Macroprudential Policy for Internal Financial Dollarization

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macroprudential policy and foreign currency

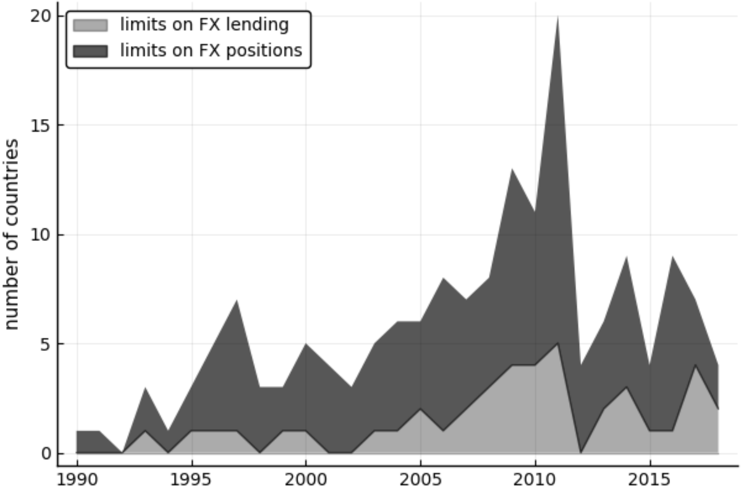

Figure: New policies enacted

motivation

- Macroprudential policy tightening related to foreign currency between 1990 and 2018:
  - 2% of all tightening episodes in advanced economies
  - 11% of all tightening episodes in emerging markets

policy dynamics examples

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- Rationale for these policies: the logic of cross-border borrowing
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- Rationale for these policies: the logic of cross-border borrowing
  - when capital decides to leave the country it will induce a depreciation of the exchange rate that borrowers do not internalize
- But cross-border and domestic borrowing in foreign currency are not identical
  - Christiano et al (2021) find that in the median country, 90% of firms' foreign currency borrowing is provided domestically

some literature

what we do

Focus on environment where dollar debt of firms comes from dollar savings of households

- depreciation increases debt burden, reduces output and wages
- households use dollar assets as insurance

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Cost-benefit analysis of intervention that limits financial dollarization:

- trading costs of dollar debt on balance sheets **vs** insurance benefits of dollar savings
- account for amplification (depreciation $\rightarrow$ drop in output $\rightarrow$ trade balance problem $\rightarrow$ ...)

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Cost-benefit analysis of intervention that limits financial dollarization:

- trading costs of dollar debt on balance sheets **vs** insurance benefits of dollar savings
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Show that costs of limiting dollarization might be lower than expected

- if dollar savings of households partly create the depreciation they are used against

Show that macroprudential policy starts a virtuous circle

- in a more stable economy (less dollar debt) households demand less of dollar assets

workers (savers)

In period $t \in \{0, 1\}$ work, save, consume, receive endowment of non-tradables $y_t^{N,w}$

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Budget constraint:

$$\overbrace{q^T b^T + p_0 q^N b^N}^{\text{saving}} + \overbrace{p_0 c_0^{N,w} + c_0^{T,w}}^{\text{consumption}} \leq w_0 l_0 + \overbrace{p_0 y_0^{N,w}}^{\text{endowment}} + T^w \tag{1}$$

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$$\underbrace{p_1 c_1^{N,w} + c_1^{T,w}}_{\text{consumption}} \leq w_1 l_1 + \underbrace{p_1 y_1^{N,w}}_{\text{endowment}} + \underbrace{b^T + p_1 b^N}_{\text{assets}} \tag{2}$$

<u>Note:</u>

- $\{p_0, p_1\}$ are relative prices of non-tradables (exchange rate)
- $\{w_0, w_1\}$ are wages
- $\{b^T, b^N\}$ is saving in tradables and non-tradables at prices $\{q^T, p_0 q^N\}$
- T^w is tax rebate

firms (borrowers)

At $t = \{0, 1\}$, use two inputs (z_t units of tradables and l_t units of labor) to produce $\eta_t f(z_t, l_t)$

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At $t = 1$:

- pre-fund a fraction θ of their input use z_1 subject to a borrowing constraint
- owe $p_1 b^N$ and b^T to households, $\tilde{b}$ to foreign investors

$$\theta z_1 + \tilde{b} + b^T + p_1 b^N \leq p_1 \overline{b} \tag{3}$$

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Budget constraint:

$$\overbrace{p_0 c_0^{N,e} + c_0^{T,e}}^{\text{consumption}} \leq \overbrace{\eta_0 f(z_0, l_0) - w_0 l_0 - z_0}^{\text{profits}} \tag{4}$$
$$+ (1 - \tilde{\tau})\tilde{q}\tilde{b} + (1 - \tau^T) q^T b^T + (1 - \tau^N) p_0 q^N b^N + T^e$$

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&+ (1 - \tilde{\tau})\tilde{q}\tilde{b} + (1 - \tau^T) q^T b^T + (1 - \tau^N) p_0 q^N b^N + T^e
\end{aligned}$$

$$\underbrace{\tilde{b} + b^T + p_1 b^N}_{\text{debt repayment}} + \underbrace{p_1 c_1^{N,e} + c_1^{T,e}}_{\text{consumption}} \leq \underbrace{\eta_1 f(z_1, l_1) - w_1 l_1 - z_1}_{\text{profits}} \tag{5}$$

equilibrium characterization

Asset prices determined by Euler equations   Euler equations   dollar premium   equilibrium definition

Exchange rate and wage determination:

$$p_1 = F(z_1), \text{ increasing function} \tag{6}$$

$$w_1 = \text{ marginal product of labor} \tag{7}$$

Not directly affected by debt $\{b^T, b^N\}$, **indirectly** via constraint

$$\theta z_1 \leq p_1 \left(\bar{b} - b^N\right) - b^T - \tilde{b} \tag{8}$$

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Spiral: p_1 falls $\rightarrow$ z_1 falls $\rightarrow$ p_1 falls more...

costs and benefits of de-dollarization

Marginal effect of debt on worker's non-financial income:

$$\mathcal{X} = \frac{\partial \text{ price of non-tradables}}{\partial \text{ debt}} \cdot \text{net sales of non-tradables} + \frac{\partial \text{ wage}}{\partial \text{ debt}}$$

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Consider a perturbation such that $\{b^N, b^T\}$ change but total expected payoff stays the same

Denote by $s_1 = p_1/p_0$ the appreciation of domestic currency, $\Delta_{UIP} = \mathbb{E}[s_1]q^T - q^N$

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Result

Marginal benefit of replacing $\mathbb{E}[p_1]$ units of dollar debt with one unit of local currency debt is

$$\Delta = \underbrace{Cov\left[\mathcal{X}, -s_1\right]}_{\text{removing contagion}} - \underbrace{\left[\Delta_{UIP} - \hat{\Delta}_{UIP}\right]}_{\text{losing insurance}} + \text{revaluation} \tag{10}$$

Here $\hat{\Delta}_{UIP}$ corresponds to zero taxes

notation

numerical example

Calibrate the model to match emerging market targets:

- UIP violation of 3%, deposit dollarization of 30%
- probability of sudden stop of 10% per year, depreciation of 15% in case of a sudden stop

Table: Marginal benefits of intervention and optimal taxes with full weight on workers

	Δ	τ^T	τ^N	dep. dollarization	UIP violation
unregulated	$4.9pp$	0	0	30.0%	$3.00pp$
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- would need return on dollar $75bp$ then in optimum lower to induce optimal holdings

conclusion and limitations

Takeaways:

- Insurance costs of de-dollarization are of second order
- Macroprudential policy launches a virtuous circle

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Limitations:

- Intermediaries: most policies target banks, EMEs depend on bank financing etc
- Monetary policy: interaction with macroprudential policy is potentially important

Questions:

- Do dollar deposits come from firms as well? How much?
- Do banks/firms actively hedge? Spillovers from derivative markets?

notation for de-dollarization

$$\Delta = \frac{1}{p_0 \mathcal{U}_0^w} \left(\frac{d\mathcal{W}}{db^N} - \mathbb{E}[p_1] \frac{d\mathcal{W}}{db^T} \right) \tag{11}$$

Marginal utilities:

$$\mathcal{U}_0^w = \frac{(\mathcal{W}^w)^\zeta (\mathcal{C}_0^w)^{-\zeta}}{P_0} \qquad \mathcal{U}_1^w = \beta^w \frac{(\mathcal{W}^w)^\zeta (\mathcal{C}_1^w)^{-\zeta}}{P_1} \left(\frac{\mathbb{K}[\mathcal{C}_1^w]}{\mathcal{C}_1^w} \right)^{\sigma-\zeta} \tag{12}$$

$$\mathcal{U}_0^e = \frac{1}{P_0} \qquad \mathcal{U}_1^e = \beta^e \frac{1}{P_1} \tag{13}$$

Λ^w is the pricing kernel of the workers: $\Lambda^w = \mathcal{U}_1^w / \mathcal{U}_0^w$ back

literature

Internal financial dollarization:

- Montamat 2020, Dalgic 2018, Bocola Lorenzoni 2020

This paper: study the normative side

Fisherian spirals and overborrowing:

- Korinek Mendoza 2014, Mendoza Smith 2006, Durdu Mendoza 2006, Mendoza Smith 2014, Mendoza 2010, Bianchi Mendoza 2011, Schmitt-Grohe Uribe 2017, Boz Mendoza 2014, Jeanne Korinek 2010b, Reyes-Heroles Tenorio 2020, Bianchi Mendoza 2018, Arellano Mendoza 2002, Mendoza 2005

This paper: introduce domestic saving in foreign currency

Quantifying externalities:

- Davila Korinek 2018, Hebert 2020

This paper: apply insights to internal financial dollarization

back

equilibrium

Fix endowments, a tax system $\mathcal{T} = \{\tau^N, \tau^T, \tilde{\tau}, T^w, T^e\}$, and the global interest rate $\tilde{q}$

Equilibrium is a set of quantities $\{\{c_t^{N,w}, c_t^{T,w}, c_t^{N,e}, c_t^{T,e}, z_t\}_{t=0,1}, b^T, b^N, \tilde{b}\}$ and prices $\{q^T, q^N, \{p_t, w_t\}_{t=0,1}\}$ such that

- consumption and borrowing decisions $\{\{c_t^{N,w}, c_t^{T,w}, c_t^{N,e}, c_t^{T,e}\}_{t=0,1}, b^T, b^N, \tilde{b}\}$ solve the problems of the agents
- traded input choices $\{z_t\}_{t=0,1}$ are optimal for the entrepreneurs
- the optimal choice of labor coincides with labor endowments $\{l_t\}_{t=0,1}$
- market for non-tradables clears internally: $c_t^{N,w} + c_t^{N,e} = y_t^{N,w} + y_t^{N,e}$ for $t = 0, 1$

Balance of payments (follows):

$$c_1^{N,w} + c_1^{N,e} = \eta_1 f(z_1, l_1) - z_1 + y_1^{T,w} + y_1^{T,w} - \tilde{b} \tag{14}$$

Under conditions, can index equilibria by $\{b^T, b^N, \tilde{b}\}$ with taxes changing in the background

back

two premia

- Occasionally binding borrowing constraint

$$(1-\tau^T)q^T = \beta^e \mathbb{E}\left[\frac{P_0}{P_1}\cdot\left(1+\underbrace{\theta^{-1}\max\left\{0,\eta_1 f_1\left(z_1,l_1\right)-1\right\}}_{\text{unearned profits}}\right)\right] \tag{15}$$

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- LC debt shrinks together with the borrowing limit, FC debt does not:

$$(1-\tau^N)q^N = (1-\tau^T)q^T\mathbb{E}\left[\frac{p_1}{p_0}\right] + \underbrace{\beta^e\mathbb{C}\left[\frac{P_1}{P_0}\cdot\frac{\eta_1 f_1(z_1,l_1)-1+\theta}{\theta},\frac{p_1}{p_0}\right]}_{\text{UIP violation}} \tag{16}$$

Euler equations back

Euler equations

$$q_t^T = \beta^w \mathbb{E}_t \left[\frac{P_t}{P_{t+1}} \left(\frac{c_t^w}{c_{t+1}^w} \right)^{\zeta} \left(\frac{\mathbb{K}_t \mathcal{V}_{t+1}^w}{\mathcal{V}_{t+1}^w} \right)^{\sigma-\zeta} \right] \tag{17}$$

$$q_t^N = \beta^w \mathbb{E}_t \left[\frac{P_t}{P_{t+1}} \left(\frac{c_t^w}{c_{t+1}^w} \right)^{\zeta} \left(\frac{\mathbb{K}_t \mathcal{V}_{t+1}^w}{\mathcal{V}_{t+1}^w} \right)^{\sigma-\zeta} \cdot \frac{p_{t+1}}{p_t} \right] \tag{18}$$

$$(1-\tau_t^T) q_t^T = \beta^e \mathbb{E}_t \left[\frac{P_t}{P_{t+1}} \left(1 + \theta^{-1} \max \left\{ 0, \eta_{t+1} f_1 \left(z_{t+1}, l_{t+1} \right) - 1 \right\} \right) \right] \tag{19}$$

$$(1-\tau_t^N) q_t^N = \beta^e \mathbb{E}_t \left[\frac{P_t}{P_{t+1}} \left(1 + \theta^{-1} \max \left\{ 0, \eta_{t+1} f_1 \left(z_{t+1}, l_{t+1} \right) - 1 \right\} \right) \cdot \frac{p_{t+1}}{p_t} \right] \tag{20}$$

dollar premium back

examples of macroprudential policies on FC instruments

- An example of a limit on FC lending from Romania: *On September 26, 2005, the authorities introduced a limit on credit institutions' exposure to at most 300% of their equity (before deducting credit risk provisions) when granting foreign currency loans to unhedged borrowers, natural and legal persons*.
- An example of a limit on FC positions from Indonesia: *Thereafter from January 1, 2016, non-bank corporations holding external debt shall be required to hedge their foreign exchange against the rupiah with a ratio of 25%, as announced in October 2014.*

back