Currency Risk under Capital Controls

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Resurge of Capital Controls

Conventional Wisdom

- Capital account liberalization/financial integration welfare enhancing
- Consumption smoothing and financing investments

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- Excessive capital flows carry risks for financial and macro stability
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- Excessive capital flows carry risks for financial and macro stability
  - Capital inflows generate overheating
  - Capital outflows trigger recessions and financial crises
- Room for the prudential use of capital control policies

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- Currencies with higher capital controls have lower returns in EMs
  - Cannot be explained by existing risk factors or characteristics

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- Capital controls reduce capital flow exposures to global push factors

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A quantitative model

- Small open economy with occasionally binding constraint + risk-averse lender
- Capital controls reduce financial fragility, currency risk, and risk premia

Relation to the Literature

Capital control and exchange rate in the literature

- Weak and inconclusive evidence on exchange rates
- Focus on **contemporaneous** real exchange rate **level**
  - Inflow $\Longrightarrow$ appreciation; outflow $\Longrightarrow$ depreciation
  - Capital controls offset the flow effects
  - Endogeneity: controls response to exchange rate level

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Our contribution

- New evidence from the perspective of currency risk and return
  - **Expected return** of currencies
- Support the macroprudential view of capital controls

Data

- Capital control: a policy designed to limit transactions on capital account
  - Taxes, reserve requirements, quantitative limits and restrictions, prohibitions, authorizations, others
- Capital control: Fernández, Klein, Rebucci, Schindler, Uribe (2016)
  - Based on IMF Annual Report on Exchange Rate Arrangements and Restrictions
  - Averaging binary indicators of controls across 10 assets, including both controls on inflow and outflow, de jure, 1995-2020 annual
  - Extensive margin
- Currencies: 19 EM, Datastream

Capital Controls: Summary Statistics

- EM is large, volatile, and persistent
- Acyclical, unrelated to output, current account, and exchange rate (Fernández, Rebucci, and Uribe 2015)

	mean	sd	high	low	AR(1)	freq of 0
EM	0.58	0.12	0.79	0.41	0.77	0.02

Average Return Decreases with Capital Controls

- Sort EM currencies on capital controls
  - return $rx_{t+1} = s_{t+1} - f_t$; s increase: appreciation against \$

	*P*1	*P*2	*P*3	*P*4	*HML*
mean	4.72	1.83	1.35	0.84	-3.89
(t-stat)	(2.90)	(0.80)	(0.69)	(0.71)	(-2.54)
SD	8.14	11.49	9.79	5.88	7.66
SR	0.58	0.16	0.14	0.14	-0.51
CC	0.16	0.45	0.67	0.88	
σ_{cc}	0.09	0.08	0.03	0.04	

Other Characteristics Cannot Explain the Return

- Capital control does not reflect other characteristics of countries?
  - No systematic pattern for NFA (Della Corte et al, 2016), CDS (Della Corte et al, 2020), bid-ask spread, CIP deviation, currency regime
  - The HML portfolio has very low correlation with fd sorted portfolio

	$P1$(low cc)	$P2$	$P3$	$P4$(high cc)	HML
mean	4.72	1.83	1.35	0.84	-3.89
(t-stat)	(2.90)	(0.80)	(0.69)	(0.71)	(-2.54)
FD	8.29	6.58	6.08	3.88	
NFA	-0.02	0.26	-0.35	-0.19	
sd(NFA)	0.62	0.42	0.11	0.12	
CDS	1.35	1.97	1.79	2.28	
Bid-ask	0.13	0.22	0.17	0.16	
CIP(abs)	120.08	112.25	64.03	108.61	
regime	2.67	2.77	2.97	2.42	

The Spread Cannot Be Explained By Existing Risk Factors

- $rx_t = \alpha + \beta factor_t' + \varepsilon_t$
- Return cannot be explained by existing factors

	$P1$	$P2$	$P3$	$P4$	HML
Mean	4.72	1.83	1.35	0.84	-3.89
(t-stat)	(2.90)	(0.80)	(0.69)	(0.71)	(-2.54)
Carry&Dollar	3.85	-2.71	-2.47	-0.83	-4.69
(t-stat)	(3.58)	(-1.77)	(-2.41)	(-0.94)	(-3.19)
Value	4.66	1.74	1.34	0.75	-3.91
(t-stat)	(2.85)	(0.75)	(0.68)	(0.64)	(-2.53)
Momentum	4.65	2.03	1.48	0.96	-3.69
(t-stat)	(2.85)	(0.88)	(0.76)	(0.82)	(-2.42)

Why Capital Control Reduces EM Currency Risk Premia?

- EM currencies face large currency depreciation risks in bad times
  - Currency mismatch: EMs borrow in USD
  - Bad time: credit disrupted, capital outflows and exchange rate depreciates (sudden stop)

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- EM currencies face large currency depreciation risks in bad times
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  - Bad time: credit disrupted, capital outflows and exchange rate depreciates (sudden stop)
- Empirical predictions on capital control effect
  - Reduce currency exposure to global risks
  - Reduce the exposure of capital flows to global push factors
  - Pronounced in debtors countries

Risk Exposure

- $rx_{i,t+1} = \beta_0 + \beta_1 CC_{i,t} + \beta_2 \Delta \ln Vol_{t+1} + \beta_3 \Delta \ln Vol_{t+1} \times CC_{i,t} + \varepsilon_{i,t+1}$
- Capital control reduces exposure to global risks
  - Vol lowers return (Lustig et al 2011; Menkhoff et al 2012)
  - Effect small for high capital-control countries

	VIX	VXY
CC_t	-4.54	-4.45
	(-2.55)	(-2.48)
$\Delta \ln Vol_{t+1}$	-0.62	-1.32
	(-5.47)	(-4.94)
$\Delta \ln Vol_{t+1} \times CC_t$	0.24	0.44
	(2.21)	(1.86)

Capital Flow Exposure

- $CF_{i,t+1} = \beta_0 + \beta_1 \overline{CF}_{t+1} + \beta_2 \overline{CF}_{t+1} \times CC_{i,t} + \varepsilon_{i,t+1}$
- Capital control reduces capital flow exposure to the EM capital flow factor (push factor), an average of CF across countries

	EM capital flow
$\overline{CF}_{t+1}$	1.20
	(12.40)
$\overline{CF}_{t+1} \times CC_{i,t}$	-0.34
	(-2.04)

Indebtedness and Currency Mismatch

- $rx_{i,t+1} = \beta_0 + \beta_1 CC_{i,t} + \beta_2 Indebt_{i,t} + \beta_3 Indebt_{i,t} \times CC_{i,t} + \varepsilon_{i,t+1}$
- Capital control effect is concentrated among debtors, not creditors

	Creditor dummy
$CC_{i,t}$	-8.40
	(-3.25)
$Indebt_{i,t}$	-7.71
	(-3.04)
$Indebt_{i,t} \times CC_{i,t}$	11.44
	(3.43)

Case Study: Great Recession and COVID

- $\Delta s_{i,t+1} = \beta_0 + \beta_1 CC_{i,t} + \beta_2 \Delta VIX_{t+1} + \beta_3 \Delta VIX_{t+1} \times CC_{i,t} + \varepsilon_{i,t+1}$
- Capital control reduces global shock exposures during the Great Recession and COVID
- The effect is asymmetric, more pronounced during an increase of VIX

		$\Delta VIX_{t+1} > 5$		$\Delta VIX_{t+1} < -5$	
	full sample	2008	2020	2008	2020
ΔVIX_{t+1}	-18.67	-55.33	-29.55	-16.94	-11.00
	(-10.52)	(-3.85)	(-3.45)	(-0.69)	(-1.20)
$\Delta VIX_{t+1} \times CC_t$	10.28	42.32	14.04	25.80	10.06
	(5.25)	(3.07)	(2.05)	(1.14)	(1.28)

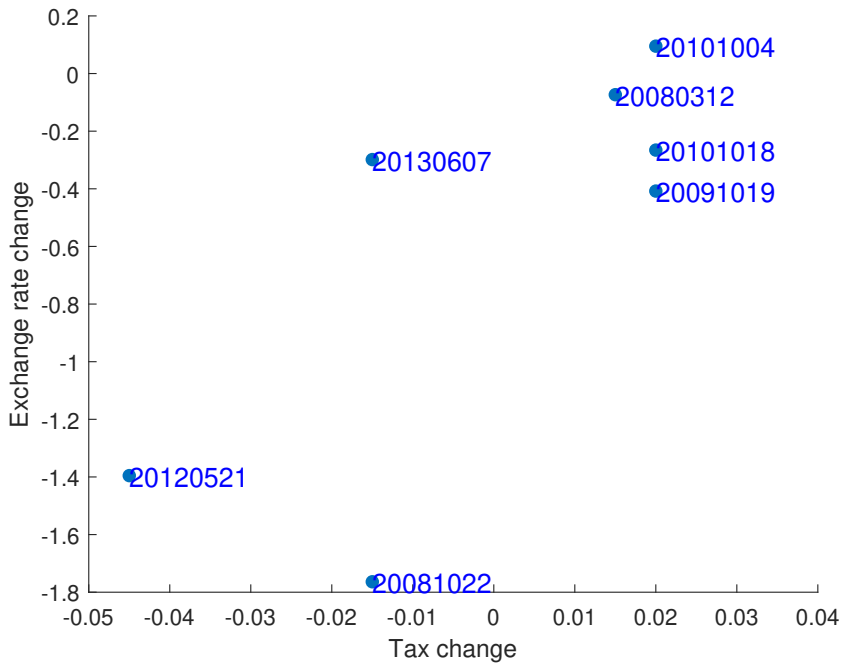
Case Study: Quantified Capital Control Policy Change

- Brazil intensified and loosened capital control policy (tax on foreign capital flow) multiple times from 2007 to 2013 (Alfaro et al, 2017)

Date	Tax rate
2008/03/12	1.50%
2008/10/22	0.00%
2009/10/19	2.00%
2010/10/04	4.00%
2010/10/18	6.00%
2012/05/12	1.50%
2013/06/07	0.00%

Brazil: Capital Control and Exchange Rate

- Exchange rate movements under different tax rates
- When tax rates increase, exchange rate appreciate due to lower risk premium
  - if tax increases are to prevent inflows, exchange rate should depreciate



- Return in high-tax periods smaller than low-tax period (coefficient =-1.64, t = -1.80)

Model: Borrower

- Small open economy, follow Mendoza (2002), Bianchi (2011)
- Rep agents consume tradable and nontradable goods, maximizing expected lifetime utility

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

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- Budget constraint
  - P^N: the price of non-tradable good, or the real exchange rate
  - B_{t+1}: amount of dollar (tradable) bond, interest rate R_t
  - T_t: lump-sum transfer of capital control revenue

$$B_{t+1} + C_t^T + P_t^N C_t^N = B_t R_t + Y_t^T + P_t^N Y_t^N + T_t$$

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- Borrowing constraint
  - Limited by the income level
  - Exchange rate depreciation tightens the constraint

$$B_{t+1} \geq -\kappa(P_t^N Y_t^N + Y_t^T)$$

- $Y_t^N = 1$, Y_t^T exogenous and stochastic

Model: Lender

- Global intermediaries' SDF
  - $\mu_{m,t}$ the conditional mean of SDF, determining risk-free rate
  - y_{t+1}^T: global macro condition
  - Γ_{t+1}: balance sheet cost
  - $\lambda_y, \lambda_\Gamma$: price of risks

$$M_{t+1} = \exp(\mu_{m,t} - \lambda_y y_{t+1}^T - \lambda_\Gamma \log \Gamma_{t+1})$$

- Specification of Γ_t, depending on global financial condition z_t and asset return vol

$$\log \Gamma_t^i = \theta_0 + \theta_1 z_t + \theta_2 \sigma_t(r_{t+1}^i), \log \Gamma_t = \theta_0 + \theta_1 z_t$$

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- Capital control tax τ
- Euler equations

$$E_t\left[M_{t+1} R_t (1-\tau)\right] = 1 + \Gamma_t, E_t\left[M_{t+1} \frac{R_t^* P_{N,t+1}}{P_{N,t}}(1-\tau)\right] = 1 + \Gamma_t^i$$

Currency Dealer and Currency Risk Premia

- Empirically, we use the difference between forward and spot exchange rate to measure currency excess return
  - Offshore, not directly subject to capital controls
- Forward provided by currency dealer, subject to balance sheet cost $1 + \Gamma_t$ and capital control $1 - \tau$

$$1 + \Gamma_t = \frac{F_t R_t^* (1 - \tau)}{P_{N,t} R_t^f}$$

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$$1+\Gamma_t = \frac{F_t R_t^*(1-\tau)}{P_{N,t} R_t^f}$$

- Currency risk premia determination
  - The covariance between SDF and exchange rate movement
  - The relative balance sheet cost for the global intermediary to hold LC bonds, and the currency dealer to provide forward

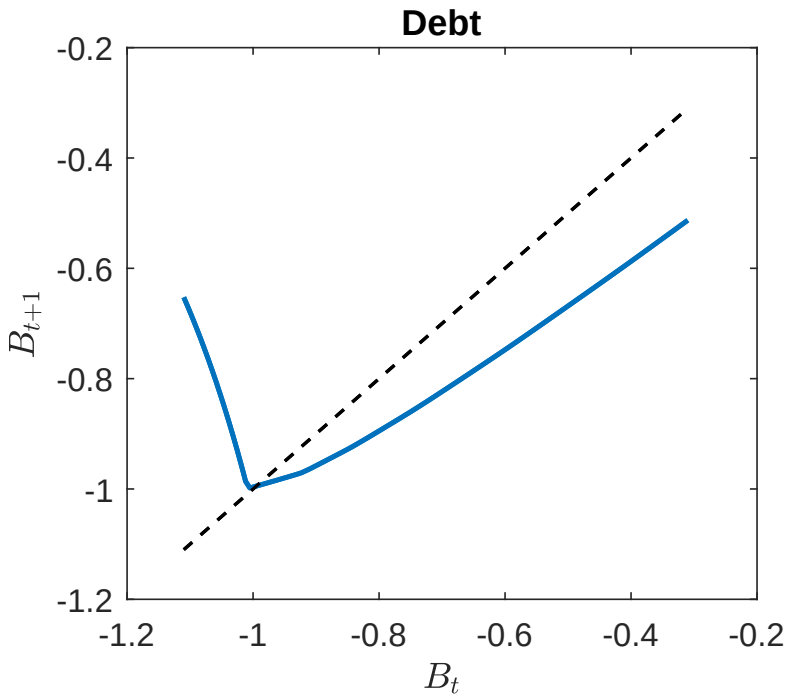
$$E_t\left(\frac{P_{N,t+1}}{F_t}-1\right) = -\frac{1-\tau}{1+\Gamma_t} cov_t\left(M_{t+1}, \frac{P_{N,t+1}}{P_{N,t}} R_t^*\right) + \frac{\Gamma_t^{LC}-\Gamma_t}{1+\Gamma_t}$$

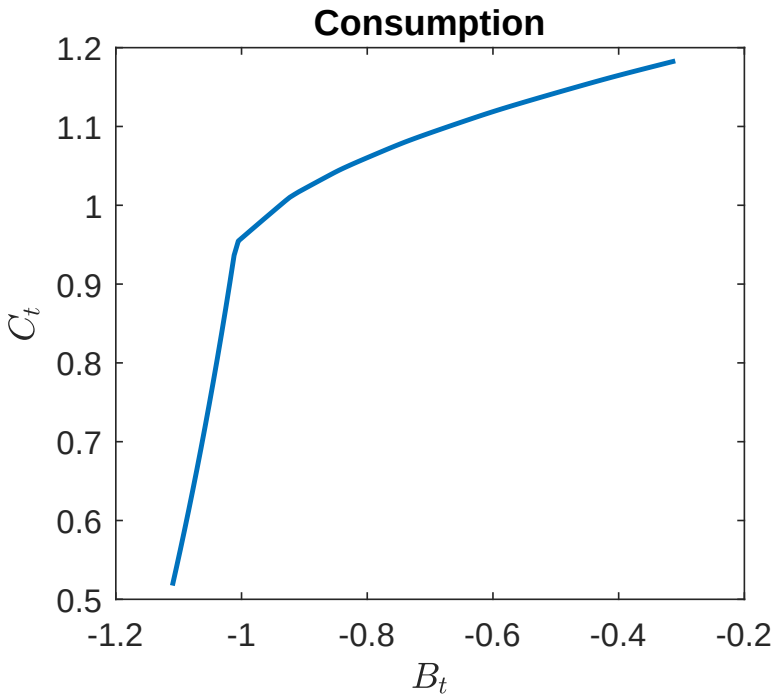
Calibration

- Numerical solution with a global method
- The borrower block follows Bianchi (2011), the intermediary block follows Fang and Liu (2021) and Du, Hebert, and Huber (2022)
  - Capital control: $\tau = 0, 0.04$
  - Price of risk: $\lambda_y = 10, \lambda_\Gamma = -2$
  - Euler equation wedge: $\theta_0 = -4.95, \theta_1 = 0.84, \theta_2 = 4$

Debt and Consumption Decision

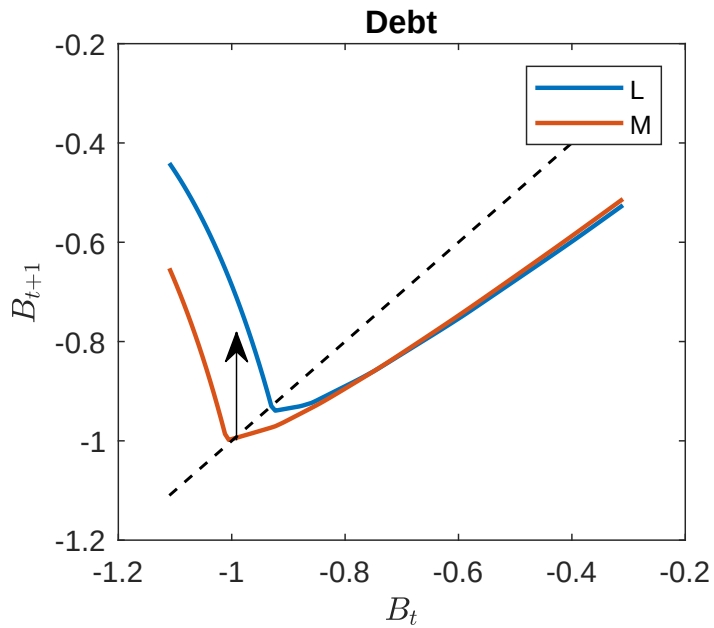
- The constraint binds to the left of the turning point
  - more debt, less consumption
  - if binding, debt and consumption reduced sharply, capital flows out

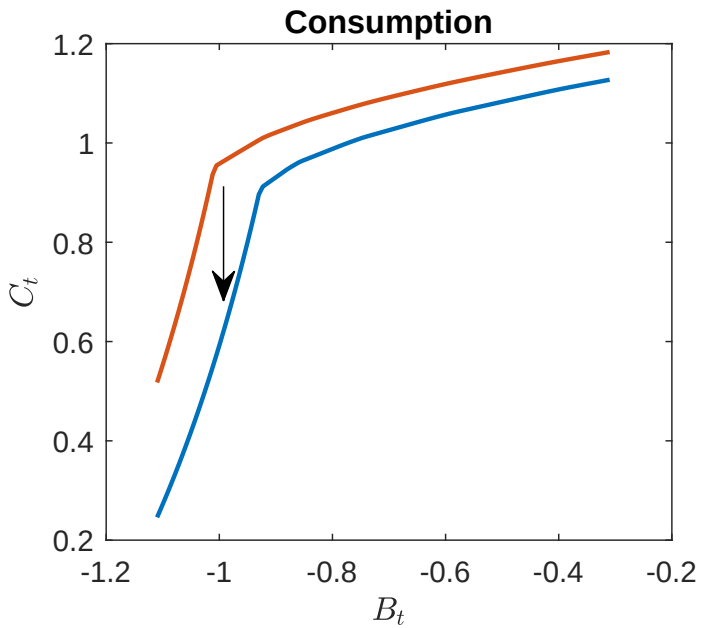




Financial Crises and Sudden Stops

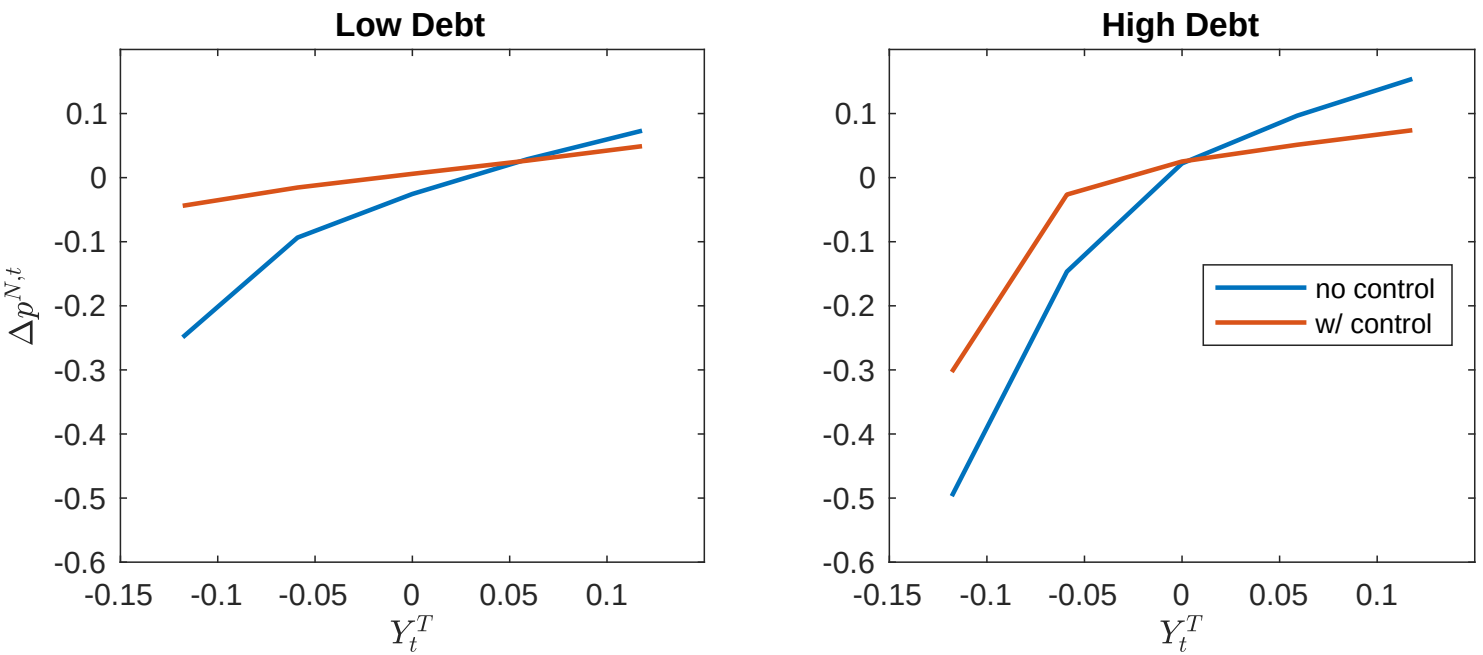
- Financial crises: close to binding + negative shock
  - e.g. from M to L, constraint binds
- Feedback loop: constraint binds, consumption reduced, currency depreciates, constraint further tightens...
- Pecuniary externality: agents do not internalize exchange rate effect on the constraint





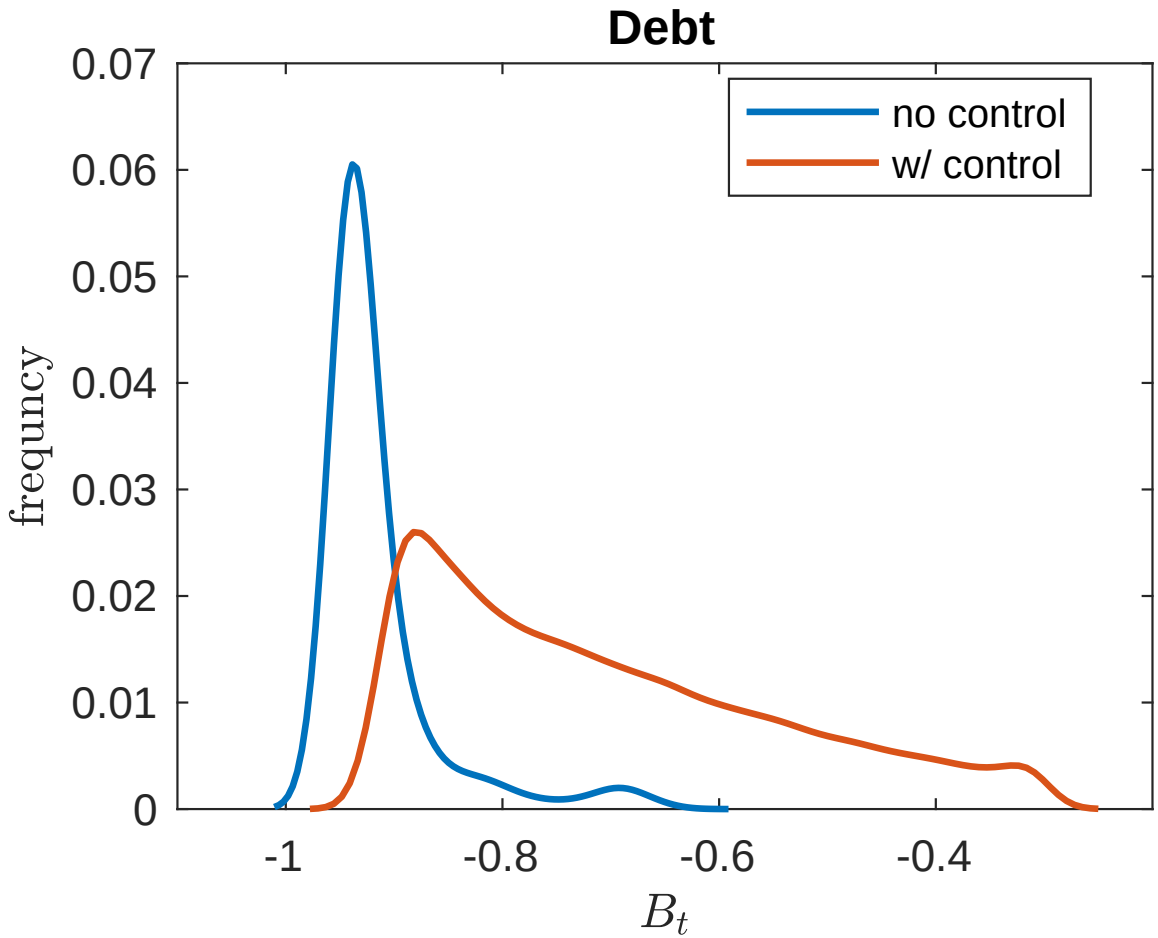
Exchange Rate and Capital Control Policy

- In bad times, investors cut comsumption and the currency depreciates (asymmetric)
  - in high debt states when constraint binds, more sharp currency depreciation
- With capital controls, milder currency depreciation



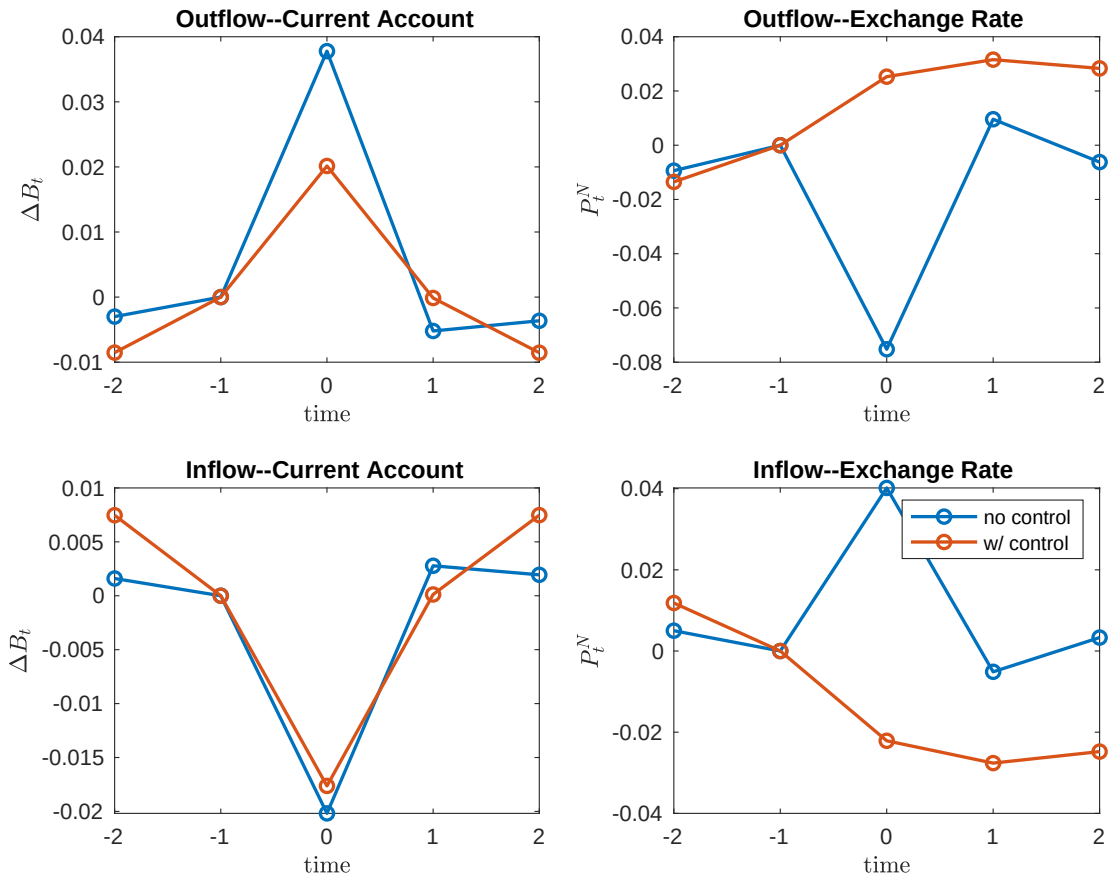
Debt Distribution

- Capital control shifts the distribution of debt to the right



Capital Flow and Exchange Rate: Outflow and Inflow

- Capital control reduces outflows and inflows
- Capital control reduces exchange rate depreciations (appreciation) during outflow (inflow) episodes



Quantitative: Currency Returns

- Currency returns drop with capital controls
  - the spread 3.03% is similar to empirical finding
- Without balance sheet cost in SDF, the macro risk stays important in currency risk premium
  - the spread is 2.52% out of 3.03%
- The model quantifies the financial impact of pecuniary externality from the exchange rate perspective

	benchmark		macro risk		financial risk	
	no control	control	no control	control	no control	control
Ex ret	5.71	2.68	4.91	2.39	5.32	2.59
Diff		-3.03		-2.52		-2.73
Ex ret vol	10.30	3.56	10.57	5.57	10.16	3.52
FD	5.81	2.65	5.03	2.36	5.41	2.56

Conclusion

- New evidence on the effect of capital control from the perspective of currency risk and return
  - Capital controls reduce currency risk premium in EM
  - Not explained by other risk factors or characteristics
  - Concentrated in debtors
  - Capital controls reduce exposures to global risk (asymmetrically)
- A quantitative model that illustrates the mechanism and match the empirical counterparts
  - Ongoing work: welfare effect of reduced risk premia
- New perspective that supports the macroprudential view of capital controls

Capital Controls in China

- Qualified Foreign Institutional Investor (QFII, RQFII)
- Qualified Domestic Institutional Investor (QDII, RQDII)
- Qualified Domestic Limited Partnership (QDLP)
- Qualified Domestic Investment Enterprises (QDIE)
- Enterprise's outbound lending $< 30\%$ of equity
- Financial institutions' overseas RMB lending $< 1\%$ of the RMB deposits
- Overseas direct investment subject to approval
- Financial institutions' foreign currency derivative transactions subject to a 20% unremunerated reserve requirement
- Leverage ratio requirements on external borrowing for enterprises and non-banking institutions

Capital Control Examples

- Brazil: a 2 percent tax on portfolio equity and debt inflows
- Indonesia: a six-month holding period on central bank bonds and a limit on short-term foreign borrowing by banks to 30 percent of capital
- Korea: withholding taxes on interest income and transfer gains from foreigners' treasury and monetary stabilization bond investment
- Peru: 400 basis point fee on nonresident purchases of central bank paper
- Thailand: 15 percent witholding tax on nonresidents' interest earnings and capital gains on new purchases of state bonds

Capital Control Examples

- Argentina: limited bank withdrawals and imposed restrictions on transfers and loans in foreign currency
- Iceland: stop of convertibility of domestic currency accounts for capital transactions
- Malaysia: 12-month waiting period for nonresidents to convert proceeds from the sale of Malaysian securities
- Thailand: limits on forward transactions and introduction of export surrender requirements
- Leverage ratio requirements on external borrowing for enterprises and non-banking institutions