Reserve Accumulation, Macroeconomic Stabilization and Sovereign Risk

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Motivation

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- But seignoriage revenue is modest and has been $\downarrow$ over time

Need theory that goes beyond purely fiscal backing argument

This Paper

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Under peg, government chooses to accumulates more reserves

- Reserves are not strictly needed to keep parity

Reserves strongly reduce incentives to default

- $\uparrow$ Debt may *reduce* spreads if gov. buys reserves

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Quantitatively: Macro-stabilization essential to account for observed reserve holdings

- Fixers hold 18% of GDP, floaters 4%

Related Literature

Two main related branches of the literature:

Reserve accumulation: Aizenmann and Lee (2005); Jeanne and Ranciere (2011) ; Durdu, Mendoza and Terrones (2009); Alfaro and Kanczuk (2009), Bianchi, Hatchondo and Martinez (2018); Hur and Kondo (2016); Amador et al. (2018); Arce, Bengui and Bianchi (2019); Bocola and Lorenzoni (2018); Cespedes and Chang (2019)

Sovereign default models with nominal rigidities: Na, Schmitt-Grohe, Uribe and Yue (2018); Bianchi, Ottonello and Presno (2016); Arellano, Bai and Mihalache (2018); Bianchi and Mondragon (2018)

Main Elements of the Model

- Small open economy (SOE) with T-NT goods:
  - Stochastic endowment for tradables y^T
  - Non-tradables produced with labor: $y^N = F(h)$
- Wages are downward rigid in domestic currency (SGU, 2016)
  - With fixed exchange rate, $\pi^\star = 0$ and L.O.P. $\Rightarrow$ wages are rigid in foreign currency $w \geq \bar{w}$
- Government issues non-contingent long-duration bonds (b) and saves in one-period risk free assets (a), all in units of T
  - Debt/Asset structure as Bianchi-Hatchondo-Martinez

Households

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \{u(c_t)\}$$

$$c \quad = \quad C(c^T, c^N) = [\omega(c^T)^{-\mu} + (1-\omega)(c^N)^{-\mu}]^{-1/\mu}$$

- Budget constraint in units of tradables

$$c_t^T + p_t^N c_t^N = y_t^T + \phi_t^N + w_t h_t^s - \tau_t$$

- ϕ^N firms' profits, τ_t taxes. No direct access to external credit.

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- Optimality

$$p_t^N = \frac{1-\omega}{\omega} \left(\frac{c_t^T}{c_t^N} \right)^{1+\mu}$$

Firms

- Maximize profits given by

$$\phi_t^N = \max_{h_t} p_t^N F(h_t) - w_t h_t$$

- Firms' optimality condition is

$$p_t^N F'(h_t) = w_t$$

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Equilibrium in the Labor Market

Assume: $F(h) = h^{\alpha}$ with $\alpha \in (0, 1]$.

Using HH and firms optimality and $y^N = c^N$:

$$\mathcal{H}(c^T, w) = \left[\frac{1-\omega}{\omega}\ \frac{\alpha}{w}\right]^{1/(1+\alpha\mu)} (c^T)^{\frac{1+\mu}{1+\alpha\mu}}$$

$$\text{Equilib. employment} = \begin{cases} \mathcal{H}(c^T, \bar{w}) & \text{for } w = \bar{w} \\ \\ \bar{h} & \text{for } w > \bar{w} \end{cases}$$

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Note: $\frac{\partial \mathcal{H}}{\partial c^T} > 0$

▸ plot

Asset/Debt Structure

- Long-term bond:
  - Bond pays $\delta\left[1,(1-\delta),(1-\delta)^2,(1-\delta)^3,...\right]$
  - Law of motion for bonds $b_{t+1}=b_t(1-\delta)+i_t$
  - price is q

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- Risk-free one-period asset which pays one unit of consumption
  - price is q_a
- Government's budget constraint if **repay:**

$$g + q_a a_{t+1} + \delta b_t = \tau_t + a_t + q_t \underbrace{\left(b_{t+1} - (1-\delta) b_t\right)}_{i_t \text{ : debt issuance}}$$

- Government's budget constraint in **default:**

$$g + q_a a_{t+1} = \tau_t + a_t$$

Foreign Investors

more

- Competitive, deep-pocketed foreign lenders, subject to “risk-premium” shocks:

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- Bond price given by:
  $q = \mathbb{E}_{s'|s} \{m(s, s')(1 - d') [\delta + (1 - \delta) q']\}$

$$d' = \hat{d}(a', b', s'), \quad q' = q(a'', b'', s')$$

Recursive Problem

$$V\left(b,a,s\right)=\max_{d\in\{0,1\}}\left\{(1-d)V^{R}\left(b,a,s\right)+dV^{D}\left(a,s\right)\right\}$$

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$\mathcal{H}(c^{T},\bar{w})\rightarrow$ implementability constraints associated with nominal rigidities

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Value of default: total repudiation, utility cost of default, 1-period exclusion, keep a and choose a'

▸ V^D

Optimal Portfolio: gains from borrowing to buy reserves

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$\tilde{a}$: reserves that can be purchased by issuing an extra unit of debt:

$$\tilde{a} = \frac{q + \frac{\partial q}{\partial b'} i}{q_a - \frac{\partial q}{\partial a'} i}$$

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<u>Remark</u> With one-period debt ($\delta = 1$):

$$\mathbb{COV}_{s'|s}\Big(\tilde{a} - \delta - (1-\delta) q' \,,\, \left(u'_T + \xi' \mathcal{H}'_T\right) \, (1 - d')\Big) = 0$$

Benefits of reserve accumulation

We want to highlight two benefits of reserves:

i. Higher reserves can reduce future unemployment.

ii. Reserve accumulation may improve bond prices.

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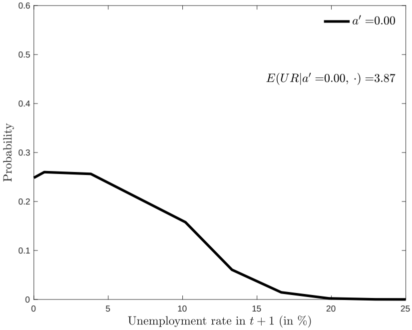
Exercise:

- Fix a point in the s.s. and a given level of consumption $\bar{c}$ (e.g. the optimal one).
- Look at alternative a', and find b' that ensures $c = \bar{c}$.

Distribution of next-period unemployment for given (a', b')



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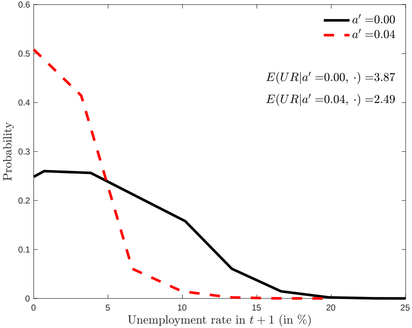
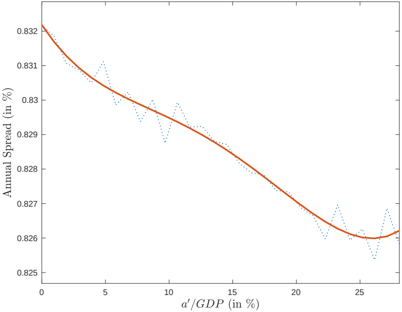


Larger reserves financed with debt (keeping c constant) reduces future unemployment

Borrowing to buy reserves may improve bond prices



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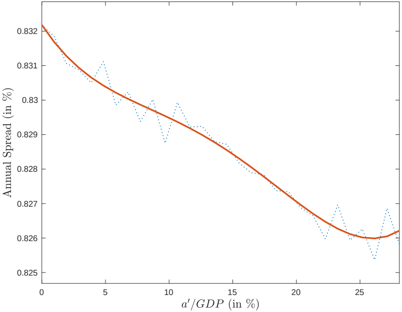

Key mechanism: Reserves increase V^R and V^D. If gov. is borrowing constrained (high unemployment), effect on V^R may dominate effect on V^D.

Quantitative Analysis

- Calibrate to the average of a panel of 17 EMEs (1993–2014).
- Benchmark = economy with wage rigidity.
- 1 model period = 1 year.

Utility function:

$$u(c) = \frac{c^{1-\gamma} - 1}{1 - \gamma}, \text{ with } \gamma \neq 1$$

Utility cost of defaulting:

$$\psi_d(y^T) = \psi_0 + \psi_1 log(y^T)$$

Tradable income process:

$$\log(y_t^T) = (1 - \rho)\mu_y + \rho log(y_{t-1}^T) + \epsilon_t$$

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with $|\rho| < 1$ and $\epsilon_t \sim N(0, \sigma_\epsilon^2)$

Quantitative Analysis – Calibration

Parameter	Description	Value
r	Risk-free rate	0.04
α	Labor share in NT sector	0.75
β	Domestic discount factor	0.90
π_{LH}	Prob. of transiting to high risk-premium	0.15
π_{HL}	Prob. of transiting to low risk-premium	0.8
σ_ϵ	Std. dev of innovation to $log(y^T)$	0.034
ρ	Autocorrelation of $log(y^T)$	0.66
μ_y	Mean of $log(y^T)$	$-\frac{1}{2}\sigma_\epsilon^2$
δ	Coupon decaying rate	0.2845
$1/(1+\mu)$	Intratemporal elast. of subs.	.44
γ	Coefficient of relative risk aversion	2.273
$\bar{h}$	Time endowment	1
	Parameters set by simulation	
ω	Share of tradables	0.3
g	Government consumption	0.25
ψ_0	Default cost parameter	2.4
ψ_1	Default cost parameter	19.5
κ	Pricing kernel parameter	22.5
$\bar{w}$	Lower bound on wages	0.8

Results: data and simulation moments

	Data	Model Benchmark
Targeted		
Mean debt (b/y)	42.0	42.5
Mean r_s	2.2	2.4
Δr_s w/ risk-prem. shock	2.0	2.0
Δ UR around crises	3.0	3.0
Mean g/y	12	12
Mean y^T/y	45	47
Non-Targeted		
$\sigma(c)/\sigma(y)$	1.1	1.1
$\sigma(r_s)$ (in %)	2.7	2.0
$\rho(r_s, y)$	-0.4	-0.7
Mean Reserves (a/y)	16	17.9
Mean Reserves/Debt (a/b)	36	37.4

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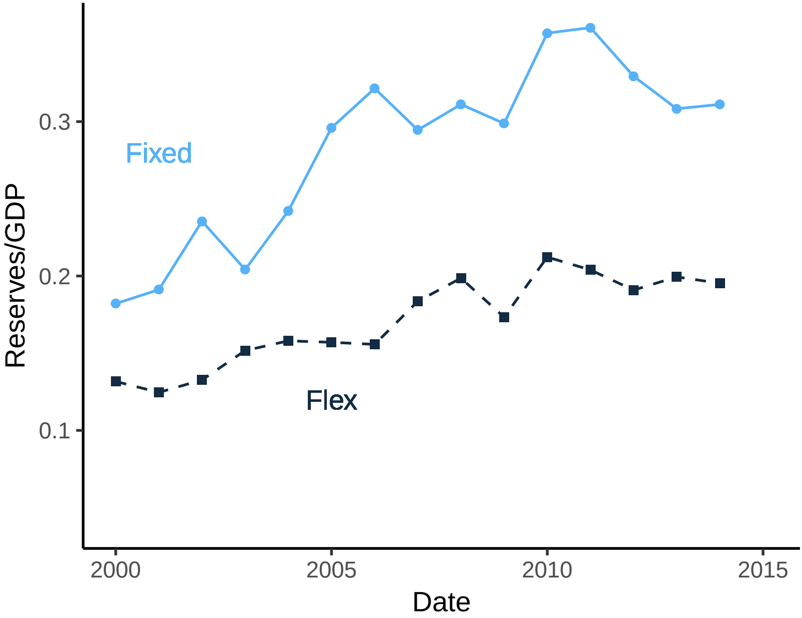
Mean y^T/y	45	47	44
Non-Targeted			
$\sigma(c)/\sigma(y)$	1.1	1.1	1.2
$\sigma(r_s)$ (in %)	2.7	2.0	1.8
$\rho(r_s, y)$	-0.4	-0.7	-0.9
Mean Reserves (a/y)	16	17.9	3.6
Mean Reserves/Debt (a/b)	36	37.4	8.1

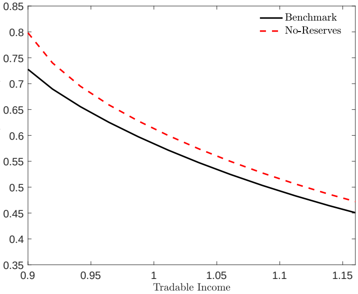
Reserves in the Data: Fixed vs. Flex



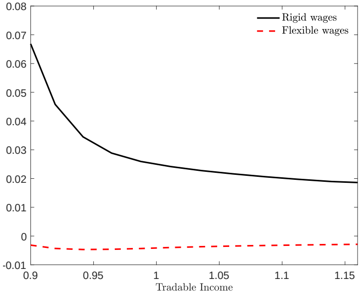
Welfare implications

▸ more

Welfare costs of rigidities



Welfare gain of reserves



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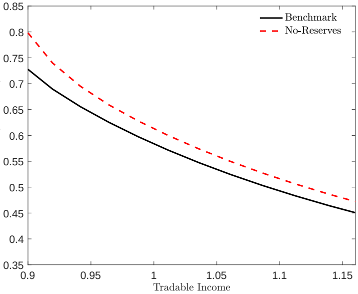

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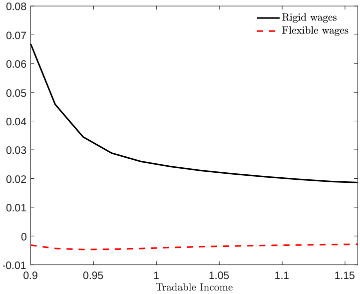

- Nominal rigidities reduce welfare by around 0.6% and are costlier if government does not accumulate reserves

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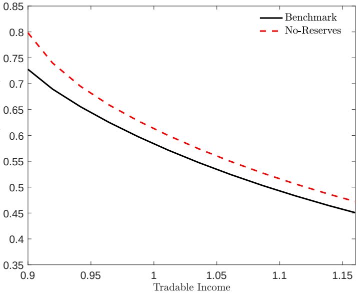
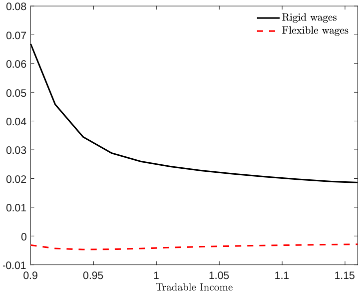


Welfare gain of reserves



- Nominal rigidities reduce welfare by around 0.6% and are costlier if government does not accumulate reserves
- Having access to reserves is welfare improving under fixed
  - Under flex, reserves may be welfare reducing because of debt-dilution is exacerbated

Inflation Targeting

▸ (more)

	Data	Model Benchmark	Model IT
Targeted			
Mean debt (b/y)	42.0	42.5	42.8
Mean r_s	2.2	2.4	2.7
Δr_s w/ risk-prem. shock	2.0	2.0	1.9
Δ UR around crises	3.0	3.0	1.0*
Mean g/y	12	12	12
Mean y^T/y	45	47	48
Non-Targeted			
$\sigma(c)/\sigma(y)$	1.1	1.1	1.1
$\sigma(r_s)$ (in %)	2.7	2.0	2.2
$\rho(r_s, y)$	-0.4	-0.7	-0.7
Mean Reserves (a/y)	16	17.9	16.0
Mean Reserves/Debt (a/b)	36	37.4	33.3

Even moderate inflexibility of exchange rate is enough to generate substantial demand for reserves

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- Agenda:
    - Equilibrium Multiplicity
    - Temptation to abandon pegs—how reserves can help