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. Incentives vs. insurance
   - FC debt $\rightarrow$ LC debt $\sim$ 0.15% of permanent consumption
   - 0.46% to move to *synthetic* LC debt

Relation to the literature

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

Roadmap

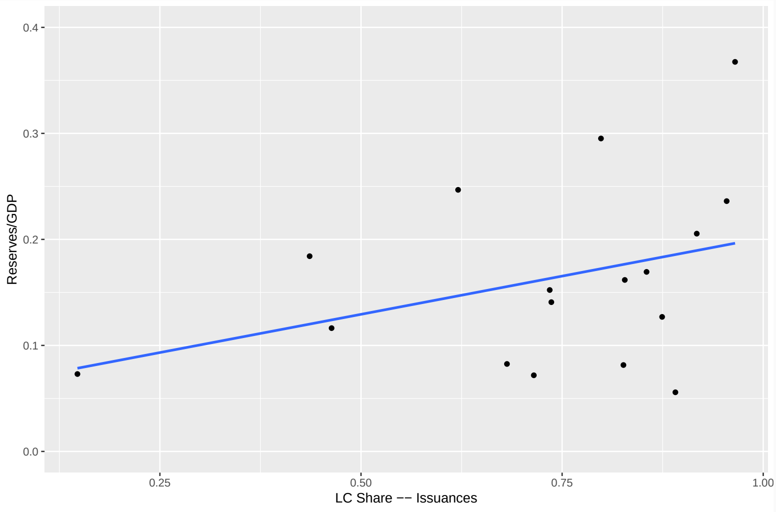
- Evidence
- Model
- Quantitative Results
  - Synthetic Debt
- Concluding Remarks

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

- Nontraded goods, produced

$$y_N = h^\alpha$$

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

Demand

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

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

- 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 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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Debt

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

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

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The planner's problem: modulation of aggregate demand

- In repayment

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

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- In default

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

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The planner's problem: choosing default

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

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

and

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

Foreign lenders

Risk-averse lenders with stochastic discount factor

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

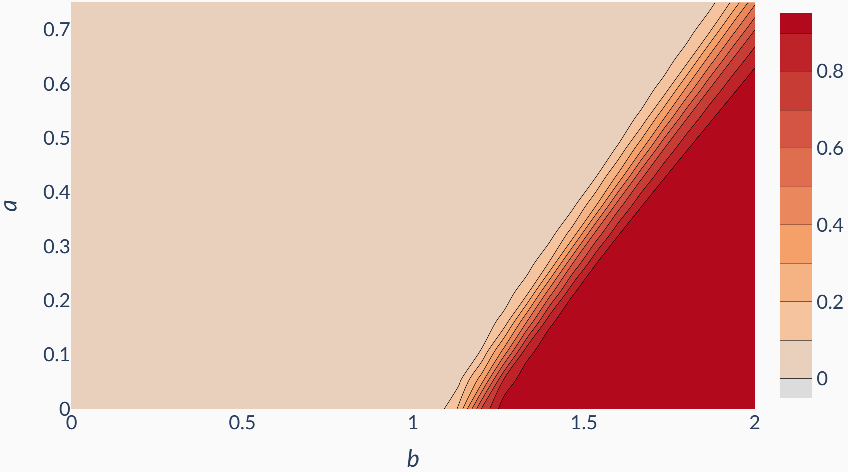
- ν follows a Markov chain with support $\{0, 1\}$
- ϵ is the innovation in tradable output

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

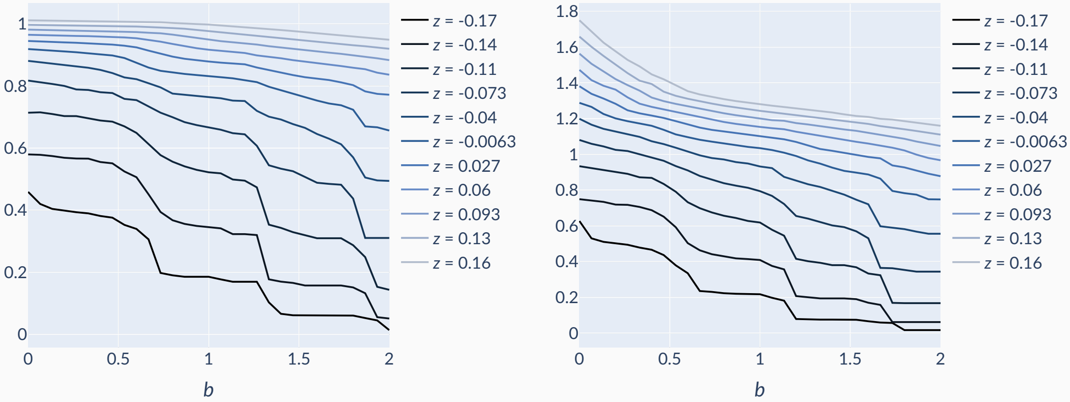
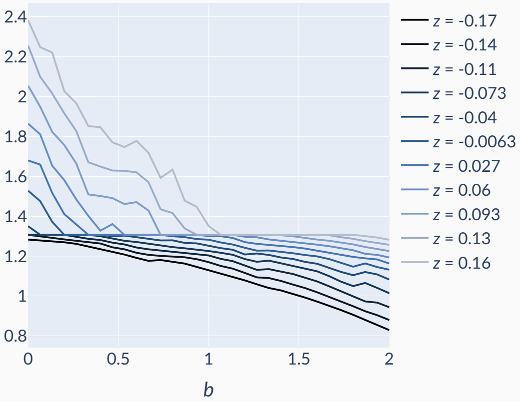


Figure: q_b for dollar debt (left) and peso debt (right)

Real Exchange Rate



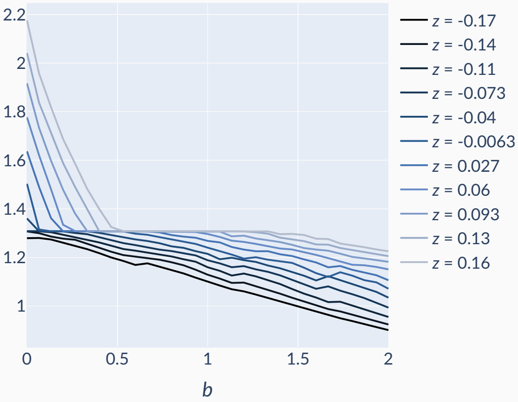


Figure: p_N for dollar debt (left) and peso debt (right)

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

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

   or

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

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%
$\mathcal{V}$	-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