COUNTRY INSURANCE THROUGH INTERNATIONAL RESERVES

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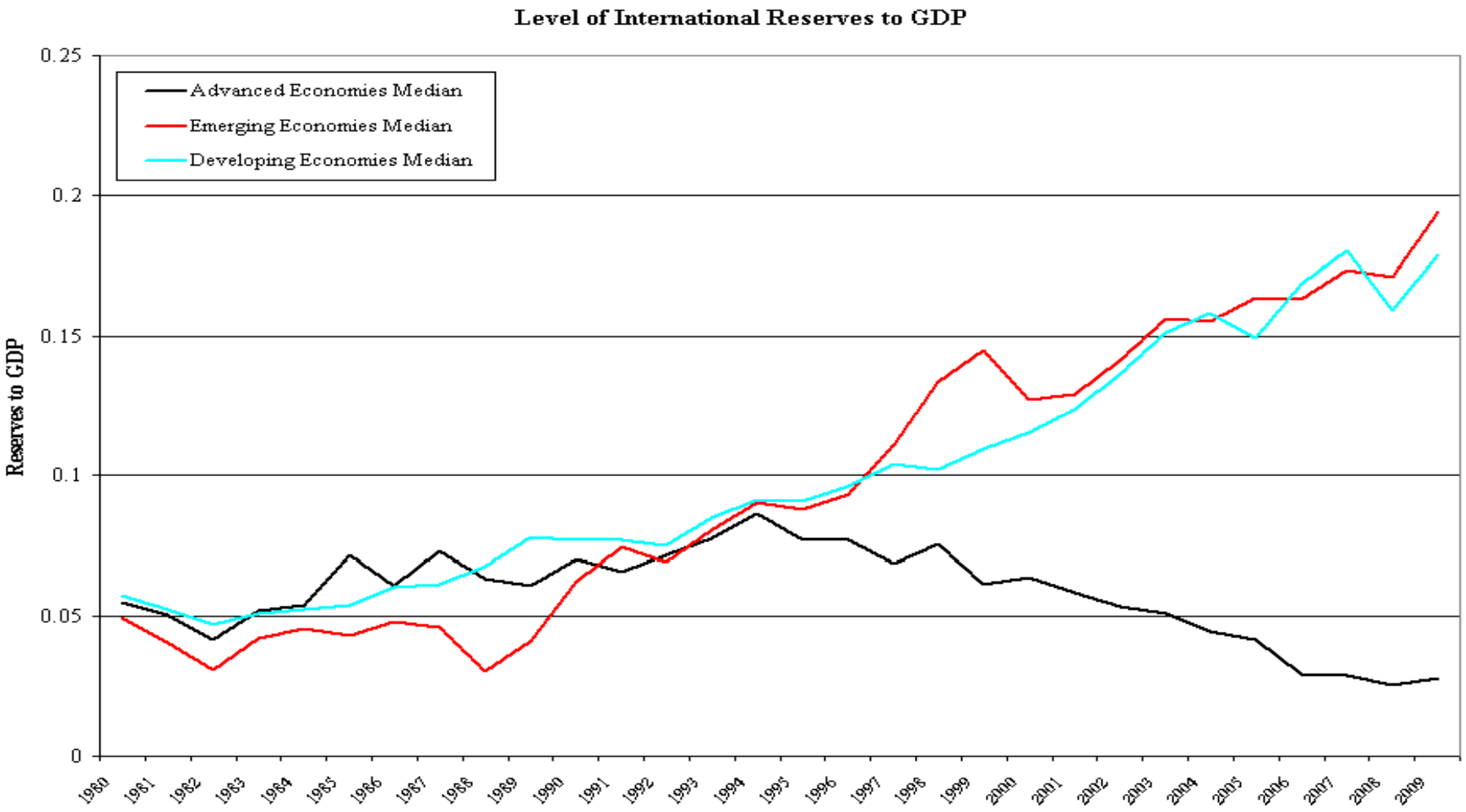
International reserves: topical issues

- International Reserves became the prime vehicle of country insurance in the emerging and developing world.
  - But this form of self-insurance has been criticized as inefficient, costly, and partly responsible for global imbalances.
  - Should we move from self-insurance to insurance? How?
    - Global financial architecture
    - Private Solution: Invested Reserves in Derivatives.
- International Reserves have been suggested to have cushioned the impact of the global crisis
  - Direct evidence is hard to find.
  - Counterfactual is hard to build


Level of International Reserves to GDP
Advanced Economies Median
Emerging Economies Median
Developing Economies Median
Reserves to GDP
0.25
0.2
0.15
0.1
0.05
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
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1998
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2000
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2006
2007
2008
2009

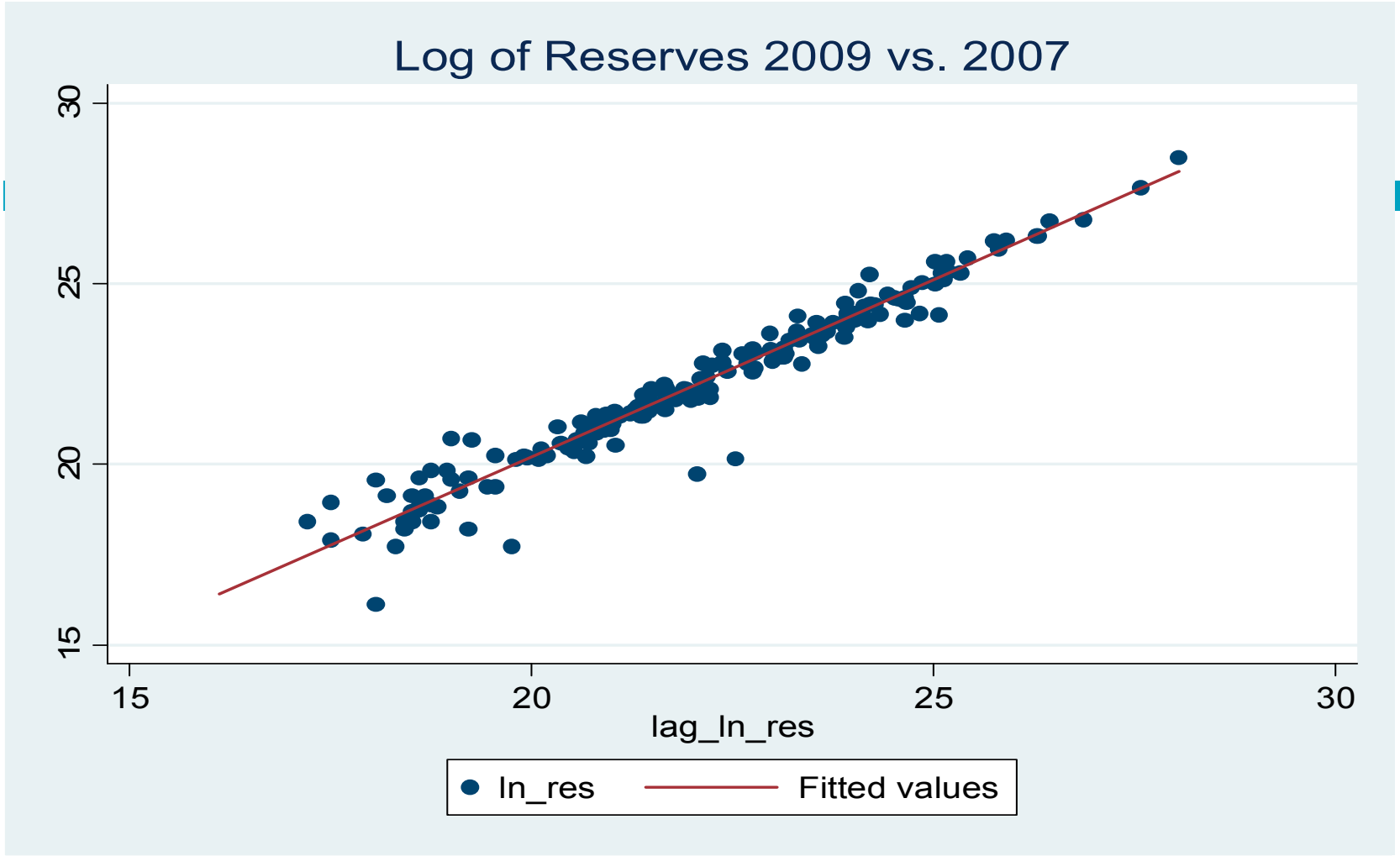
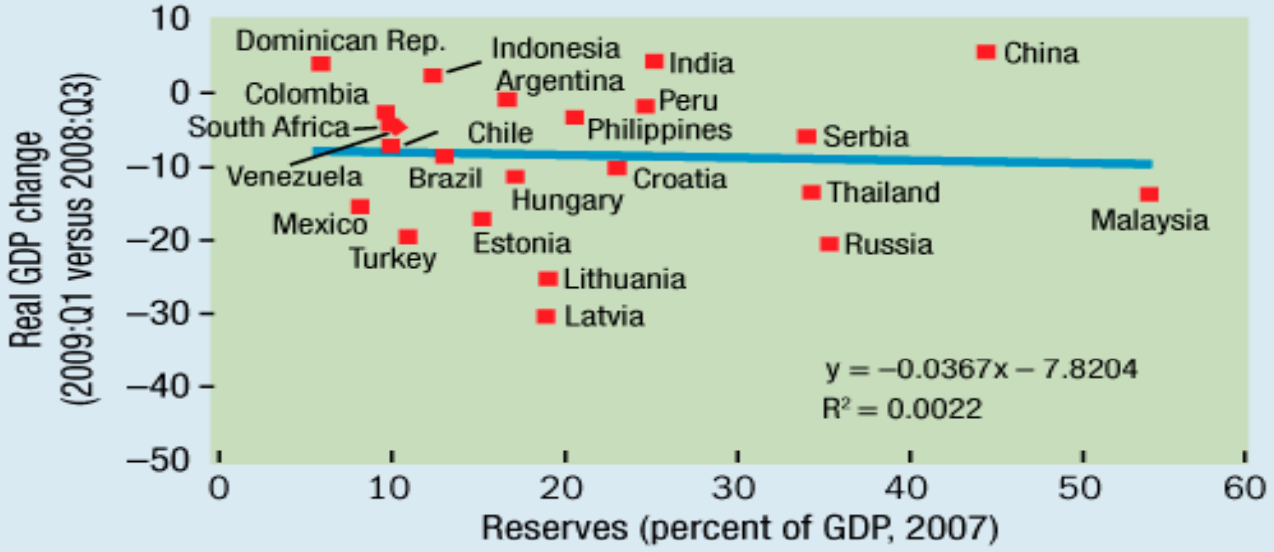

Log of Reserves 2009 vs. 2007
30
25
20
15
15
20
25
30
lag_ln_res
ln_res
Fitted values

Chart 2

How much cushion?

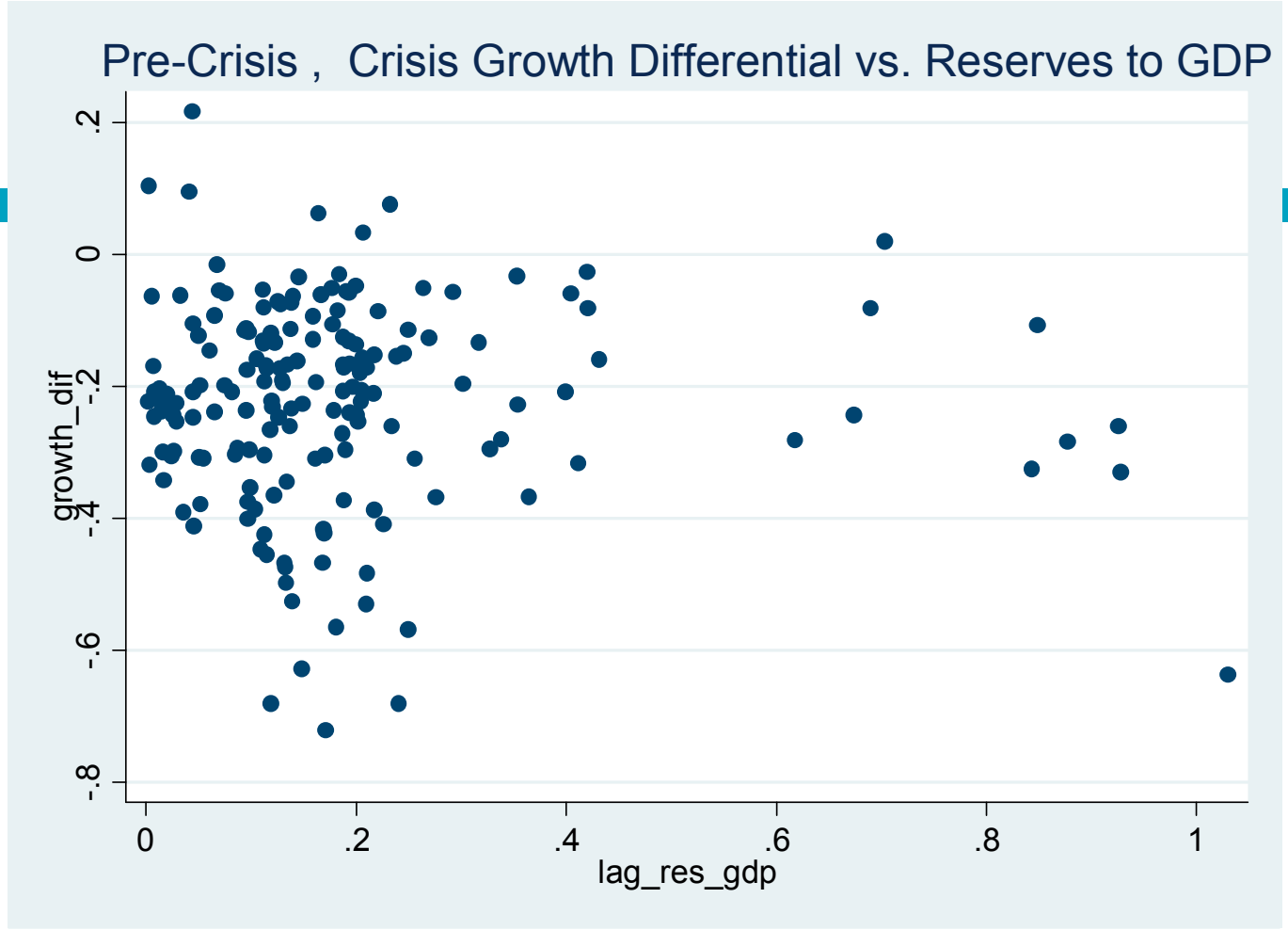
Larger reserves did not lead to lower declines in economic activity at the peak of the crisis.

(selected emerging countries, in percent)



Sources: IMF, Global Data Source database and staff estimates.

Blanchard-Faruquee-Klyev (2010)


Pre-Crisis , Crisis Growth Differential vs. Reserves to GDP
growth_dif
.2
0
-.2
-.4
-.6
-.8
0
.2
.4
.6
.8
1
lag_res_gdp

Roadmap

- Modeling Optimal Reserves.
  - Crisis Mitigation.
  - Crisis Prevention.
- What do we really know:
  - Cost of Reserves.
  - Benefits of Reserves.
  - How to use reserves.
- Alternative to self-insurance.
  - Generalized Flexible Credit Lines.
  - Global Reserves Fund

Modeling Optimal Reserves

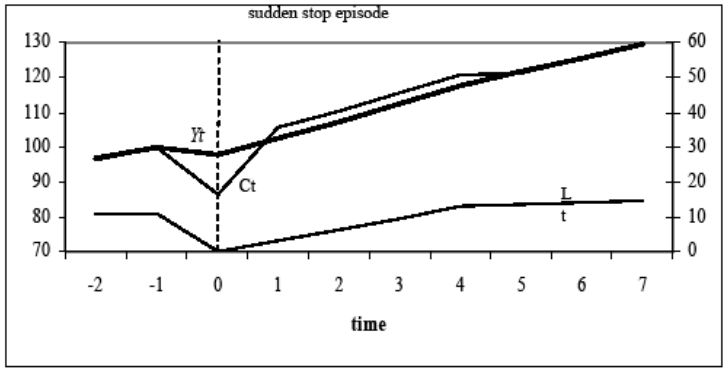
- Rule of Thumbs
  - Imports coverage
  - Short-term debt coverage (Greenspan-Guidotti Rule)
- Precautionary Savings Models
  - Caballero-Panageas (2007), Durdu-Mendoza-Terrones (2009)
  - Comprehensive but no analytical solutions.
- Small Scale Models.
  - Assumption necessary but analytical solutions.
  - Jeanne-Ranciere (2009): Emerging Market [substitute for Greespan-Guidotti)
  - Barnichon (2009): Low Income Countries [substitue for import coverages)
- Reserve Pooling Models
  - Basu-Bi-Kannan (2010)

A model for emerging market economies: Jeanne-Ranciere (2009)

- Large increase in EMEs international reserves since 2000.
- • **"Insurance view"**: after crises of the late 1990s, reserves were accumulated as self-insurance against capital flow volatility
  - (Aizenman and Marion, 2003; Stiglitz, 2006).
- • An **"insurance model"** of the optimal level of reserves to deal with sudden stops in capital flows
  - closed-form expression for the optimal level of reserves.
- • **Calibration:**
  - can explain the reserves build-up in some EMEs (Latin America)
  - suggests Asian build-up excessive.

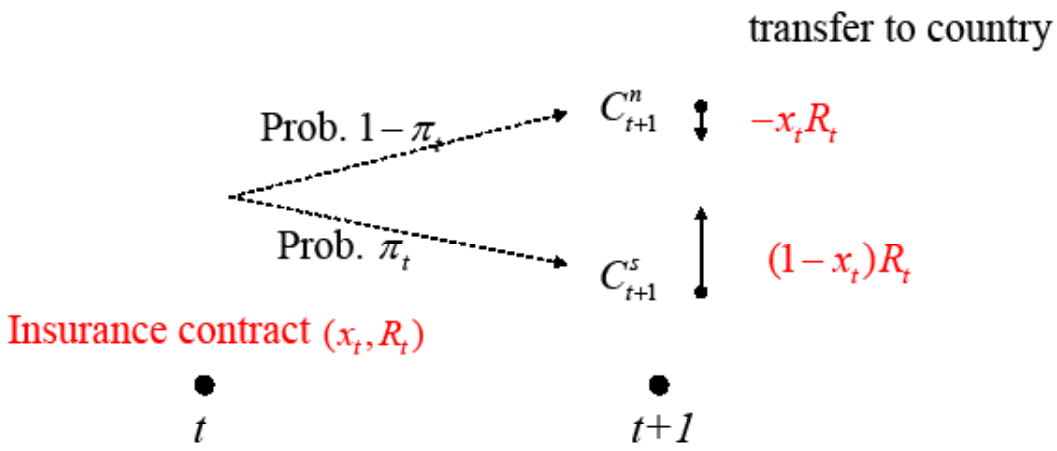
Infinite Horizon Economy

- Constant output growth g but with proba. π_t the economy can be hit by a **"sudden stop"** with:
  - loss of access to external borrowing
  - fall in domestic output.



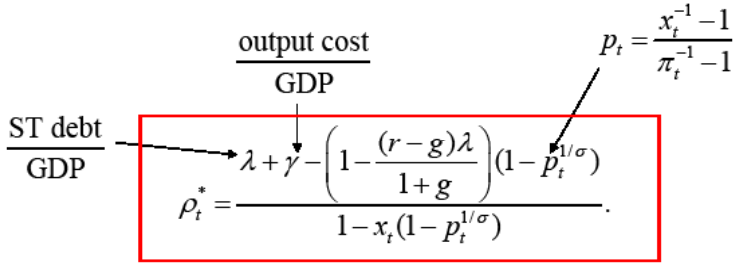
Reserves as insurance contracts

- The domestic consumer can smooth consumption with **"reserves insurance contracts"** with the ROW:



Formula for Optimal level of Reserves

Formula for the optimal ratio of reserves to GDP



- Optimal level of reserves increasing with short-term debt λ, output cost of sudden stop γ, risk aversion σ, probability of sudden stop π_t.
- The optimal level of reserves could be higher or lower than Greenspan-Guidotti rule,

$$\rho_t^* - \lambda.$$

The opportunity cost of reserves

The opportunity cost of reserves

- The reserves insurance contract can be replicated by
  - ➢ issuing debt with default contingent on sudden stop
  - ➢ accumulating proceeds as reserves

→ spread on debt $x_t = \pi_t + \delta_t$

default probability: π_t

pure risk premium: δ_t

- The opportunity cost of holding reserves is measured, in the literature (Edwards, 1985; Rodrik, 2006, etc.) as the spread x_t.

- This is an overestimate: the cost of insurance is δ_t, not $\pi_t + \delta_t$.

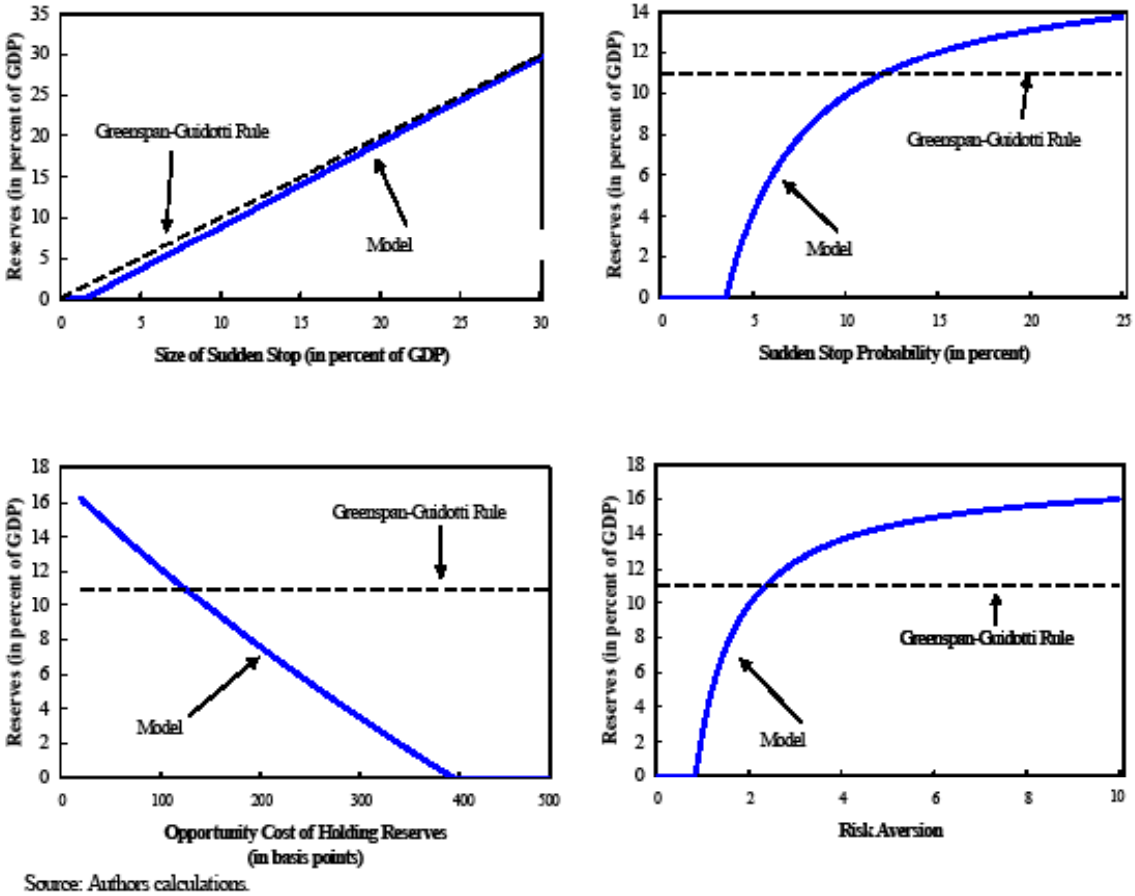
Calibration

Parameter	Baseline	Range of variation
Size of sudden stop (% of GDP)	$\lambda = 11\ \%$	[0,30%]
Prob. of sudden stop	$\pi = 10\ \%$	[0,25%]
Output loss (% of GDP)	$\gamma = 6.5\ \%$	[0,20%]
Premium	$\delta = 1.5\ \%$	[0, 5%]
Risk aversion	$\sigma = 2$	[1,10]

→ $\rho^* = 10.1\ \%$ of GDP
$= 92\ \%$ of ST debt

Baseline

Figure 4. Optimal Ratio of Reserves to GDP: Basic Model



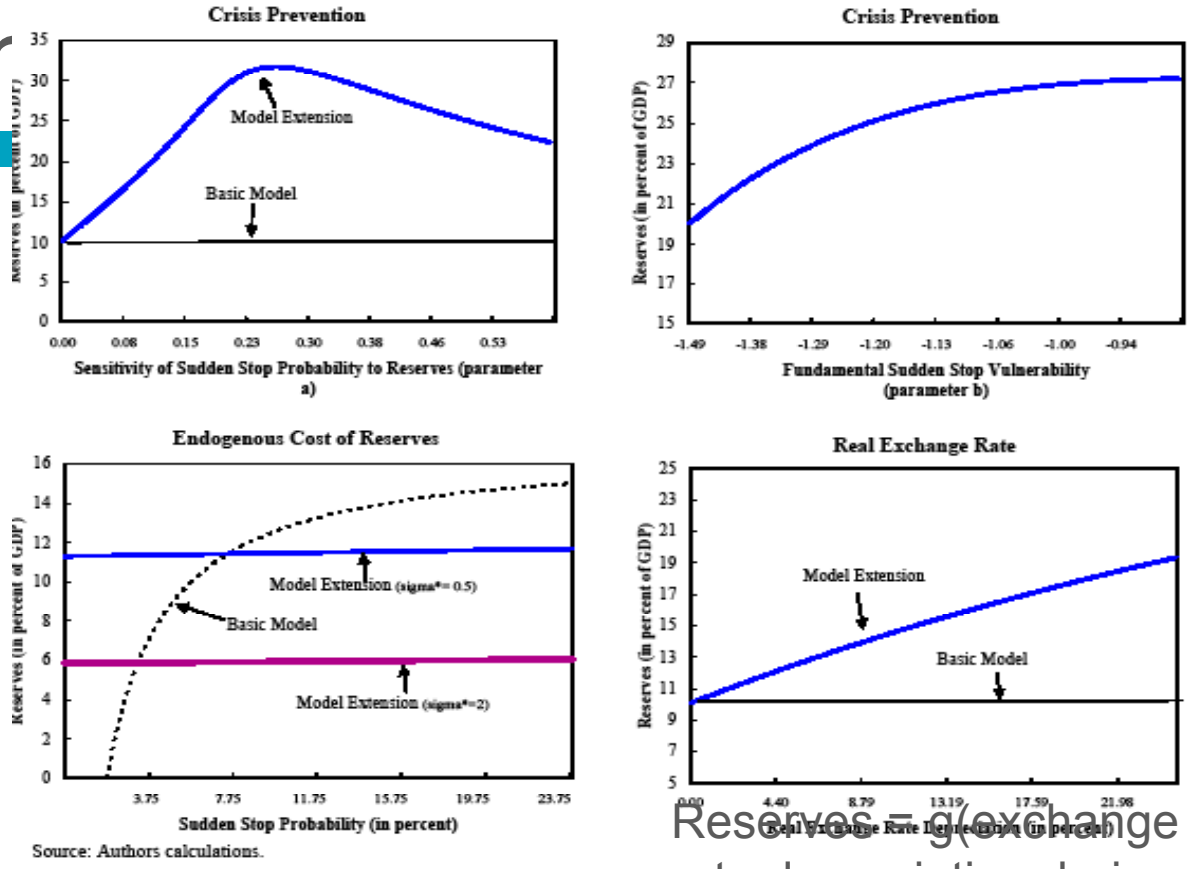
Source: Authors calculations.

Extensior

ba(SS)=f(b-a*R)

es=f(Proba(SS))

Figure 5. Optimal Ratio of Reserves to GDP: Model Extensions



Source: Authors calculations.

Reserves = g(exchange rate depreciation during SS)

Puzzle

- High Reserves to GDP Ratio in East Asia
- How to explain it?
  - Problem of “over” insurance
  - Need:
    - Higher Output Cost
      - Ouput Cost Uncertainty+loss avoidance preference.
      - Robust Control model.
    - Lower Cost of Reserve Accumulation
      - Combined endogenous probability of reserves and endogenous cost.
    - Alternative Motive for Reserve Accumulation: Mercantilist.

A model for low income countries: Barnichon (2009)

- Have limited access to private foreign capital
  - Different from sudden stop in capital flows.
- International reserves to self-insure against
  - terms of trade shocks
  - natural disasters

Economic impact of hurricanes in the Caribbean

- One major hurricane every 25 years
- Output growth falls by 3 percentage points
- Exports growth falls by 5 percentage points
- Imports growth does not fall

Economic impact of droughts in the Sahel

- One major drought every 12 years
- Output growth is roughly constant
- Exports growth falls by 8 percentage points
- Imports growth does not fall

Terms of trade shocks

- Caribbean:
  - One major shock every 17 years
  - Average tot loss of 10% and no significant effect on output growth or exports growth
- Sahel
  - One major shock every 10 years
  - Average tot loss of 15%, output growth falls by 0.5% and exports growth by 5%

2. A model of optimal FX reserves

- Two countries: Home and Foreign
- Home is a small open economy consisting of a representative agent that consumes two types of goods:
  - home goods c_H
  - foreign goods c_F

- With probability $1-\pi^{nd}$, Home is in a "normal" state and receives an endowment Y^n and exports a fraction of output $c_F^{*n} = \delta Y^n$.

- With probability π^{nd}, Home is hit by a shock that affects production, exports capacities and the real exchange rate:

$$Y^d = \eta_y Y$$

$$X^d = \eta_X X \qquad \text{with } \eta_{..} \leq 1.$$

$$\varepsilon^d = \eta_\varepsilon \varepsilon$$

FX constraint

- To purchase foreign goods, the country needs to pay in foreign currency
  (similar to a "cash-in-advance" constraint)
- Can buy imports goods through
  - Exports: c_F^*
  - Foreign capital: Tr (includes foreign loans and grants)
  - FX reserves: R

- $c_{F,t} \leq \varepsilon_t c_{F,t}^* - (R_{t+1} - R_t) + Tr_t$ (in US$)

- However, opportunity cost of holding FX reserves: $\frac{rR}{\varepsilon}$

A closed-form solution for R*

(the level of reserves in good times)

- Using r<<1, log-utility and assuming that the Home uses all of its reserve the period the disaster hits (only an approximation, plausible if shock has little persistence):

$$\frac{R^*}{c_F} \approx \left[\frac{\beta \pi^{nd}}{\beta r \left(1-\pi^{nd}\right) \frac{\varepsilon \delta}{1-\delta} + \left(1-\beta\left(1-\pi^{nd}\right)\right) \frac{1-\theta}{\theta}} - \eta_X \eta_\varepsilon \right] \frac{1}{1+\frac{Tr}{\varepsilon \delta Y^n}}$$

- Probability of disaster π^{nd} ↑ => *R/M* ↑
- FX earnings loss η_X, η_ε ↑ => *R/M* ↑
- Size of export sector δ↑ => *R/M* ↑
- Preference for Home goods θ↑ => *R/M* ↓
- Higher steady-state transfers *Tr*↑ => *R/M* ↓

Reserves Pooling

- Risk-Sharing Argument.
  - Pool should be as large as possible.
    - Like the IMF but with Prices and Quantity.
  - Restriction on the number of countries in the insurance pool.
    - Mauro-Imbs (2008)
- Trade Externalities (Basu, Bi, Kannan (2010)
  - Self-insurance ignores externalities.
  - Terms of Trade Shock
  - Intra-Regional Trade Linkage is stronger: case for reserves

ssue 1: Cost of Reserves

Balance-Sheet Approach.

- Term Premium?
- Reserves Invested in Long Term Bonds.
  - Excess Returns compensate.

Growth Approach.

- Opportunity of Foregone Investment
- Average vs. Marginal Product of Capital (Caselli)

Cost of Sterilization.

- Degree of Integration of Domestic vs. Capital Markets.
- Cost in Merchantilist Approach: Asymetry between China and Rest of Asia
  - “Trade-War” (Aizenman, 2007)

ssue 2. Benefits of Reserves

- Crisis Prevention and Crisis Mitigation Benefits.
  - Hard to identify in data for sudden stops (in contrast with currency crises)
  - Endogeneity Issue: Countries with higher fundamental risks will have higher reserves. (currency crisis less fundamental)
  - Output Cost of Crises and Benefits of Reserves.
    - Counterfactual – Peso Problem.

ssue 3: when to use the reserves.

- Uncertainty on the duration of the event.
- Time-varying probability of a disaster.
  - A small crisis→ update probability of a complete meltdown.
- Signaling Issue. Asymmetric information.
- Rule-based Reserve Policy
  - Tranquil times: Ex. Chile.
  - Crisis Times.

Reserves and the Global Financial Architecture I

- Globalized Flexible Credit Lines.
- Implementability
  - Eligibility
    - Rules.
    - Risk of losing eligiblity
  - Sovereignty Issue
    - A country can use its reserves even if policy framework needs to deviate from model.

Reserves and the Global Financial Architecture II

- IMF: A Global Bank for Reserves.
- Issue Reserve Deposits (aka. Voluntary Reserves)
- Pooling of Reserves: Liquidity Management.
  - Higher Interest Rate on Reserve Deposits
  - No Liquidity Risk.
- Trade of Reserve Deposits: Insurance Role.
  - Short Sale of Reserve Deposits i.e. borrowing.
  - Discipline. You need to save (deposit reserves) in order to borrow.
    - Multiple of voluntary reserves

Thank you