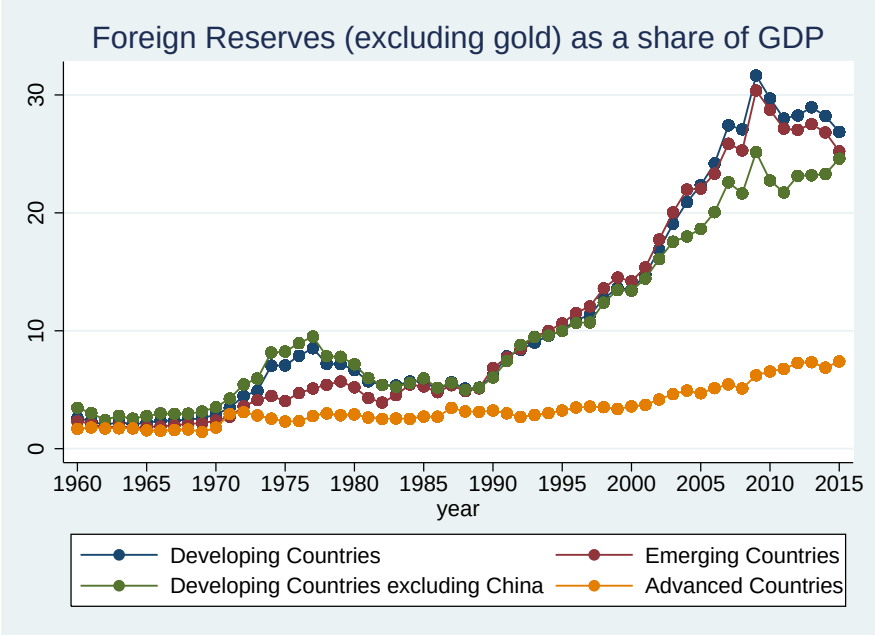
Figure: Reserves as a Share of GDP (%)



Source: Author's Calculations based data from World Bank World Development Indicators

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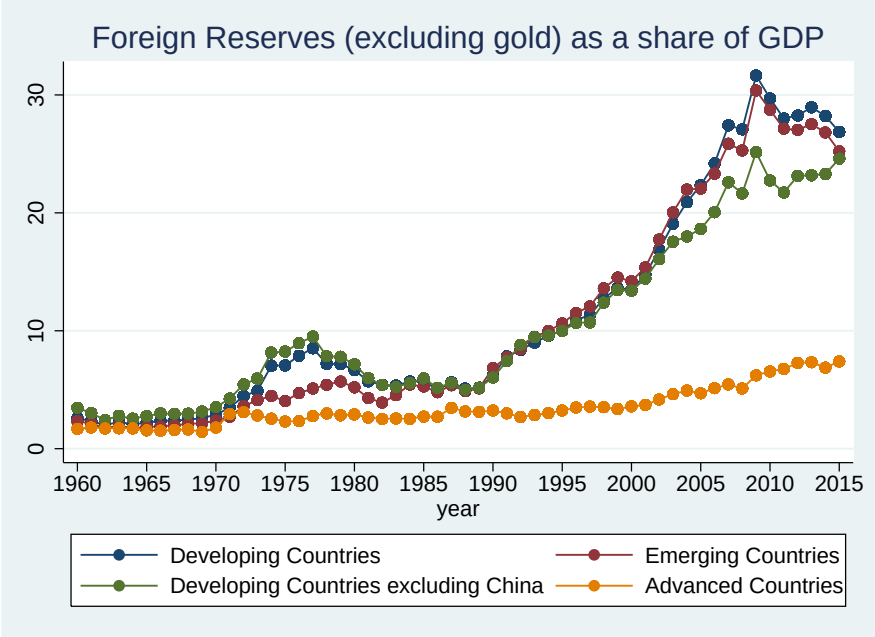

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Main Argument

- This papers entertains the theoretical possibility that the extent of reserve accumulation has unintended consequences that are costly.
- I argue that higher reserve accumulation may make economies more attractive to foreign capital inflows in the context of the global financial cycle.
- Therefore, it may be the case that higher reserve accumulation, intended as a safeguard against the effects of volatile capital flows creates the conditions it seeks to prevent through moral hazard.

Research Question

- Main Purpose: To theorize and identify potential indirect costs of foreign exchange intervention.
- Research Question: Is it possible that higher reserve holdings encourage higher capital inflows and create instability and crisis, ceterus paribus?
  - One of the best predictors of financial crises can be shown to be excessive credit growth. In particular, gross flows of capital can serve as a source of significant instability, even if net flows do not reflect an imbalance in the balance of payments.
  - There has been significant build up of reserves in many developing countries which theoretically create moral hazard.

Basic Assumptions and Stylized Facts

- Global financial cycle in in capital flows, asset prices, and credit growth that is correlated with monetary policy in the core countries, regardless of specific domestic macroeconomic conditions.

Heatmap of Correlation of Gross Inflows (Rey, 2013)

Liability	Equity	Equity	Equity	Equity	Equity	Equity	Equity	FDI	FDI	FDI	FDI	FDI	FDI	FDI
Flows	N.Am	LatAm	CE.EU	W.EU	Em.As	Asia	Africa	N.Am	LatAm	CE.EU	W.EU	Em.As	Asia	Africa
Equity N.Am	1													
Equity LatAm	0.39	1												
Equity CE.EU	0.52	0.49	1											
Equity W.EU	0.63	0.35	0.5	1										
Equity EM.As	0.37	0.24	0.28	0.47	1									
Equity Asia	0.24	0.31	0.28	0.4	0.51	1								
Equity Africa	0.41	0.22	0.26	0.55	0.54	0.26	1							
FDI N.Am	0.54	0.06	0.07	0.45	0.52	-0.07	0.22	1						
FDI LatAm	0.41	0.1	0.08	0.29	0.52	-0.07	0.04	0.68	1					
FDI CE.EU	0.46	0.11	0.08	0.18	0.23	-0.12	0.09	0.61	0.65	1				
FDI W.EU	0.57	0.21	0.19	0.58	0.35	0.01	0.16	0.61	0.59	0.75	1			
FDI EM.As	0.47	0.24	0.16	0.54	0.56	-0.04	0.04	0.65	0.77	0.69	0.64	1		
FDI Asia	0.36	0.16	0.03	0.29	0.5	-0.17	0.05	0.6	0.7	0.57	0.51	0.69	1	
FDI Africa	0.33	0.01	0.1	0.18	0.03	-0.16	-0.19	0.31	0.36	0.35	0.35	0.34	0.27	1
Debt N.Am	0.42	0.17	0.32	0.51	0.29	0.21	0.31	0.4	0.39	0.55	0.51	0.48	0.37	0.08
Debt LatAm	0.2	0.4	0.33	0.16	0.13	0	-0.05	0.16	0.35	0.13	0.05	0.31	0.26	0.06
Debt CE.EU	0.37	0.42	0.5	0.43	0.13	0.17	0.19	0.14	0.35	0.14	0.12	0.47	0.21	0.04
Debt W.EU	0.49	0.05	0.33	0.5	0.23	0.27	0.47	0.29	0.1	0.44	0.27	0.25	0.02	0.1
Debt EM.As	0.4	0.58	0.65	0.55	0.2	0.23	0.2	0.13	0.24	0.25	0.37	0.35	0.15	0.02
Debt Asia	0.16	0.18	0.24	0.22	0.16	-0.04	0.16	0.35	0.31	0.3	0.3	0.45	0.26	0.14
Debt Africa	0.26	0.27	0.39	0.18	0.07	0.14	0.09	0.12	0.21	0.1	0.01	0.41	0.21	0.07
Credit N.Am.	0.29	-0.02	0.21	0.58	0.15	-0.01	0.32	0.2	0.02	0.19	0.2	0.12	0.09	0.04
Credit LatAm	0.41	0.34	0.21	0.26	0.12	0.04	0.22	0.38	0.35	0.42	0.27	0.48	0.35	0.24
Credit CE.EU	0.42	0.25	0.27	0.28	0.32	0.15	0.21	0.54	0.38	0.72	0.55	0.47	0.36	0.28
Credit W.EU	0.19	-0.05	0.24	0.51	0.19	-0.16	0.26	0.27	0.08	0.2	0.3	0.19	0.15	0.15
Credit EM.As	0.25	0.54	0.39	0.21	0.1	0.16	0.05	0.22	0.16	0.3	0.29	0.38	0.24	0
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Basic Assumptions

- Global financial cycle in in capital flows, asset prices, and credit growth that is correlated with monetary policy in the core countries, regardless of specific domestic macroeconomic conditions.
- One of the best predictors of financial crises can be shown to be excessive credit growth.
- There has been an unprecedented increase in reserve accumulation, especially in developing countries
- Moral hazard may be an unintended consequence of this reserve accumulation
  - *...no ex-ante announcement by policy makers can convince the public that ex-post (that in the midst of a generalized financial turmoil) the government would cross its arms and let the financial system proceed towards its debacle.* (Corsetti et al., 1999)

Model Basics: Three regimes of Firm Finance a la Minsky

- Model of financial fragility based on Foley (2001) and Taylor and O'Connell (1985).

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- Model of financial fragility based on Foley (2001) and Taylor and O'Connell (1985).
- Monetary policy of the center country plays an important role, instead of domestic monetary policy.
- Incorporation of elements of moral hazard: higher reserve accumulation leading to more rapid transition from a hedge finance regime to a ponzi finance regime.

Firm Finance

- Cash Flows of a Firm: $R + D \equiv I + V$
  - R: Operating Revenues
  - D: New Borrowing
  - I: Investment
  - V: Debt Service
- Three possible financial states
  - Hedged Firm: $R \geq V + I$ (Revenues covers debt service and investment)

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  - Ponzi Firm: $R < V$, so that $D > I$ (Firm is borrowing to at least partly service its debt)

Firm Finance: Regimes of Finance

- If the total debt of the firm is B, then

$$\begin{aligned} \dot{B} &= D \\ &= D = I + V - R \end{aligned} \tag{1}$$

- Writing this as a proportion of the firm's assets and liabilities

$$\dot{B} = (g - r)A + iB \tag{2}$$

Where, $g = I/A$, $r = R/A$, and $i = V/B$

- Solution of this differential equation is

$$B(t) = (B_0 - \frac{g - r}{g - i}A_0)e^{it} + \frac{g - r}{g - i}A_0 e^{gt} \tag{3}$$

Firm Finance: Regimes of Finance

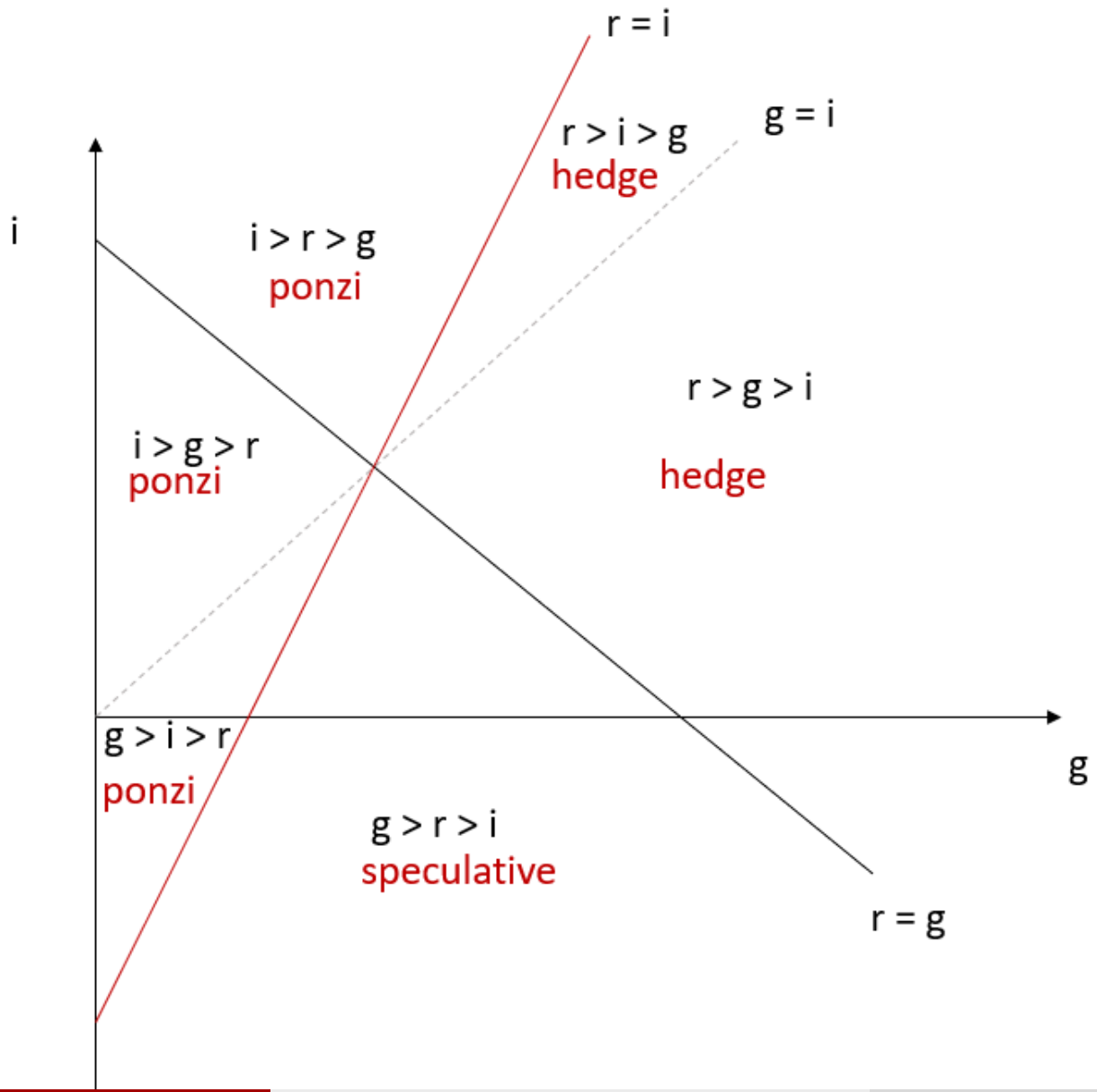
- Writing this in terms of $\phi = B/A$

$$\phi(t) = \phi^* + (\phi_0 - \phi^*)e^{(i-g)t} \tag{4}$$

  where $\phi^* = \frac{g-r}{g-i}$

- Firm solvency requires $\phi < 1$. The firm would be on the path of becoming bankrupt under the following conditions:
  - If $i > g$, $\lim_{t\to\infty} \phi(t) = \pm\infty$ as $\phi_0 > \phi^*$
  - If $g > i$, $\lim_{t\to\infty} \phi(t) = \phi^*$. This would be a path on which the firm would also become bankrupt in finite time if $\phi^* > 1$ or if $i > r$.
- Firms will not be on the path to bankruptcy if $i < g$ and $r > i$.

Regimes of Finance



Finance at the level of the Economy: Setup

- Writing $d = D/K$, $g = I/K$, and $r = \pi X/K$,
  - D is capital account surplus
  - I is investment
  - X is output
  - K is capital stock
  - pi is share of profits out of output X
- We can analogously write

$$d = g - sr \tag{5}$$

- We assume that capital account surplus d depends on the interest rate of the center country that determines global conditions of liquidity i, and the profit rate r:

$$d = d_0 - \eta i - \psi sr \tag{6}$$

- We assume that growth rate of capital depends on profit rate r, real interest rate i, and a confidence factor ρ

$$g = g_0 + h(r + \rho - i) \tag{7}$$

Model Dynamics

- Laws of motion of state variables ρ and i
  - $\dot{\rho}$

$$\dot{\rho} = \beta(g - \overline{g}) - \delta i \tag{8}$$

    where $\beta > 0$ and $\delta > 0$
  - $\dot{i}$

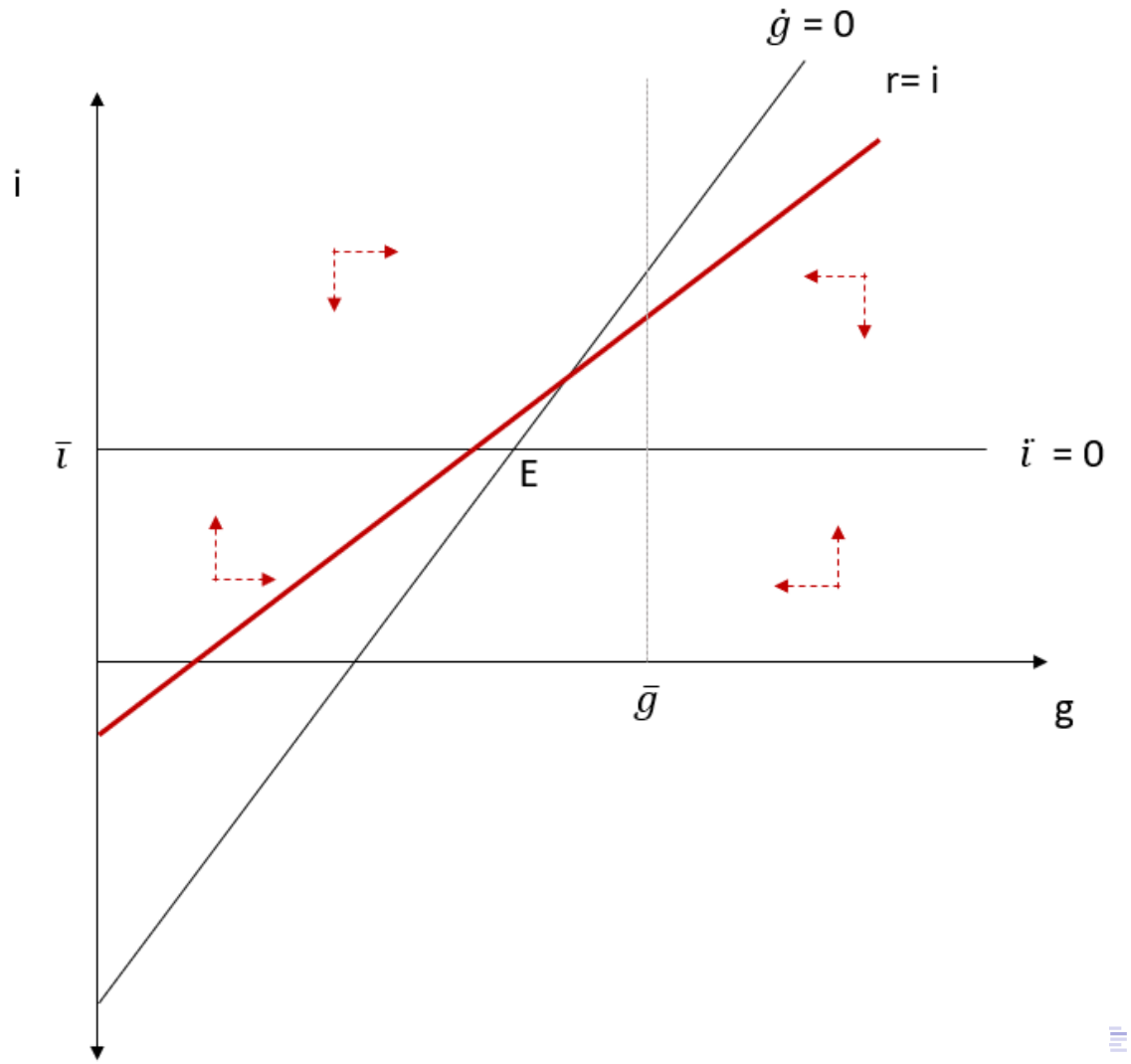
$$\dot{i} = \gamma(i - \bar{i}) \tag{9}$$

    where $\gamma < 0$
- This allows us to get a dynamic equation for $\dot{g}$

$$\dot{g} = \frac{hs(1-\psi)\beta g}{s(1-\psi)-h} - \frac{(hs(1-\psi)(\delta+\gamma) - h\eta\gamma)i}{s(1-\psi)-h} - \frac{hs(1-\psi)\beta\overline{g} + h\gamma\bar{i}}{s(1-\psi)-h} \tag{10}$$

Model Dynamics: Phase Diagram

Figure: Phase Diagram



Model: Adding Reserves

- Reserve accumulation would be the excess of new borrowing d over the current account deficit. Let us assume it depends on g and i in the following way

$$R = \lambda g - \alpha i \tag{11}$$

- Reserves positively affects the change in confidence factor

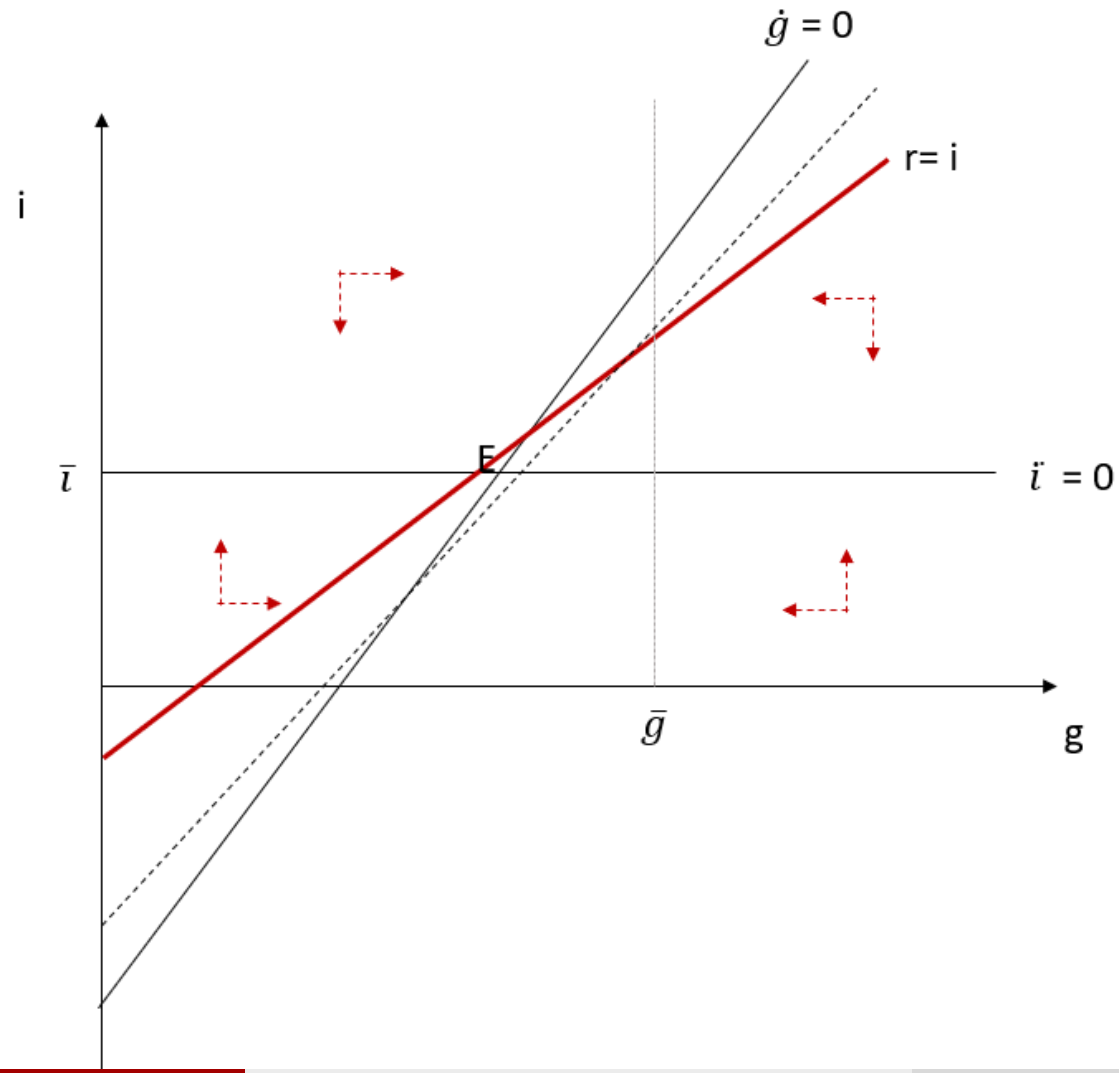
$$\begin{aligned} \dot{\rho} &= \beta(g - \overline{g}) - \delta i + \lambda R \\ &= \beta(g - \overline{g}) - \delta i + \lambda g - \alpha i \end{aligned} \tag{12}$$

- $\dot{g}$ then becomes

$$\begin{aligned} \dot{g} &= \frac{hs(1-\psi)}{s(1-\psi)-h}\dot{\rho} - \frac{h(s(1-\psi)-\eta)}{s(1-\psi)-h}\dot{i} \\ &= \frac{hs(1-\psi)(\beta+\lambda)}{s(1-\psi)-h}g + \frac{hs(1-\psi)(\gamma\bar{i} - \beta\overline{g}) - h\eta\gamma\bar{i}}{s(1-\psi)-h} \\ &- \frac{hs(1-\psi)(\delta+\alpha+\gamma)-\eta\gamma}{s(1-\psi)-h}i \end{aligned} \tag{13}$$

New Phase Diagram

Figure: Phase Diagram with Reserves



Conclusions

- There may be unintended consequences of the current model of self-insurance used by central banks in the current international monetary system, which may render it ineffective and expensive.
- This paper builds a theoretical model in the tradition of Minsky to show that theoretical possibility.
- In this model, reserves create more exuberance in the economy that pushes the economy into a more financially vulnerable state.

Next Steps

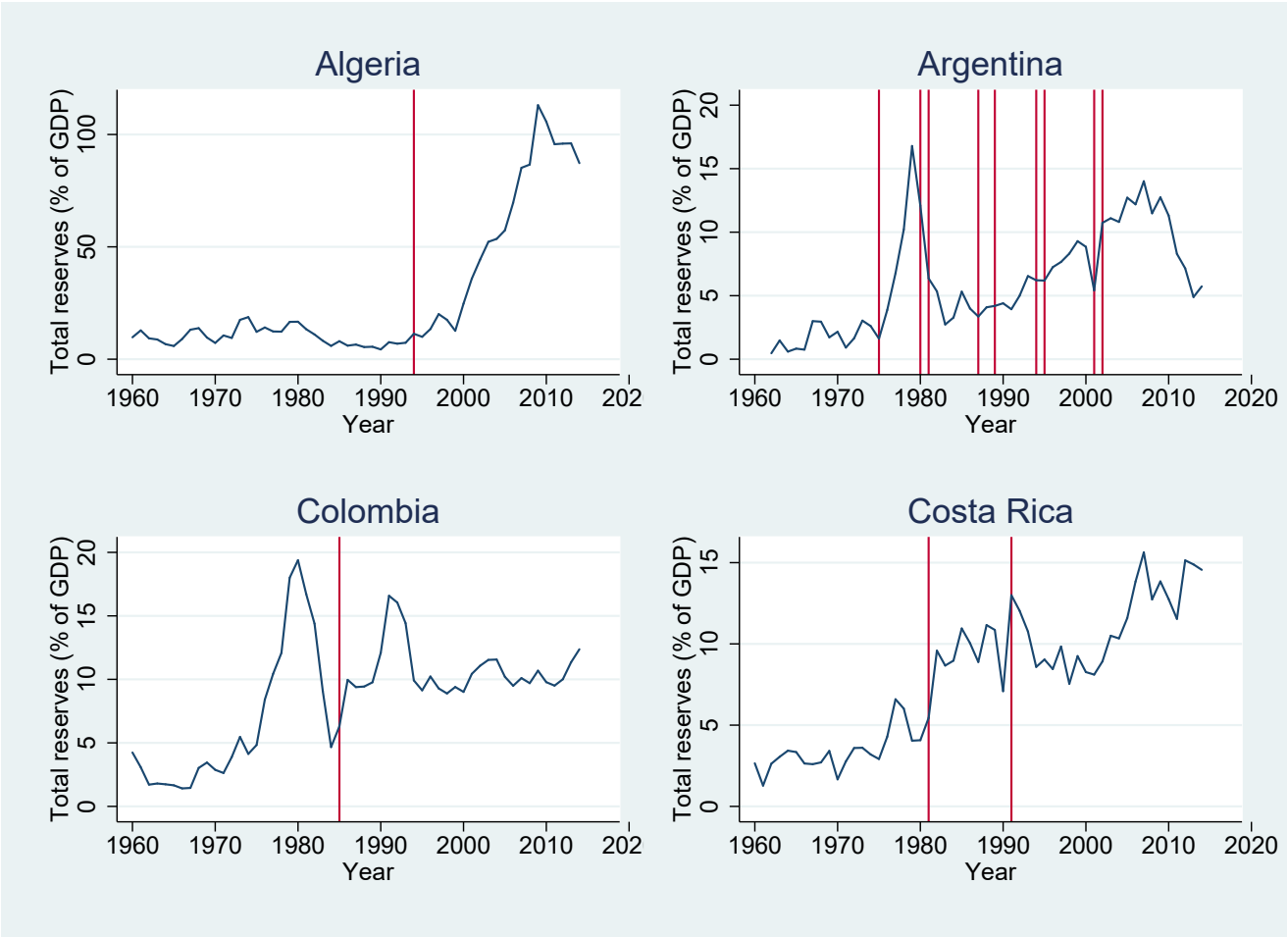
- Empirical verification!!

▸ Trend

Thank you for you attention!

Evidence: Reserve Accumulation and Crises?

Figure: Reserve Accumulation and Crises in Emerging Markets



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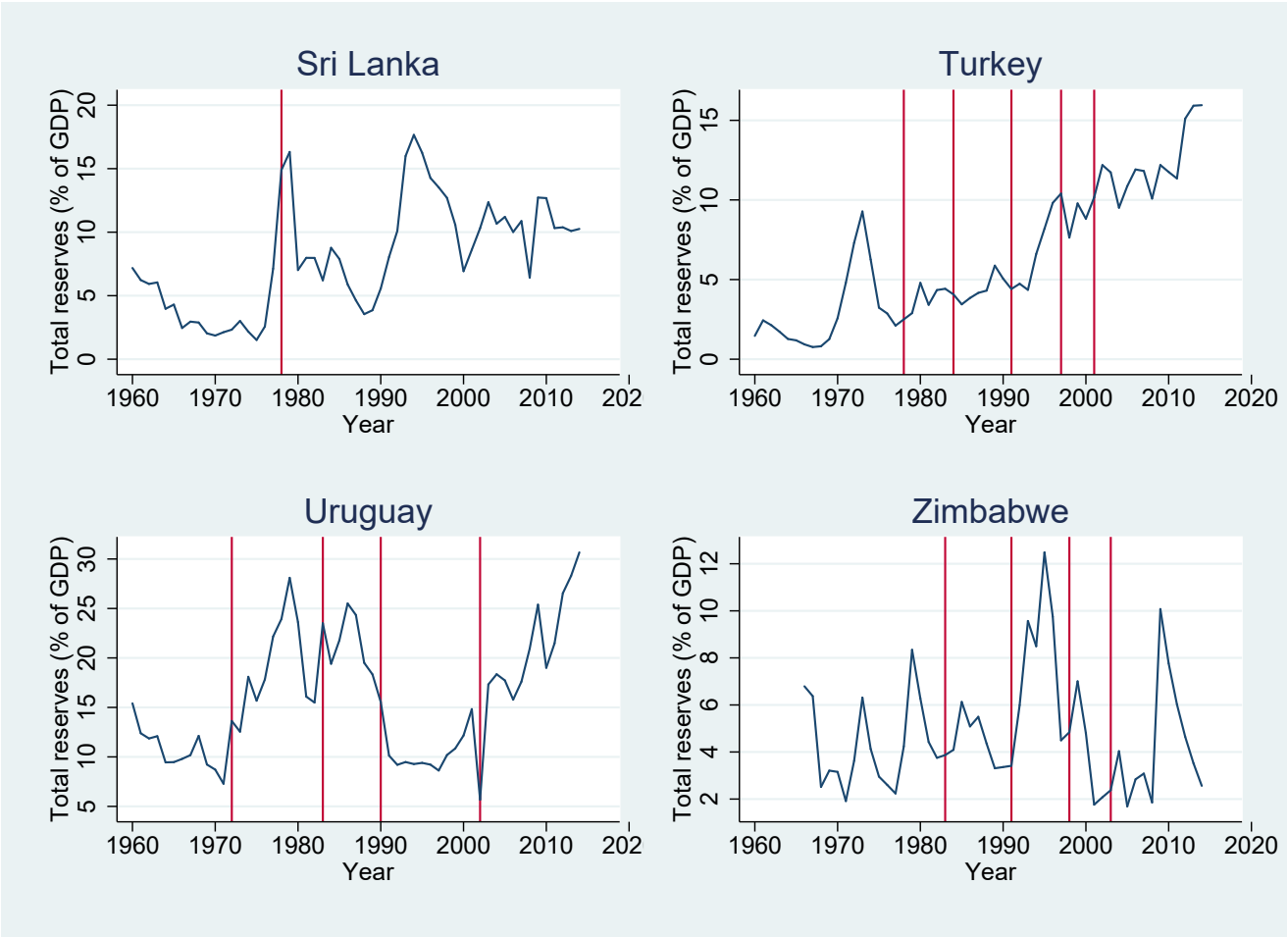

Evidence: Reserve Accumulation and Crises?

Figure: Reserve Accumulation and Crises in Advanced Economies

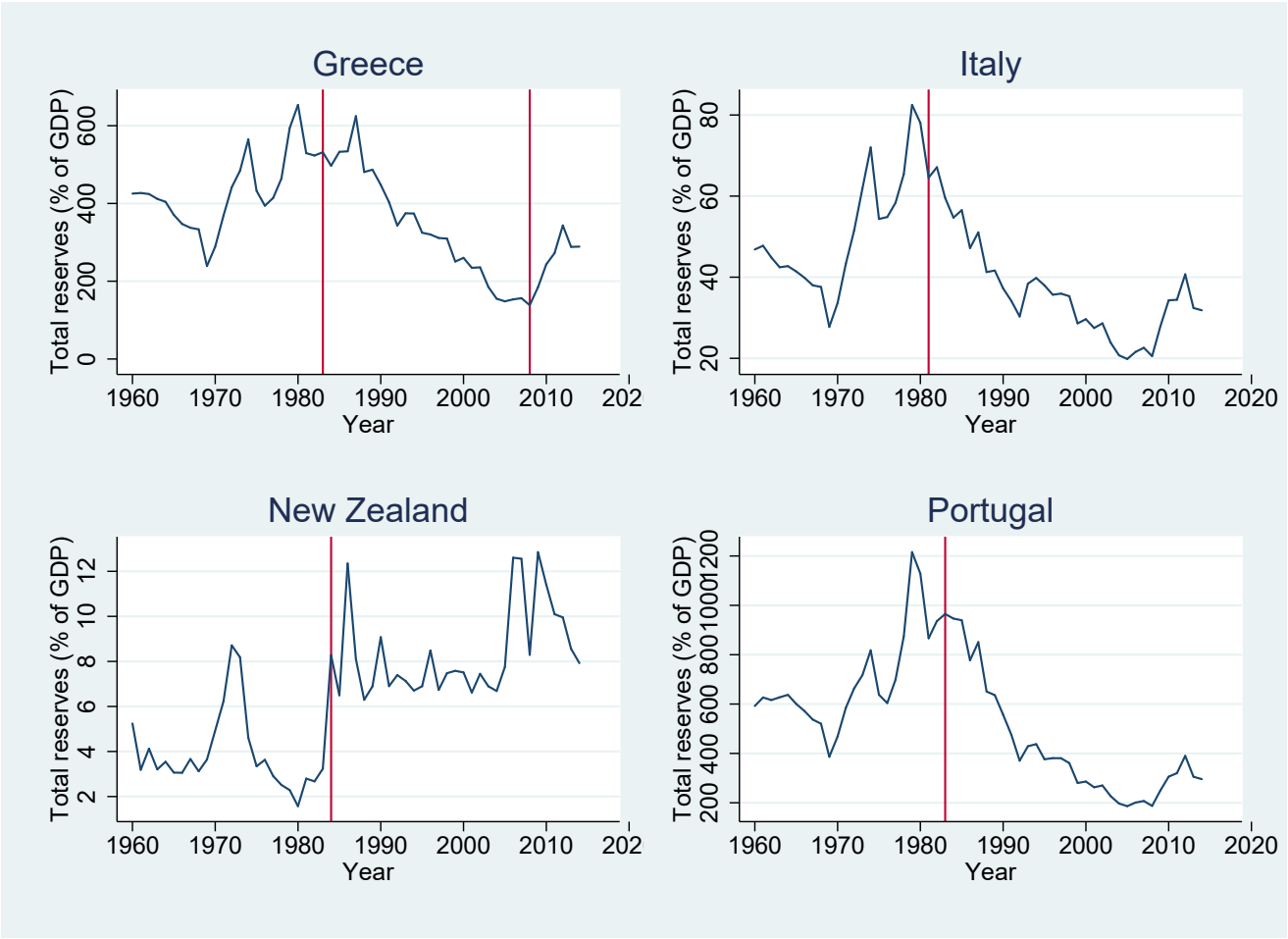

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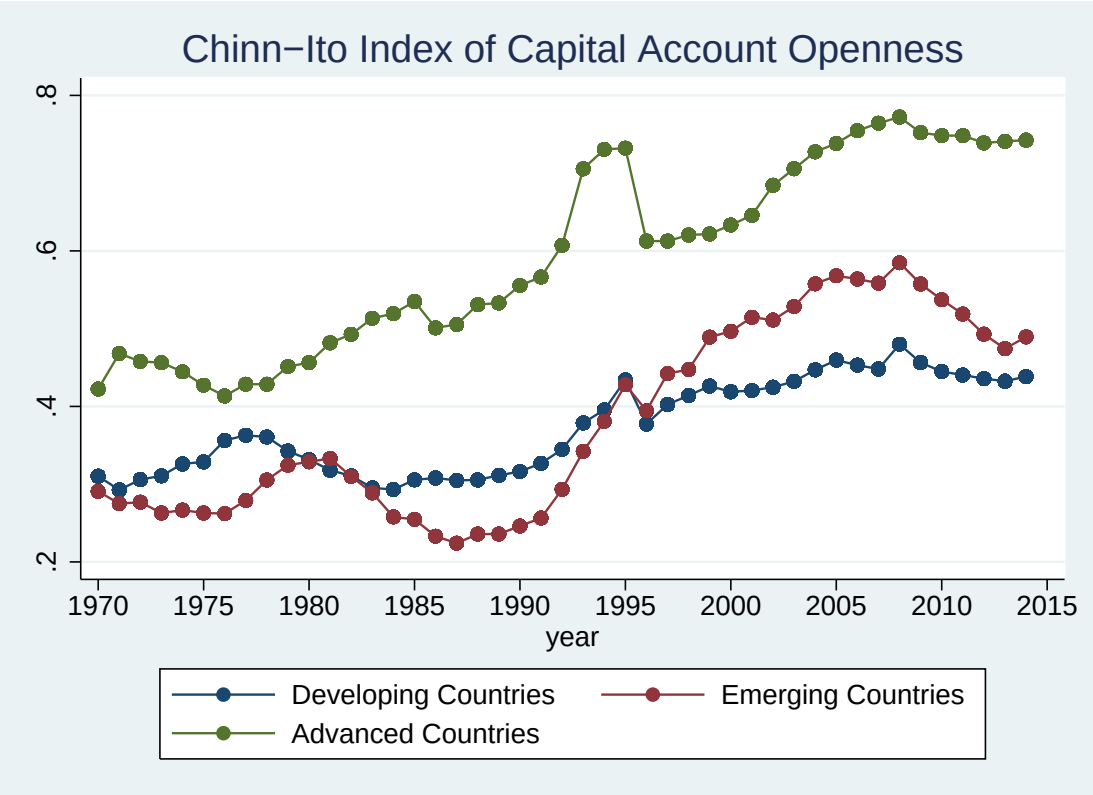
Figure: Trend in Capital Account Openness



Source: Author's Calculations based on Chinn-Ito (2006)

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