Currency Risk under Capital Controls

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CKGSB

Resurge of Capital Controls

Conventional Wisdom

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

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Dark Side: Financial Stability

- Excessive capital flows carry risks for financial and macro stability
  - Capital inflows generate overheating
  - Capital outflows trigger recessions and financial crises

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Dark Side: Financial Stability

- 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
  - IMF: "There is no presumption that full liberalization is an appropriate goal for all countries at all times"
  - G20 Coherent Conclusion: "Capital flow management measures may constitute part of a broader approach to protect economies from shocks"

Currency Risk under Capital Controls

- Why capital controls? How to control? What are the effects?
- This paper: capital control's effect on currency risk and return

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- Currencies with higher capital controls have lower returns in emerging markets
  - Cannot be explained by existing risk factors or characteristics
- Concentrated in debtor countries
- Capital controls reduce exposures to global risk

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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

Literature

Theory

- Capital controls for pecuniary externality
  - Lorenzoni 2008, Bianchi 2011, Bianchi Mendoza 2018, Korinek 2018, Jeanne and Korinek 2020
- Capital controls for demand externality and terms of trade manipulation
  - Farhi and Werning 2016, Schmitt-Grohé and Uribe 2016, Korinek and Simsek 2016, Costinot, Lorenzoni, and Werning 2014

Empirical

- Increase the cost of capital, lowers stock prices and investments (Forbes 2007, Alfaro, Chari, and Kanczuk 2017)
- Reduces financial vulnerability, bank leverage, credit growth (Forbes, Fratzscher, and Straub 2015)
- Increases resilience during the crisis (Ostry et al 2012)

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

- A capital control is a policy designed to limit transactions on capital account
  - taxes, reserve requirements, quantitative limits and restrictions, prohibitions, authorizations, others
- Capital control index from Fernández et al (2016)
  - Based on IMF's Annual Report on Exchange Rate Arrangements and Restrictions
  - Averaging binary indicators of controls across 10 asset categories, 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

- China 0.96 (sd 0.06)

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 \$

	$P1$	$P2$	$P3$	$P4$	HML
mean	5.39	3.26	2.22	1.29	-4.11
(t-stat)	(3.39)	(1.47)	(1.15)	(1.13)	(-2.78)
SD	7.95	11.11	9.69	5.70	7.39
SR	0.68	0.29	0.23	0.23	-0.56
CC	0.16	0.45	0.67	0.88	0.72

- China 1.11% (sd 10.17%)

Other Characteristics Cannot Explain the Return

- No systematic pattern for other characteristics
- The HML portfolio has very low correlation with each HML portfolio

	$P1$(low cc)	$P2$	$P3$	$P4$(high cc)	HML corr
mean	5.39	3.26	2.22	1.29	
FD	8.48	6.64	6.11	3.89	0.09
NFL	0.02	-0.26	0.35	0.19	-0.08
CDS	1.35	1.97	1.79	2.28	0.34
Bid-ask	0.13	0.22	0.17	0.16	0.12
CIP(abs)	120.08	112.25	64.03	108.61	0.31
Regime	2.67	2.77	2.97	2.42	-0.08
FXI (dummy)	0.17	0.13	0.11	0.14	0.03
FXI (quantity)	0.09	0.12	0.06	0.20	-0.05
FXR	0.18	0.18	0.16	0.22	0.15

The Spread Cannot Be Explained By Existing Risk Factors

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

	*P*1	*P*2	*P*3	*P*4	*HML*
Mean	5.39	3.26	2.22	1.29	-4.11
(t-stat)	(3.39)	(1.47)	(1.15)	(1.13)	(-2.78)
Carry&Dollar	4.58	-1.24	-1.54	-0.37	-4.95
(t-stat)	(4.42)	(-0.86)	(-1.52)	(-0.44)	(-3.51)
Momentum	5.33	3.48	2.34	1.41	-3.92
(t-stat)	(3.34)	(1.57)	(1.21)	(1.24)	(-2.66)
3-Factor	4.48	-1.15	-1.51	-0.33	-4.81
(t-stat)	(4.40)	(-0.80)	(-1.49)	(-0.39)	(-3.47)

Why Capital Control Reduces EM Currency Risk Premia?

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

Why Capital Control Reduces EM Currency Risk Premia?

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- Empirical predictions on capital control effect
  - Reduce currency exposure to global risks
  - Pronounced in debtors and countries with strong currency mismatch

Risk Exposure

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

	VIX	VXY
CC_t	-4.96	-4.87
	(-2.93)	(-2.83)
ΔVol_{t+1}	-3.12	-12.06
	(-6.19)	(-5.82)
$\Delta Vol_{t+1} \times CC_t$	1.29	4.22
	(2.97)	(2.42)

Indebtedness and Currency Mismatch

- Capital control effect is concentrated
  - among debtors ($NFL > 0$)
  - among countries with liabilities in foreign currencies (L^{FC})

	rx_{t+1}			
CC_t	-5.04	2.64	CC_t	-7.72
	(-2.80)	(1.10)		(-2.71)
NFL_t		8.45	L_t^{FC}	0.51
		(3.41)		(2.71)
$NFL_t \times CC_t$		-11.63	$L_t^{FC} \times CC_t$	-0.70
		(-3.59)		(-3.24)
			L_t^{DC}	0.13
				(0.68)
			$L_t^{DC} \times CC_t$	-0.41
				(-1.87)

Endogenous Policy Response

- The curent measure is the lagged capital control; government is unlikely to respond to expected exchange rate change
- Lagged three year control
- Unconditional sort with first three year control
- Panel regression conditioning on the joint behavior of Δcc and Δs
  - e.g. increase control when inflow triggers appreciation $\Delta cc > 0,\ \Delta s > 0$

$\Delta cc = 0$	$\Delta cc > 0,\ \Delta s > 0$	$\Delta cc < 0,\ \Delta s > 0$	$\Delta cc < 0,\ \Delta s < 0$	$\Delta cc > 0,\ \Delta s < 0$
-5.31	-4.53	6.01	9.03	-2.65
(-2.66)	(-0.74)	(1.16)	(1.42)	(-0.34)

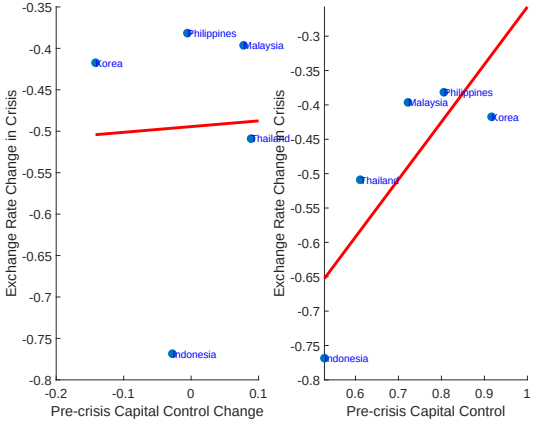
Case Study: Great Recession and COVID

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

	Full Sample	$\Delta VIX_{t+1} > 5$		$\Delta VIX_{t+1} < -5$	
		GFC	Covid	GFC	Covid
CC_t	-2.75	-96.58	-81.37	159.71	26.82
	(-1.28)	(-0.70)	(-1.15)	(0.66)	(0.22)
ΔVIX_{t+1}	-19.83	-56.76	-29.86	-16.40	-12.74
	(-10.42)	(-3.82)	(-3.37)	(-0.67)	(-1.21)
$\Delta VIX_{t+1} \times CC_t$	10.77	43.32	14.24	25.49	11.99
	(4.84)	(2.86)	(2.01)	(1.14)	(1.31)

Case Study: Asian Financial Crises

- Higher pre-crises capital control is associated with smaller depreciation
- Capital control change is not related to deprecation



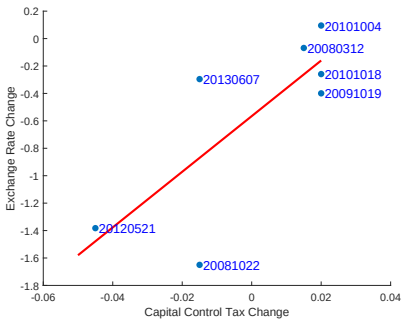
Case Study: Quantified Capital Control Policy Change

- 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%

Case Study: Quantified Capital Control Policy Change

- Exchange rate movements under different tax rates
- When tax rates increase, exchange rates 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)

Other Empirical Results

- Advanced economy: no significant return difference between more and less controlled portfolios
- Controls on inflow and outflow are highly correlated (0.79) and have similar effects
- Controls on asset categories with significant effects: equity, bonds, money market instruments, collective investment securities, deriatives, financial credits, real estate
- Control on asset categories with insignificant effects: direct investment, commercial credits, guarantees

Theory: Capital Controls Prevent Currency Crashes in Financial Crises

- Incomplete market
- Financial constraint: debt is constraint by income, positively related to exchange rate

Macro Sudden stops (SS) and financial crises

- Constraint binds, consumption drops, capital flows out, currency depreciates
- Feedback loop: constraint further tightens
- Pecuniary externality and market inefficiency
- Capital controls reduce overborrowing and probability of sudden stop

Finance Currency risk premium

- Currency depreciates in bad times
- Capitol controls reduce the depreciation and thus the expected return

Model: Borrower

- Based on Mendoza (2002), Bianchi (2011)
- A small open economy
- Representative agents consume tradable and nontradable goods

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

- Y_t^T: tradable endowment follows AR(1)
- Y_t^N: nontradable endowment is 1

Optimization Problem

$$E_0 \sum_{t=0}^{\infty} \beta^t u(C_t)$$

$$s.t. : B_{t+1} + C_t^T + P_t^N C_t^N = B_t R_t (1 + \tau_t) + Y_t^T + P_t^N Y_t^N + T_t$$

- 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
- τ_t: international borrowing subject to a capital control tax
- T_t: lump-sum transfer of capital control revenue

Financial Constraint

- Borrowing subject to financial constraint ($B < 0$)

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

- Limited by the income level
- Low exchange rate tightens the constraint
- κ_t could change with global financial condition

Optimality Conditions

- Euler Equation

$$1 = E_t\left[\beta \frac{u_{T,t+1}}{u_{T,t}} R_t(1+\tau_t)\right] + \mu_t$$

  - If slack ($\mu_t = 0$), debt and consumption are determined by the Euler Equation
  - If binding ($\mu_t > 0$), debt and consumption are determined by the constraint

- Exchange rate

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

  - Currency appreciates when tradable consumption increases

Model: Lender

- Global intermediaries' SDF
  - y_{t+1}^T: global macro condition
  - κ_{t+1}: global financial condition
  - $\lambda_y, \lambda_\kappa$: price of risks

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

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- Euler equations

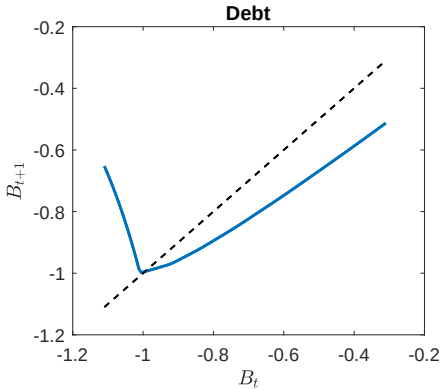
$$E_t\left[M_{t+1} R_t\right] = 1, E_t\left[M_{t+1} \frac{R_t^* P_{N,t+1}}{P_{N,t}}\right] = 1$$

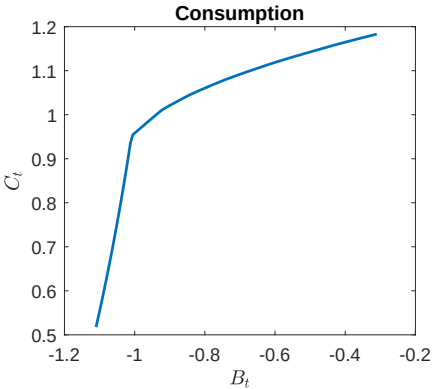
Calibration

- 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: $\lambda_y = 8, \lambda_\kappa = -48$

Debt and Consumption Decision

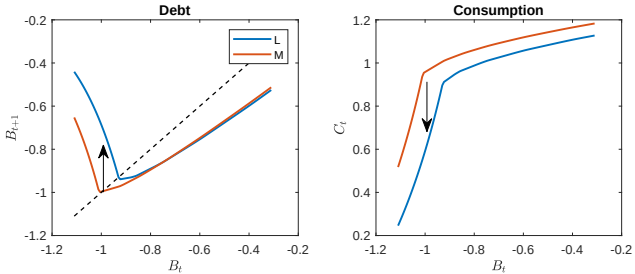
- The constraint binds to the left of the turning point
  - more debt, less consumption
  - if binding, debt and consumption reduced sharply, capital flows out





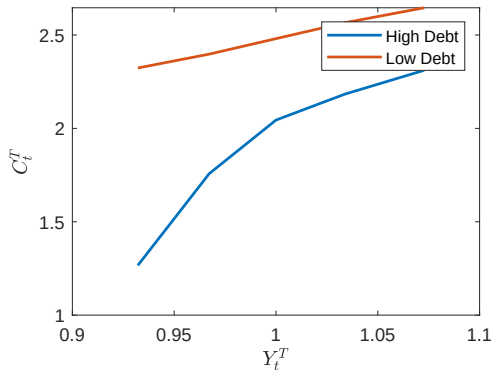
Financial Crises and Sudden Stops

- 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 asset price effect on the constraint
- Asymmetric effect: only negative shocks trigger the constraint



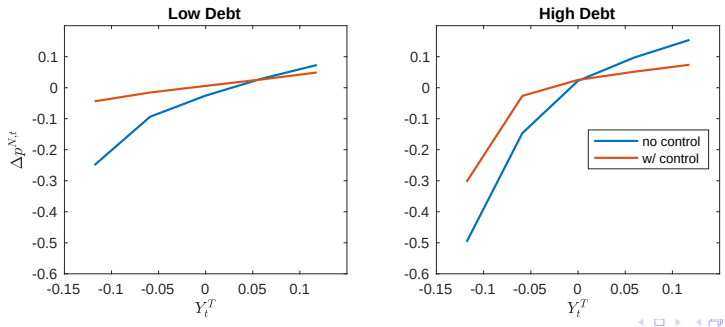
Asymmetric Consumption Policy

- Consumption is lower in high-debt states
- Consumption beta is small and symmetric in low-debt states
- Consumption beta is larger and asymmetric in high-debt states



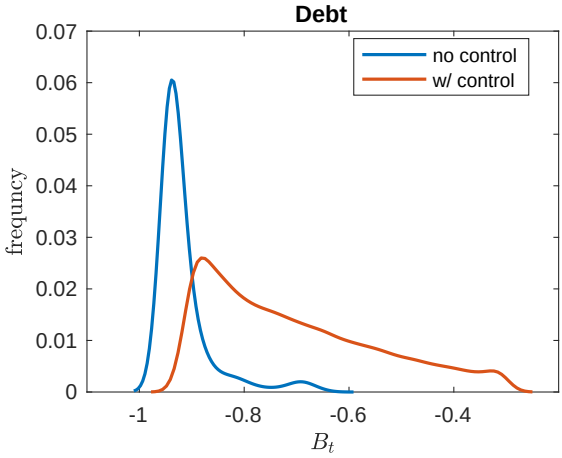
Exchange Rate and Capital Control Policy

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



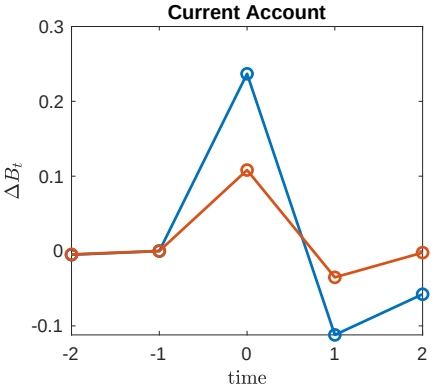
Debt Distribution

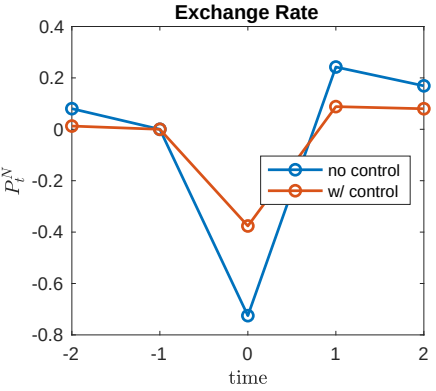
- Capital control shifts the distribution of debt to the right



Currency Crashes in Financial Crises

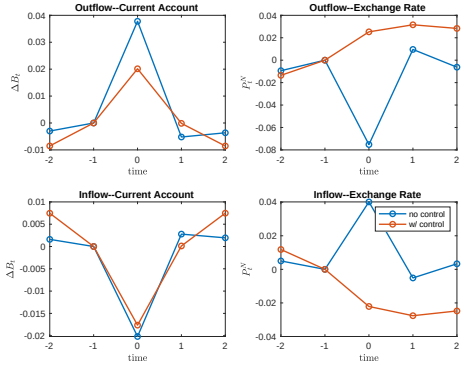
- Definition of a crisis: constraint binding & 2 s.d. CA
- Even upon crises, capital controls reduce currency crashes and large capital outflows





Capital Flow and Exchange Rate

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



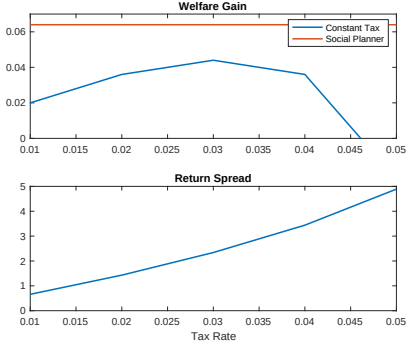
Quantitative: Currency Returns

- Currency returns drop with capital controls
  - the spread 3.45% is similar to empirical finding
  - macro risk and financial risk both important

	benchmark		macro risk	
	no control	control	no control	control
Excess return	6.74	3.30	3.48	1.90
Diff		3.45		1.58
Excess return vol	11.14	6.48	10.26	5.92
Crises frequency	4.07	1.25	4.07	1.25

Quantitative: Welfare Analysis

- Welfare gain from imposing a constant tax rate peaks around 0.03
- Social planner imposes state contingent tax and internalize the externality
- Use currency return to assess policy welfare: the optimal policy implies 2.5%
- The model quantifies the financial impact of non-pecuniary externality



Model Summary

- Currency return decreases with capital controls
  - debtors
  - currency mismatch
- Capital controls reduce risk exposure
  - asymmetric effect
- Capital controls reduce risk premium
  - both macro and financial risk
- Welfare analysis
  - assess policy using currency returns

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
- 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