

Reserve Accumulation and the Currency Composition of Sovereign Debt

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A puzzle in risk

Three facts

1. International reserves help central banks hedge risks
2. Local-currency debt mitigates risks by promising lower real payments in bad times
3. Countries which issue LC debt also hold more reserves

How to make sense of this?

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Local currency debt is a two-edged sword

Two effects

LC debt reacts to RER

- RER depreciates in recessions
- \implies LC debt builds in state-contingency

Gov't can affect RER

- Planner modulates demand
- \implies LC debt boosts these incentives

- Affecting the RER costly: prefer to pay with reserves
- Affecting the RER costly *ex-ante*: prefer to accumulate reserves

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A model of LC sovereign debt and reserves

Ingredients

- Small-open economy borrowing from RoW
- Two-sector structure, nominal rigidities
 - Aggregate-demand externality
 - Modulate labor demand (in all sectors) through consumption (of tradables)
- Government issues long-term **debt**, accumulates **reserves**
- No commitment to (i) repayment, (ii) future borrowing decisions
- Debt in **domestic** or **foreign** currency
- Compare with **synthetic** LC debt

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Main findings

1. Significant reserve holdings to curtail time-inconsistency
 - Synthetic LC debt issuer holds **twice** as many reserves as LC debt issuer
2. Time-inconsistency erodes most of the gains from indexation
 - FC debt \rightarrow LC debt \sim **XXXXX**% of permanent consumption
 - **XXXX**% to move to *synthetic* LC debt

- Sovereign debt and default
 -
- Reserves for macroeconomic stabilization
 -
- Currency composition of sovereign debt
 -

Roadmap

Evidence

Model

Quantitative Results
Synthetic Debt

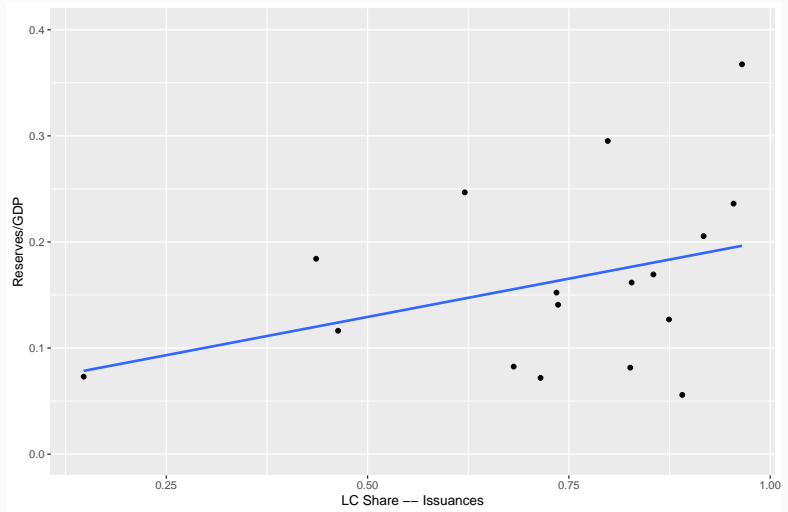
Concluding Remarks

Evidence

Local currency debt and reserves

Local currency share of
debt issued from
Ottonello and Perez
(2019)

FX reserve holdings from
IFS



Model

Two-sector small-open economy structure

Supply

- **Traded** goods
 - Exogenous endowment $y_T = \exp(z)$, can be exported/imported

$$z' = \rho_z z + (1 - \rho_z)\mu_z + \sigma_z \epsilon'$$

with $\epsilon \stackrel{iid}{\sim} \mathcal{N}(0, 1)$

- **Nontraded** goods, produced

$$y_N = h^\alpha$$

with labor supply h (inelastic up to \bar{h}) = 1

Demand

- Households consume both goods
 - Standard **CRR**A preferences $\frac{c^{1-\gamma}-1}{1-\gamma}$
 - **CES** aggregator

$$c = \mathcal{C}(c_N, c_T) = [\varpi_N c_N^{-\eta} + \varpi_T c_T^{-\eta}]^{-\frac{1}{\eta}}$$

- Intratemporal FOC gives relative price

$$p_N = \frac{\varpi_N}{\varpi_T} \left(\frac{c_T}{c_N} \right)^{1+\eta} p_T$$

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Aggregate Demand

Aggregate constraint: $w \geq \bar{w}$

- Labor demand of firms

$$p_N \underbrace{F'(h)}_{=\alpha h^{\alpha-1}} = w$$

- In equilibrium, $c_N = y_N$, and

$$h \leq \left(\frac{\varpi_N}{\varpi_T} \frac{\alpha}{\bar{w}} \right)^{\frac{1}{1+\alpha\eta}} c_T^{\frac{1+\eta}{1+\alpha\eta}} = \mathcal{H}(c_T, \bar{w})$$

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Geometrically decaying coupons with currency

- One unit of (face value) debt issued at t promises payments
 - $\kappa(s)$ in $t + 1$, state s
 - $(1 - \delta)\kappa(s)$ in $t + 2$
 - $(1 - \delta)^2\kappa(s)$ in $t + 3$
 - ...
 - $(1 - \delta)^{k-1}\kappa(s)$ in $t + k$
- Debt issued yesterday = $(1 - \delta)$ of debt issued today
- Currency of denomination

$$\kappa(s) = (r + \delta) \left(\xi + (1 - \xi)p_N(s) \right)$$

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The planner's problem: modulation of aggregate demand

- In repayment

$$V^R(b, a, s) = \max_{b', a'} u(c_T, F(h)) + \beta \mathbb{E} [\mathcal{V}(b', a', s')]$$

$$\text{subject to } c_T + q_a a' + \kappa(s)b = a + y_T(s) + q_b(b', a', s)(b' - (1 - \delta)b)$$

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- In default

$$V^D(b, a, s) = \max_{a'} u(c_T, F(h)) - \varphi(y_T(s)) + \beta \mathbb{E} [\theta \mathcal{V}(b, a', s') + (1 - \theta)V^D(b, a', s')]$$

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The planner's problem: choosing default

Planner receives *iid* EV1 preference shocks for repayment and default so that

$$\mathcal{P}(b, a, s) = \frac{\exp(V^D((1 - \bar{h})b, a, s)/\sigma_V)}{\exp(V^D((1 - \bar{h})b, a, s)/\sigma_V) + \exp(V^R(b, a, s)/\sigma_V)}$$

and

$$\begin{aligned}\mathcal{V}(b, a, s) &= \max \{ V^R(b, a, s) + \epsilon_R, V^D((1 - \bar{h})b, a, s) + \epsilon_D \} \\ &= \sigma_V \log [\exp (V^R(b, a, s)/\sigma_V) + \exp (V^D((1 - \bar{h})b, a, s)/\sigma_V)]\end{aligned}$$

Risk-averse lenders with stochastic discount factor

$$m(s, s') = \exp \left(-r - \nu(\psi\epsilon' + 0.5\psi^2\sigma_\epsilon^2) \right)$$

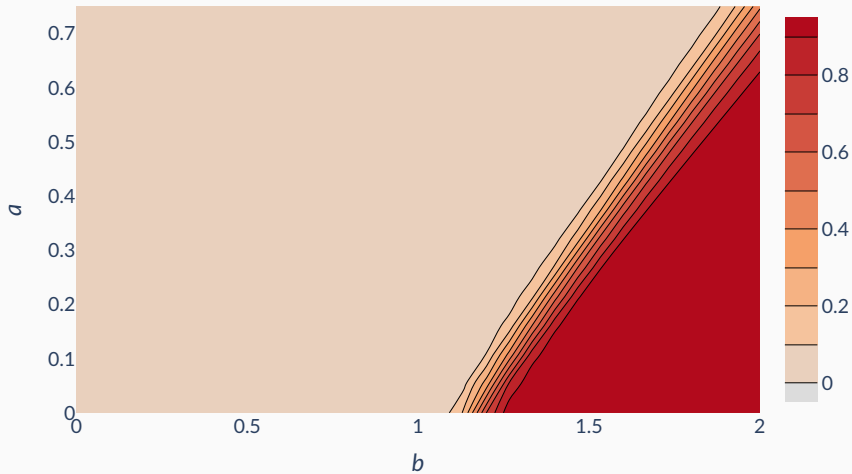
- ν follows a Markov chain with support $\{0, 1\}$
- ϵ is the innovation in tradable output

Price bonds as

$$q_b(b', a', s) = \mathbb{E} \left[m(s, s') \left(\mathbb{1}_{\mathcal{D}'} (1 - \hbar) q_b^D((1 - \hbar)b', a'', s') + (1 - \mathbb{1}_{\mathcal{D}'}) (\kappa(s') + (1 - \delta) q_b(b'', a'', s')) \right) \right]$$

Quantitative Results

Default Sets



Price of Debt

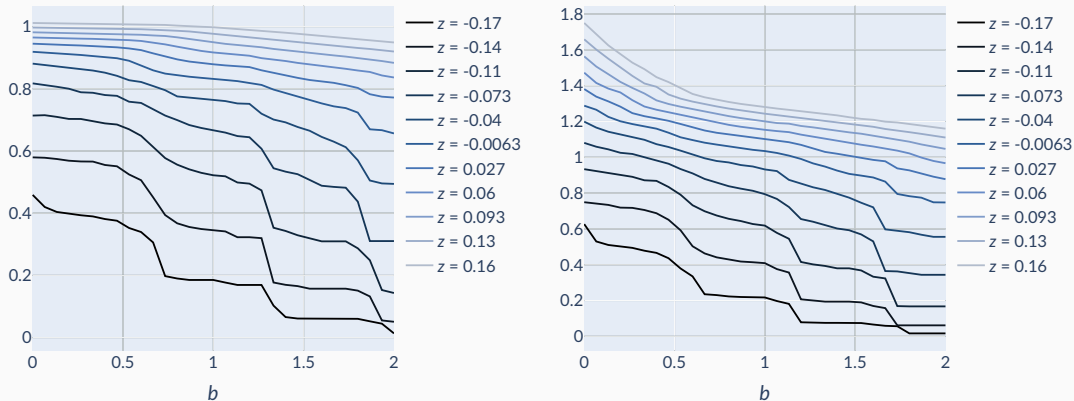


Figure: q_b for dollar debt (left) and peso debt (right)

Real Exchange Rate

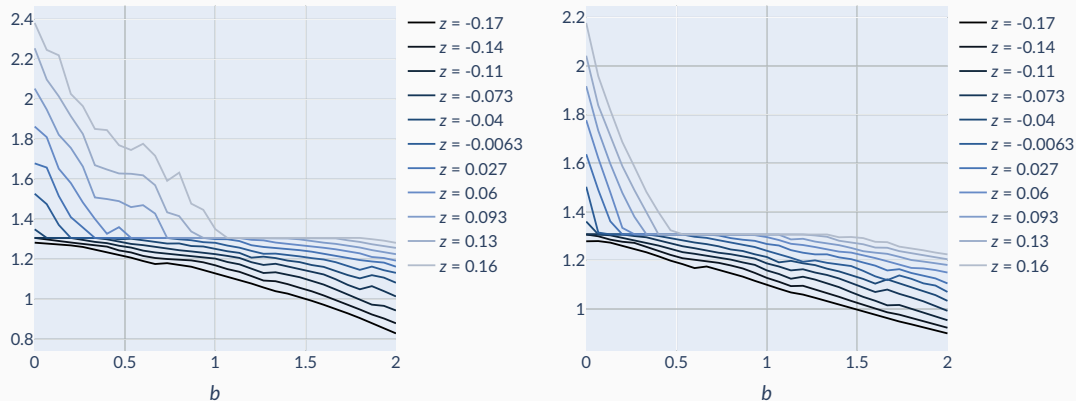


Figure: pN for dollar debt (left) and peso debt (right)

A synthesized LC bond

Idea: fix the hedging properties of LC debt while taking out incentives

1. Solve the model with FC debt
2. Record the state-dependent payments

$$\kappa^{\text{synth}}(b, a, s) = (r + \delta)p_N(b, a, s)$$

or

$$\kappa^{\text{exog}}(b, a, s) = (r + \delta)p_N(0, 0, s)$$

3. Fix the state-contingent bond with coupon payments κ^i and resolve

Comparative statics

Statistic	Dollar debt	Peso debt	Exogenous SCI	Full SCI
mean a/y	9.98%	4.57%	2.32%	2.79%
mean b/y	23.9%	12.8%	9.76%	10.3%
mean ds/y	13.5%	18.7%	13.3%	13.2%
mean a/ds	75.4%	24.7%	18.8%	20.5%
corr c,y	75.9%	27.1%	64.2%	73.7%
vol c/vol y	25.8%	21.2%	23.7%	20.5%
std RER	18.9%	20.2%	19.4%	21.2%
mean unemp	2.4%	2.55%	1.94%	1.98%
default freq	2.32%	2.26%	2.13%	2.04%
γ	-8.089	-8.0738	-8.0425	-8.0572
Welfare gain	-	0.15%	0.46%	0.31%

Concluding Remarks

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- Motivated by empirical association between high reserves and local-currency debt
- Model emphasizes **dual** role of LC debt
- Time-inconsistency erodes most of the gains from indexation
 - ... and induces high reserves compared to synthetic SCIs