Liability Dollarization, Sudden Stops & Optimal Financial Policy

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Motivation

- Liability dollarization (LD): Banks in EMs intermediate hard-currency inflows into domestic-currency loans
  - 2007: Foreign currency liabilities/total liabilities = 40% in LA, 25% in E. Europe, 15% in others; median ext. liabilities/loans = 36% (BIS (09))
  - 1996: Foreign liabilities/assets ranged from 143% in Indonesia to 775% in Thailand (Eichengreen & Hausmann (99))
- In standard Sudden Stops (SS) models, debt is in units of tradables, but nontradables are used as collateral
  - Pecuniary ext. justifies MPP (current debt choices affect future collateral values & borrowing capacity)
  - Quantitatively, models generate deep crises, optimal MPP is time-consistent and very effective, but LD implications are unknown.
- LD literature mostly focuses on bank solvency and balance sheet effects, but not on private non-financial borrowers.

What we do

- Propose Sudden Stops model w. liability dollarization (SSLD) and compare with SS models
  - SSLD model introduces “intermediation externality” via ex-post and ex-ante real int. rate fluctuations, and a risk-taking incentive

- Analyze optimal policy problems:
  1. <u>Commitment</u>: Optimal effective debt tax tackles externalities, but is time-inconsistent and does not justify capital controls.
  2. <u>Conditionally efficient</u>: Debt taxes & cap. controls (maintain credibility)

- Conduct quantitative analysis:
  1. Debt is higher but Sudden Stops milder (closer to data) in SSLD model
  2. Optimal policy removes Sudden Stops, yields 0.5% welfare gain, but is complex and subsidizes inflows often
  3. Simpler rules are less effective, tax debt relatively more than inflows, tend to impose capital controls during crises

Standard SS Model

Max. $$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t), \quad u(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma}.$$

$$c_t = \left[\omega \left(c_t^T\right)^{-\eta} + (1-\omega)\left(c_t^N\right)^{-\eta}\right]^{-\frac{1}{\eta}}$$

s.t.

$$q_t^* b_{t+1} + c_t^T + p_t^N c_t^N = b_t + y_t^T + p_t^N y_t^N$$

$$q_t^* b_{t+1} \geq -\kappa(y_t^T + p_t^N y_t^N)$$

Debt is issued in T units at the world price q*=1/R* (intermediation is inessential)

SSLD model: Intermediaries

- Risk-neutral banks borrow abroad at price q_t^* in T units to fund domestic loans at price q_t^c in units of domestic consumption (with a CPI p_t^c in T units)

- No-arbitrage condition:

$$q_t^c = \frac{q_t^* \mathbb{E}_t \left[p_{t+1}^c \right]}{p_t^c}$$

- Ex-ante (in c) and ex-post (in c^T) real interest rates:

$$R_{t+1}^c \equiv 1/q_t^c = \frac{R_{t+1}^* p_t^c}{\mathbb{E}_t \left[p_{t+1}^c \right]} \qquad \tilde{R}_{t+1}^c \equiv 1/\tilde{q}_t^c = \frac{R_{t+1}^c p_{t+1}^c}{p_t^c}$$

- Nearly frictionless intermediation (nsc. bonds and collateral constraint are the only frictions)

SSLD model: Domestic agents

Max. $$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t), \quad u(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma}.$$

$$c_t = \left[\omega \left(c_t^T\right)^{-\eta} + (1-\omega)\left(c_t^N\right)^{-\eta}\right]^{-\frac{1}{\eta}}$$

s.t.

$$q_t^c p_t^c b_{t+1}^c + c_t^T + p_t^N c_t^N = p_t^c b_t^c + y_t^T + p_t^N y_t^N$$

$$q_t^c p_t^c b_{t+1}^c \geq -\kappa(y_t^T + p_t^N y_t^N)$$

Debt is issued in units of domestic CPI (real ex. rate):

$$p_t^c = \left[\omega^{\frac{1}{1+\eta}} + (1-\omega)^{\frac{1}{1+\eta}}\left(p_t^N\right)^{\frac{\eta}{1+\eta}}\right]^{\frac{1+\eta}{\eta}}$$

Effects of liability dollarization

1. Ex-post RIR changes alter debt repayment burden

$$p^c(c_t^T, y_t^N) b_t^c$$

2. Ex-ante RIR changes alter resources generated by new debt

$$-q_t^* \mathbb{E}_t \left[p^c(c_{t+1}^T, y_{t+1}^N) \right] b_{t+1}^c$$

3. Risk-taking incentive lowers expected marginal cost of borrowing

$$u_T(t) = \beta R_{t+1}^* \mathbb{E}_t \left[u_T(t+1) \right] + \beta \boxed{\text{Cov}_t(u_T(t+1), \tilde{R}_{t+1}^c)} + \mu_t$$

Policy instruments

- Capital controls: tax θ_t on intermediaries inflows:

$$q_t^c = \frac{q_t^*}{(1+\theta_t)} \frac{\mathbb{E}_t\left[p_{t+1}^c\right]}{p_t^c}$$

- Domestic regulation: tax τ_t on domestic debt:

$$q_t^c p_t^c b_{t+1}^c + c_t^T + p_t^N c_t^N = p_t^c b_t^c (1+\tau_t) + y_t^T + p_t^N y_t^N + T_t$$

- Euler equation with policy intervention:

$$u_T(t) = (1+\tau_t)(1+\theta_t)\beta \mathbb{E}_t\left[u_T(t+1)\tilde{R}_{t+1}^c\right] + \mu_t$$

  - Equivalent effects on marginal cost of borrowing

- ....but capital controls also enhance debt capacity:

$$q^* \mathbb{E}_t(p_{t+1}^c) b_{t+1}^c \geq -\kappa(1+\theta)(y_t^T + p_t^N y_t^N)$$

Planner's problem under commitment

$$\max_{\{c_t^T, b_{t+1}^c\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t(c_t^T, y_t^N))$$

s.t.

$$q_t^* \mathbb{E}_t \left[p^c(c_{t+1}^T, y_{t+1}^N)\right] b_{t+1}^c + c_t^T = p^c(c_t^T, y_t^N) b_t^c + y_t^T$$

$$q_t^* \mathbb{E}_t \left[p^c(c_{t+1}^T, y_{t+1}^N)\right] b_{t+1}^c \geq -\kappa(y_t^T + p^N(c_t^T, y_t^N) y_t^N)$$

- Euler eq. (μ_t=0) & externalities:

standard MP ext. (+)

$$u_T(t) = \beta \mathbb{E}_t \left[\left[u_T(t+1) + \boxed{\mu_{t+1} \kappa y_{t+1}^N p^{N\prime}(t+1)} \right] \tilde{R}_{t+1}^c \boxed{\Psi(t+1)} \right]$$

intermediation ext. > or < 1

$$\Psi(t+1) \equiv \left(\frac{1-\psi(t)}{1-\psi(t+1)} \right)$$

ex-post RIR

ex-ante RIR

risk incentive

$$\psi(t) \equiv p^{c\prime}(t) b_t^c \left[1 - \left(\frac{\mathbb{E}_{t-1}[\lambda_t]}{\lambda_t} + \frac{\mathrm{Cov}_{t-1}\left(\lambda_t, p^c(t)\right)}{\lambda_t \mathbb{E}_{t-1}[p^c(t)]} \right) \right]$$

Time inconsistency & optimal taxes

- At *t*, induce expectations of higher c_{t+1} to boost q^c_t, but suboptimal at *t+1* due to higher debt repayment

$$\lambda_t = \frac{u_T(t) + \mu_t \kappa p^{N\prime}(t) y_t^N - p^{c\prime}(t) b_t^c \frac{q^*_{t-1}}{\beta} \boxed{(\lambda_{t-1} - \mu_{t-1})}}{1 - p^{c\prime}(t) b_t^c}$$

- Allocations & prices independent of μ_t when μ_t >0.
- If μ_t=0 and $E_t[\mu_{t+1}]$>0, an *effective* debt tax can be used to implement planner' solution:

$$\tau_t = \frac{\mathbb{E}_t\left[\left(u_T(t+1) + \mu_{t+1}\kappa y^N_{t+1} p^{N\prime}(t+1)\right)\tilde{R}^c_{t+1}\Psi(t+1)\right]}{\mathbb{E}_t\left[\tilde{R}^c_{t+1} u_T(t+1)\right]} - 1$$

  – **No case for capital controls** (θ_t and τ_t are equivalent)

Conditionally efficient (time consistent) planner

- Takes as given debt pricing function (ex-ante RIR function) of the unregulated DE

$$V(b^c, y^T, y^N) = \max_{\{b^{c\prime}, c^T\}} \left[u(c(c^T, y^N)) + \beta \mathbb{E}_{(y^{T\prime}, y^{N\prime})|(y^T, y^N)} \left[V(b^{c\prime}, y^{T\prime}, y^{N\prime}) \right] \right]$$

s.t.

$$\boxed{q^{\mathrm{DE}}(b^c, y^T, y^N)} p^c(c^T, y^N) b^{c\prime} + c^T = p^c(c^T, y^N) b^c + y^T$$

$$\boxed{q^{\mathrm{DE}}(b^c, y^T, y^N)} p^c(c^T, y^N) b^{c\prime} \geq -\kappa (y^T + p^N(c^T, y^N) y^N)$$

Planner's Euler equation (μ_t=0)

standard MP ext. (+)

$$u_T(t) = \beta \mathbb{E}_t \left[\left[u_T(t+1) + \mu_{t+1} \kappa y^N_{t+1} p^{N\prime}(t+1) \right] \tilde{R}^c_{t+1} \hat{\Psi}(t+1) \Omega(t+1) \right]$$

intermediation ext.

$$\hat{\Psi}(t+1) \equiv \left(\frac{1-\hat{\psi}(t)}{1-\hat{\psi}(t+1)} \right)$$ > or <1

$$\hat{\psi}(t) \equiv p^{c\prime}(t) \left[b^c_t - q^{\mathrm{DE}}(t) b^c_{t+1} \left(1 - \frac{\mu_t}{\lambda_t} \right) \right]$$

$$\Omega(t+1) \equiv \left(1 - \left(1 - \frac{\mu_{t+1}}{\lambda_{t+1}} \right) q^{DE\prime}(t+1) b^c_{t+2} \right)$$ < 1

Optimal policies

- Effective debt tax (or subsidy):

$$\tau_t^{ef} = \frac{\mathbb{E}_t\left[\left(u_T(t+1) + \mu_{t+1}\kappa y_{t+1}^N p^{N\prime}(t+1)\right)\tilde{R}_{t+1}^c \hat{\Psi}(t+1)\Omega(t+1)\right]}{\mathbb{E}_t\left[\tilde{R}_{t+1}^c u_T(t+1)\right]} - 1$$

- Capital controls (tax or subsidy depending on expected RER appreciation relative to DE):

$$\theta_t = \frac{q_t^*}{q^{\mathrm{DE}}(t)} \frac{\mathbb{E}_t[p^c(t+1)]}{p^c(t)} - 1$$

- Domestic debt tax is the one given by:

$$(1+\tau_t^{ef}) \equiv (1+\tau_t)(1+\theta_t)$$

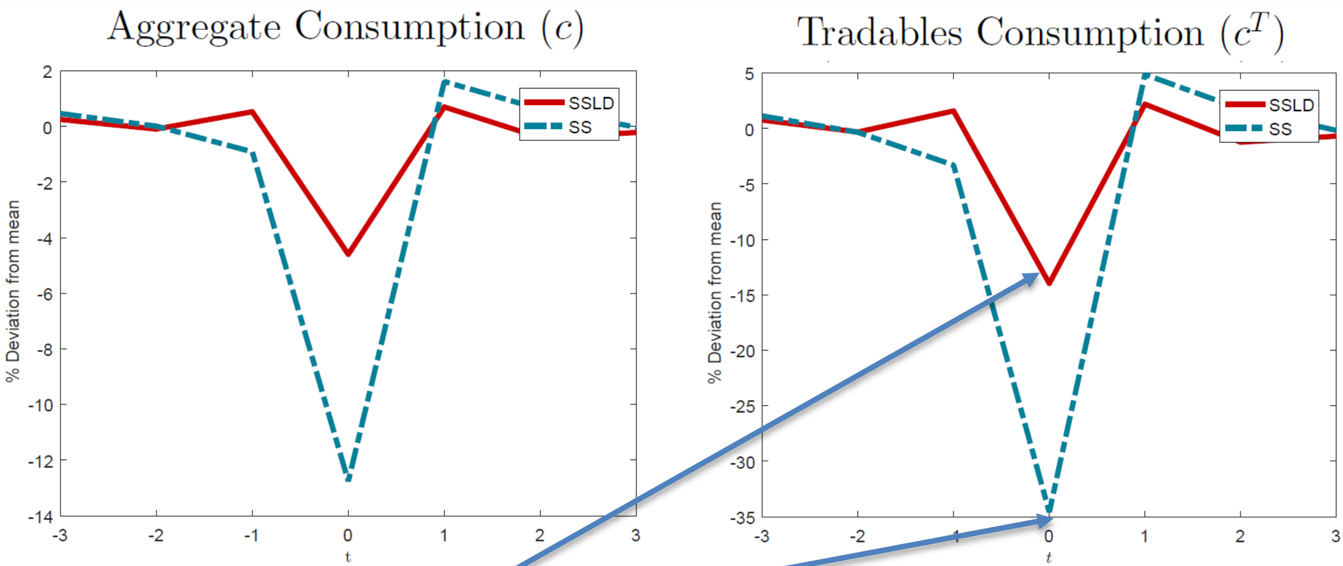
Calibration (Bianchi, 2011)

Parameter	Value
γ	2
η	0.205
ω	0.31
β	0.91
q^*	0.96
ρ_{y^T}	0.54
σ_{y^T}	0.059
y^N	1.00
κ	0.32

SSLD-SS comparison

1. Strong risk-taking incentive, equivalent on average to 46 bpts. cut in R* (4% to 3.54%)
2. SSLD economy sustains higher debt (29.4% v. 27.2% of GDP on average)
3. Sudden Stops are less frequent (3.8% v. 4.8%), milder, and reached with higher income levels
4. Welfare is 0.26% higher (liability dollarization is desirable!), due to milder, less freq. crises
5. Milder crises largely due to fall in ex-ante RIRs (also higher income & lower ex-post RIR), even though CA reversal is about the same

Sudden Stops in consumption: SS v. SSLD

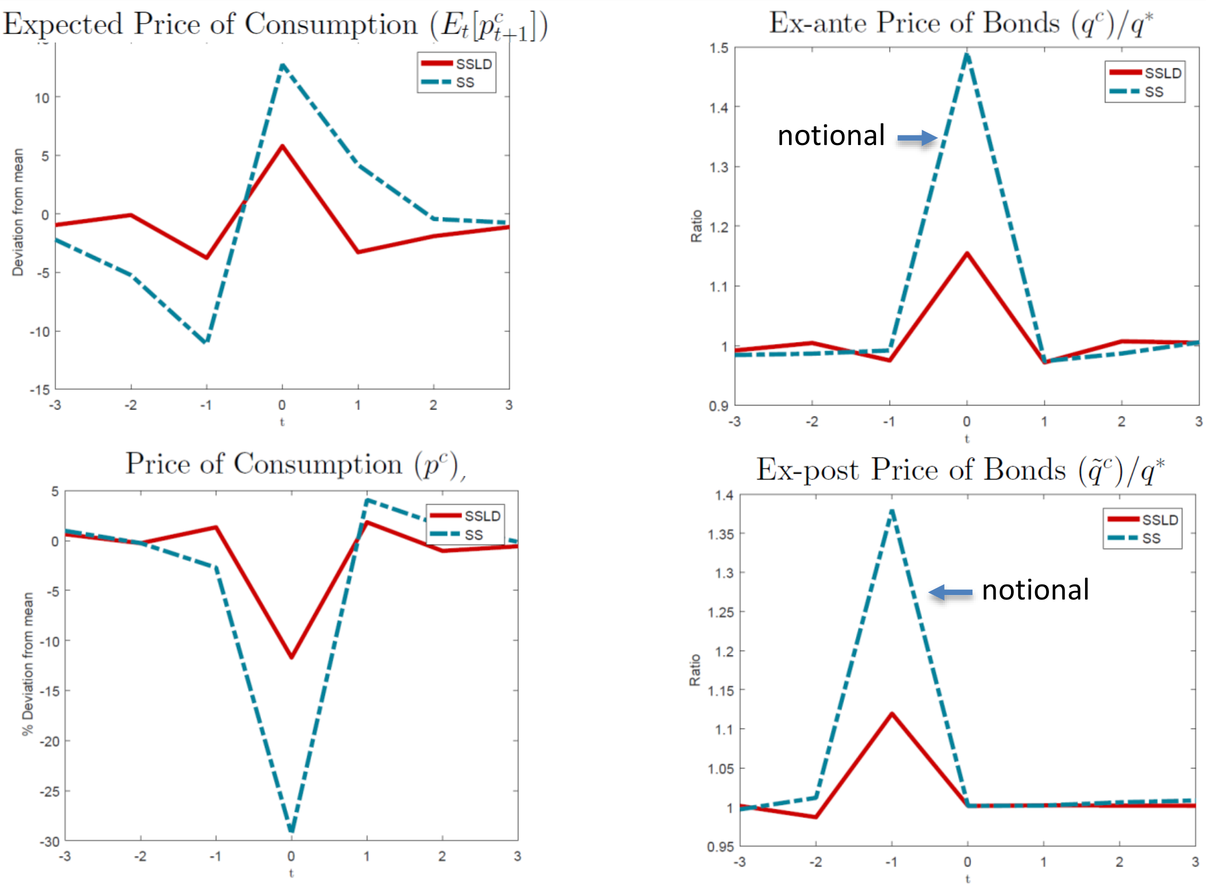


$$\Delta c^T = \Delta y_t^T + \Delta p_t^c b_t^c + \Delta q_t^c p_t^c b_{t+1}^c \quad = 0.2$$

$$0.021 \qquad 0.034 \qquad \boxed{0.149}$$

3/4ths of the consumption gain are due to ex-ante RIR effect!

Sudden Stops in prices: SS v. SSLD



Comparing SS, SSLD and SP

Long-run Moments	(1)	(2)	(3)
	SS	SSLD	SSLD - SP
Average $(p^c b^c / Y)\%$	-27.16	-29.41	-22.57
Average TB/Y Ratio	1.22	1.12	0.80
Welfare gain[1]%	n/a	0.26	0.54
Prob. of Sudden Stops[2]%	4.76	3.83	0.00
Prob$(\mu_t > 0)$ %	9.30	35.38	22.96
Prob of MP tax region %	n/a	n/a	49.7
Median Debt Tax Rate τ %	n/a	n/a	5.79
Median Capital Control Rate θ %	n/a	n/a	-12.78
Average c	0.989	0.989	1.024
Average fall in c in Sudden Stops[3]	- 12.73	-4.60	n/a

Simple policy rules

1. Constant taxes: $\tau_t = \tau \qquad \theta_t = \theta$

2. Debt-tax Taylor Rule (credit targeting):

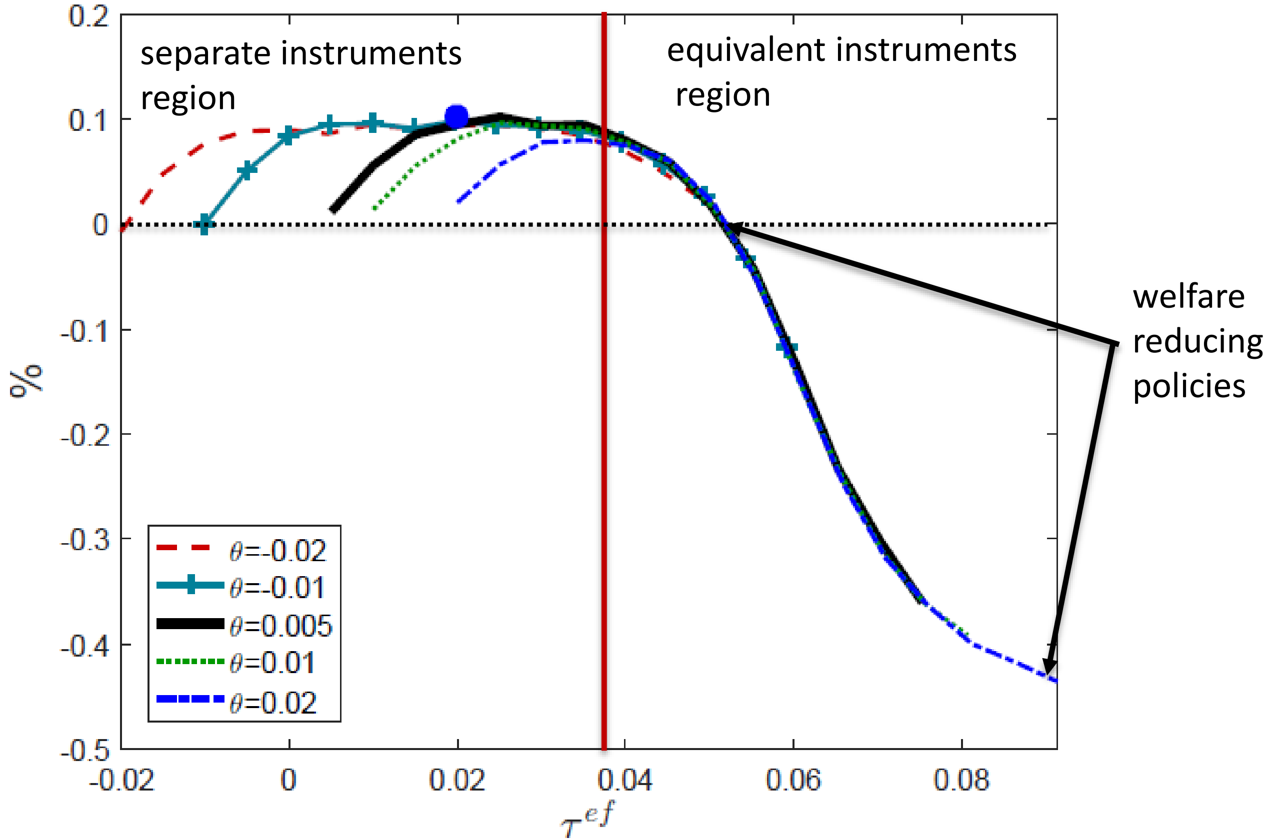
$$\tau_t = \max\left\{(1+\tau^*)\cdot\left(\frac{b_t^c}{\bar{b}^c}\right)^{\phi_T} - 1, 0\right\}$$

3. Capital-controls Taylor Rule (RER targeting):

$$\theta_t = (1+\theta^*)\cdot\left(\frac{p_t^c}{\bar{p}^c}\right)^{\phi_C} - 1$$

- All three optimized to find largest welfare gain

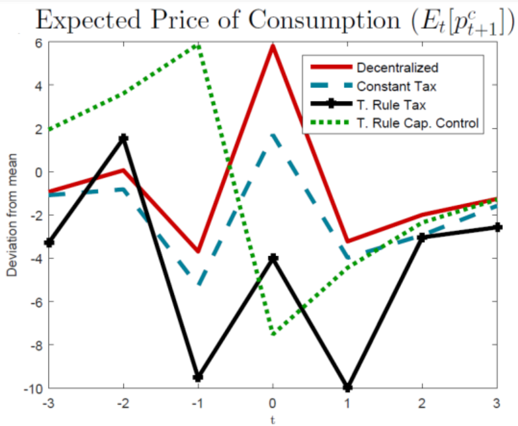
Welfare with fixed taxes

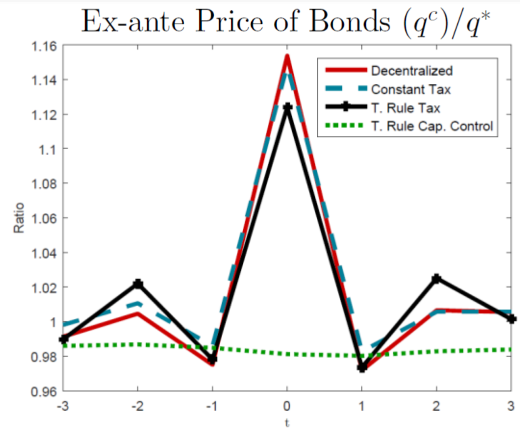


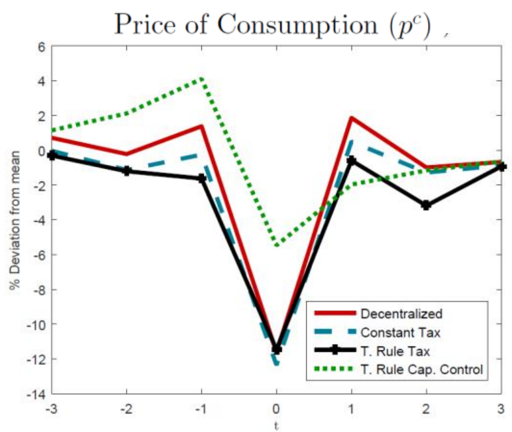
Effectiveness of simple rules

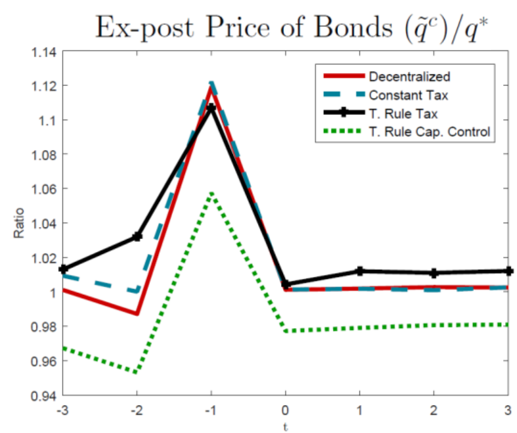
Long-run Moments[1]	(1)	(2)	(3)	(4)	(5)
	DE	CT	TRT	TRCC	SP
Average $(P^c b^c / Y)$ %	-29.41	-29.07	-28.18	-30.49	-22.57
Welfare Gain[2]%	n/a	0.10	0.12	0.14	0.54
Prob. of Sudden Stops[3]%	3.83	3.23	2.76	3.55	0.00
Prob$(\mu_t > 0)$ %	35.38	31.84	7.15	71.08	22.87
Median Debt Tax Rate τ %	n/a	2.00	3.59	2.00	5.79
Median Capital Control Rate θ %	n/a	0.50	0.50	1.73	-12.78
Average c	0.989	0.989	0.990	0.989	1.024
Average change of c in Sudden Stops[4]%	-4.60	-4.87	-4.48	-2.06	n/a

Sudden Stops in prices with simple rules









Conclusions

- LD alters significantly the positive & normative predictions of Sudden Stops models
  1. Adds intermediation externality via ex- and ex-post RIR fluctuations, and risk-taking incentive
  2. Time-inc. under commitment, no role for capital controls.
  3. Time-consistent regulator uses both domestic debt taxes and capital controls
  4. Higher debt & welfare, less frequent & weaker crises
  5. Optimal policy very effective but complex
  6. Simple rules are less effective, can reduce welfare, tend to tax debt more than inflows (except during crises)
- Future work to introduce banking frictions