Capital Controls, Monetary Policy, and Sudden Stops

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Macroeconomic Policy for Emerging Economies

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- Booms in asset prices appreciating currency, followed by "Sudden Stops", crashes and depreciation

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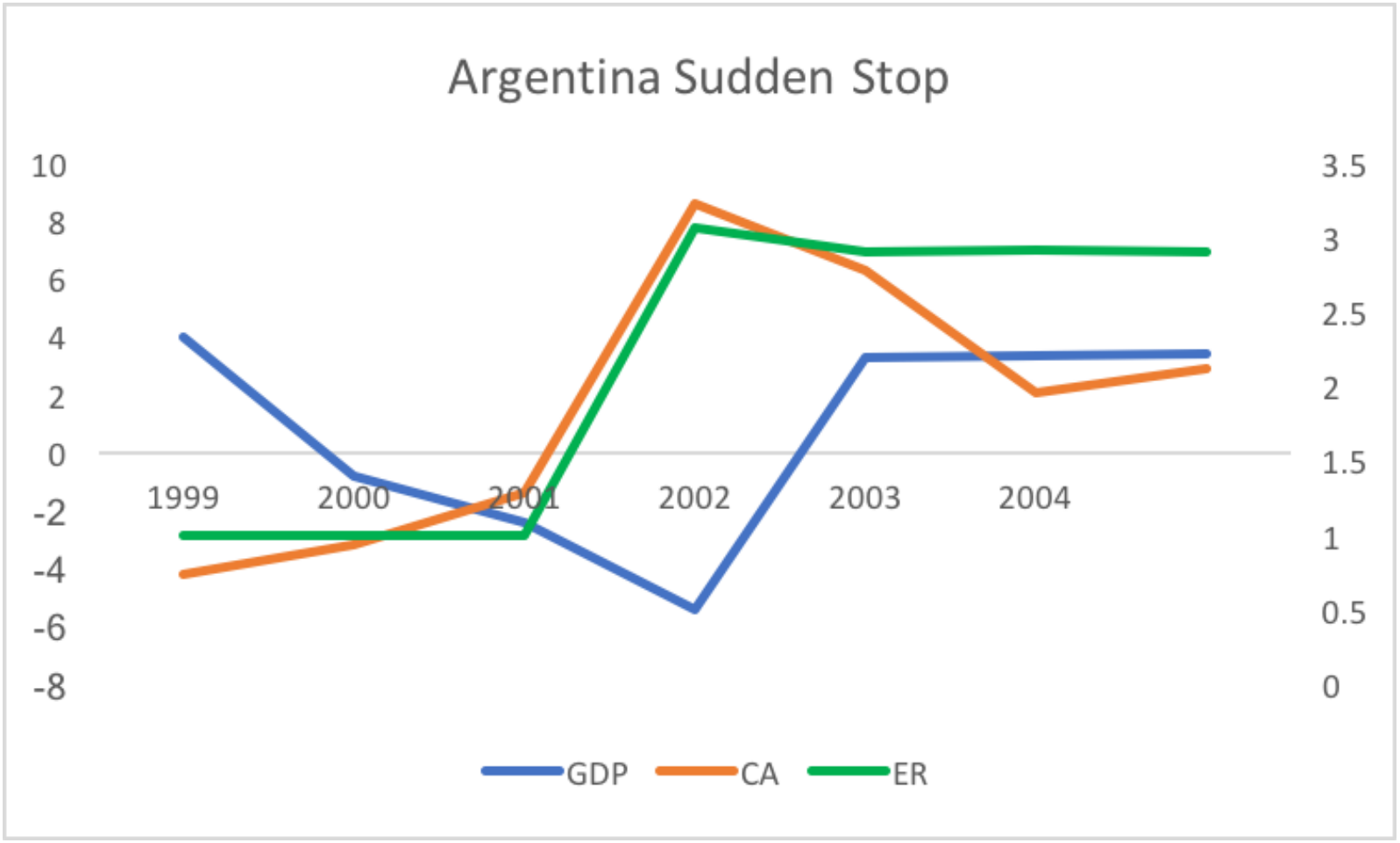
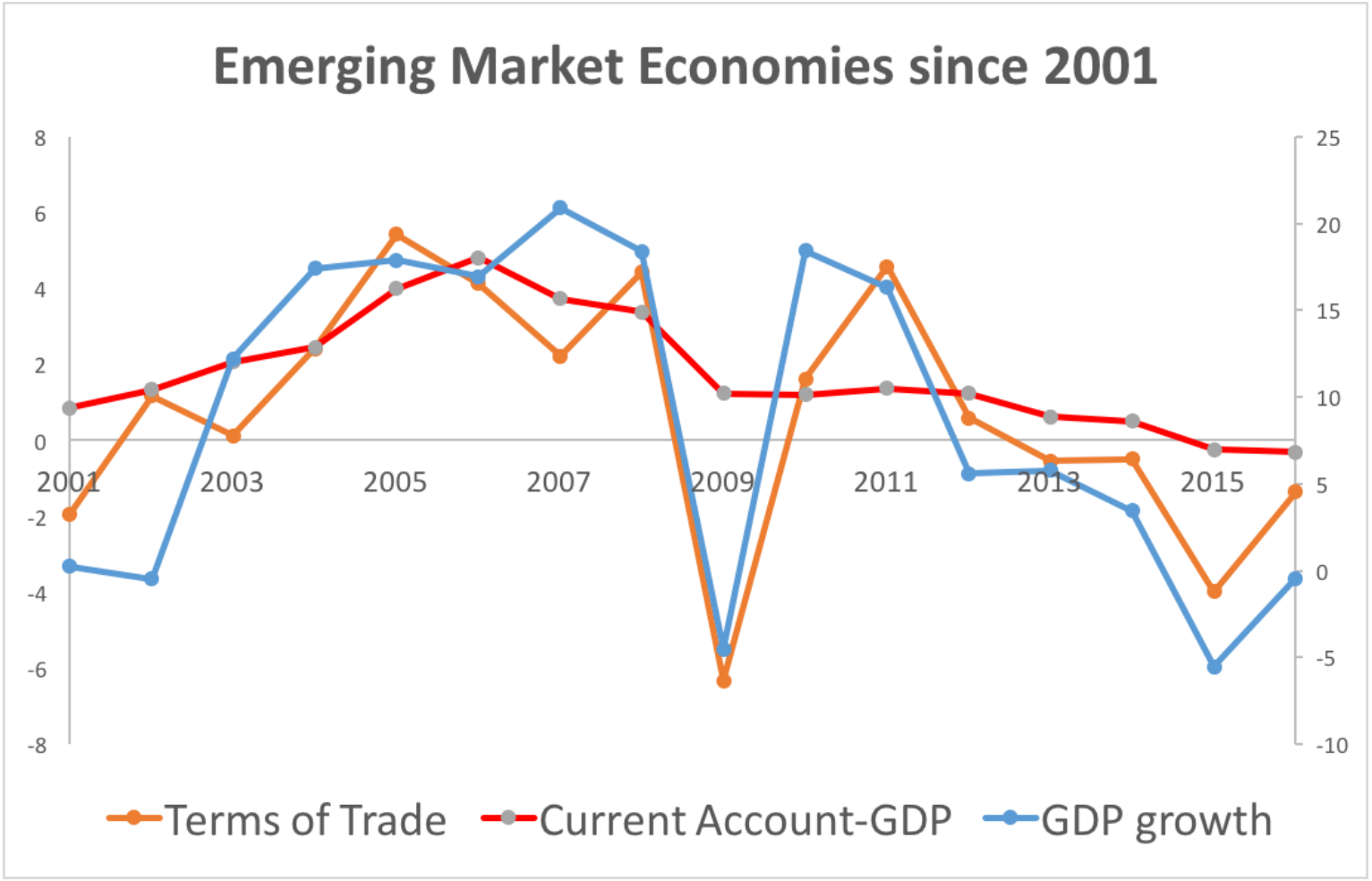
  - Classic Case is a) sharp fall in GDP, b) big reversal of CA, c) large ER depreciation

Argentina 2001 case



- Source: WDI

Experience of EME's pre and post GFC has been similar



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Policy for EMEs

- Independent monetary policy and flexible exchange rates not necessarily a solution
  - Policy 'dilemma' - policy effectiveness or open capital markets, not both
  - Need to supplement flexible exchange rates with capital market intervention?

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  - Need to supplement flexible exchange rates with capital market intervention?
- Complete closure of capital markets unrealistic for most EMEs
  - But selective capital controls may be needed?
  - New 'orthodoxy' calls for combination of capital controls and monetary policy

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- Yes..
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This paper

- Small open-economy DSGE model
  - Financial frictions
  - Sudden stops associated with occasionally-binding credit constraints
  - Sticky nominal prices
- Use this to conduct a normative analysis of optimal monetary policy and capital controls

Dual roles for economic policies

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Preview of results

- Monetary policy: Price stability in normal times, inflation during a crisis
- Capital controls: capital inflow tax in a crisis
  - Capital controls substitutes for an active monetary policy
  - But, capital controls suffer from severe problem of time consistency
- No role for 'macro-prudential' policy

Related literature: Theory

- Sudden Stop Crises and Macro-prudential Policy
  - Mendoza (2010), Mendoza and Yue (2010)
  - Bianchi (2011), Bianchi and Mendoza (2013), Jeanne and Korinek (2010), Benigno et al. (2013), Stein (2012), Devereux Yu (2016, 17)
- Aggregate demand externalities, exchange rate pegs
  - Farhi and Werning (2012, 2014, 2015), Korinek and Simsek (2014)
- Monetary policy
  - Fornaro (2015), Schmitt-Grohe and Uribe (2015), Davis and Presno (2015), Ottonello (2015) Liu and Spiegel (2015)
- Monetary stability vs. financial stability
  - Limited interaction: i.e., Collard, Dellas, Diba and Loisel (2013)
  - Leaning against growing financial imbalances, but secondary in monetary policy, i.e., Borio and Lowe (2002); Woodford (2012)
  - Financial stability is price stability: i.e., Brunnermeier and Sannikov (2012)

The model

- Wholesale good production
  - Imported intermediate goods, hire labor and rent capital
- Final good production
  - Use wholesale goods to produce varieties of consumption goods (sticky prices)
- Consumption composite
  - Domestically consumed or exported
- Firm-households
  - Own all domestic firms, make consumption-saving decisions
  - Accumulate capital (in aggregate fixed supply)
  - Supply labor
  - Borrow in dollars from the rest of the world
  - Face borrowing constraints (expected value of capital is collateral)

Budget Constraint

$$P_t c_t + Q_t k_{t+1} + \frac{B_{t+1}}{R_{t+1}} + \frac{B^*_{t+1}\mathcal{E}_t}{R^*_{t+1}}(1-\tau_{c,t})$$

$$\leq W_t l_t + k_t(R_{K,t}+Q_t) + B_t + B^*_t\mathcal{E}_t + T_t$$

$$+\left[P_{M,t}M(Y_{F,t},L_t,K_t) - (1+\tau_N)Y_{F,t}P^*_{F,t}\mathcal{E}_t - W_t L_t - R_{K,t}K_t\right]+D_t.$$

Collateral constraint

$$\vartheta Y_{F,t}P^*_{F,t}(1+\tau_N) - B^*_{t+1} \leq \kappa_t E_t \left\{\frac{Q_{t+1}k_{t+1}}{\mathcal{E}_{t+1}}\right\}$$

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- Two kinds of borrowing
  - Inter-temporal borrowing
  - A-temporal working capital loans
- Future expected capital price limits borrowing capacity

Optimal monetary policy under discretion

- Policy maker maximizes the representative household's welfare
- Policy instrument: nominal interest rate R_{t+1}

$$V(b_t^*, Z_t) = \max_{\{\Xi\}} \left\{ U(C_t, L_t) + \beta E_t V\left(b_{t+1}^*, Z_{t+1}\right) \right\}$$

with

$$\Xi \equiv \{L_t, C_t, Y_t, Y_{F,t}, b_{t+1}^*, q_t, \mu_t, r_{K,t}, e_t, p_{M,t}, \pi_t\}$$

- subject to implementability constraints
- Key feature is no commitment - government takes future policy functions as given

Theoretical results

- Absent collateral constraints, price stability is optimal
- Implication - active monetary policy used only due to presence of financial frictions

Proposition 1

- Without working capital in the collateral constraint, $\vartheta = 0$, the optimal monetary policy strictly stabilizes inflation $\pi_t = \pi$.

Intuition: Monetary policy to correct pecuniary externalities

Planner

$$1 = \lambda_t R^*_{t+1}(1 + \kappa_t \frac{\partial(q_{t+1}/e_{t+1})}{\partial b^*_{t+1}}) + E_t \left\{ \beta \frac{U_c(t+1)}{U_c(t)} \frac{e_{t+1}}{e_t} R^*_{t+1} \right\}$$

Private sector

$$1 = \mu_t R^*_{t+1} + E_t \left\{ \beta \frac{U_c(t+1)}{U_c(t)} \frac{e_{t+1}}{e_t} R^*_{t+1} \right\},$$

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- When $\mu > 0$, want to raise b^*_{t+1} to raise q_{t+1}.
- But without working capital cannot do this

$$-b^*_{t+1} \leq \kappa_t E_t \left\{ \frac{q_{t+1}}{e_{t+1}} (b^*_{t+1}) k_{t+1} \right\}$$

Proposition 2

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  - *No macro-prudential role for monetary policy*

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- Intuition: Planner/Household Euler equations identical

$$1 = E_t \left\{ \beta \frac{U_c(t+1)}{U_c(t)} \frac{e_{t+1}}{e_t} R^*_{t+1} \right\}$$

  - *Does not depend on* $E_t \mu_{t+1}$
  - Therefore, no pecuniary externality to correct

Optimal monetary and capital control policy

- Policy instruments: R_{t+1} and 'capital control' $\tau_{c,t}$

$$V(b_t^*, Z_t) = \max_{\{\Xi\}} \left\{ U(C_t, L_t) + \beta E_t V\left(b_{t+1}^*, Z_{t+1}\right) \right\}$$

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- Subject to implementability constraints
- Optimal capital control
- Omit foreign bond Euler equation from the set of constraints

Proposition 3

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a) The optimal monetary policy strictly stabilizes inflation $\pi_t = \pi$,
b) The capital inflow tax satisfies,

$$\tau_{c,t} \equiv \frac{\mu_t R^*_{t+1}}{\rho} \left[-1 + (\rho - 1)\kappa_t \frac{\partial(q_{t+1}/e_{t+1})}{\partial b^*_{t+1}} \right],$$

Impose a capital inflow tax when constraint is binding

Intuition

- Part a) depart from $\pi_t = \pi$ only to influence b^*_{t+1} through working capital
- But capital inflow tax is perfect substitute for monetary policy

Intuition

- Part b) Private Euler equation

$$1 - \tau_{c,t} = E_t \left\{ \beta \frac{U_c(t+1)}{U_c(t)} \frac{e_{t+1}}{e_t} R^*_{t+1} \right\} + \mu_t R^*_{t+1}$$

- Planner Euler equation

$$1 = E_t \left\{ \beta \frac{U_c(t+1)}{U_c(t)} \frac{e_{t+1}}{e_t} R^*_{t+1} \right\} + \lambda_t (1 + \kappa_t \frac{\partial (q_{t+1}/e_{t+1})}{\partial b^*_{t+1}})$$

- Tax corrects the pecuniary externality

Comments

- When constraint binds, planner corrects pecuniary externality through capital inflow tax - correct private sector's 'over-borrowing'
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- When constraint doesn't bind, no gain from capital inflow tax
- With *both* wage and price rigidities, capital controls do not fully substitute for monetary policy

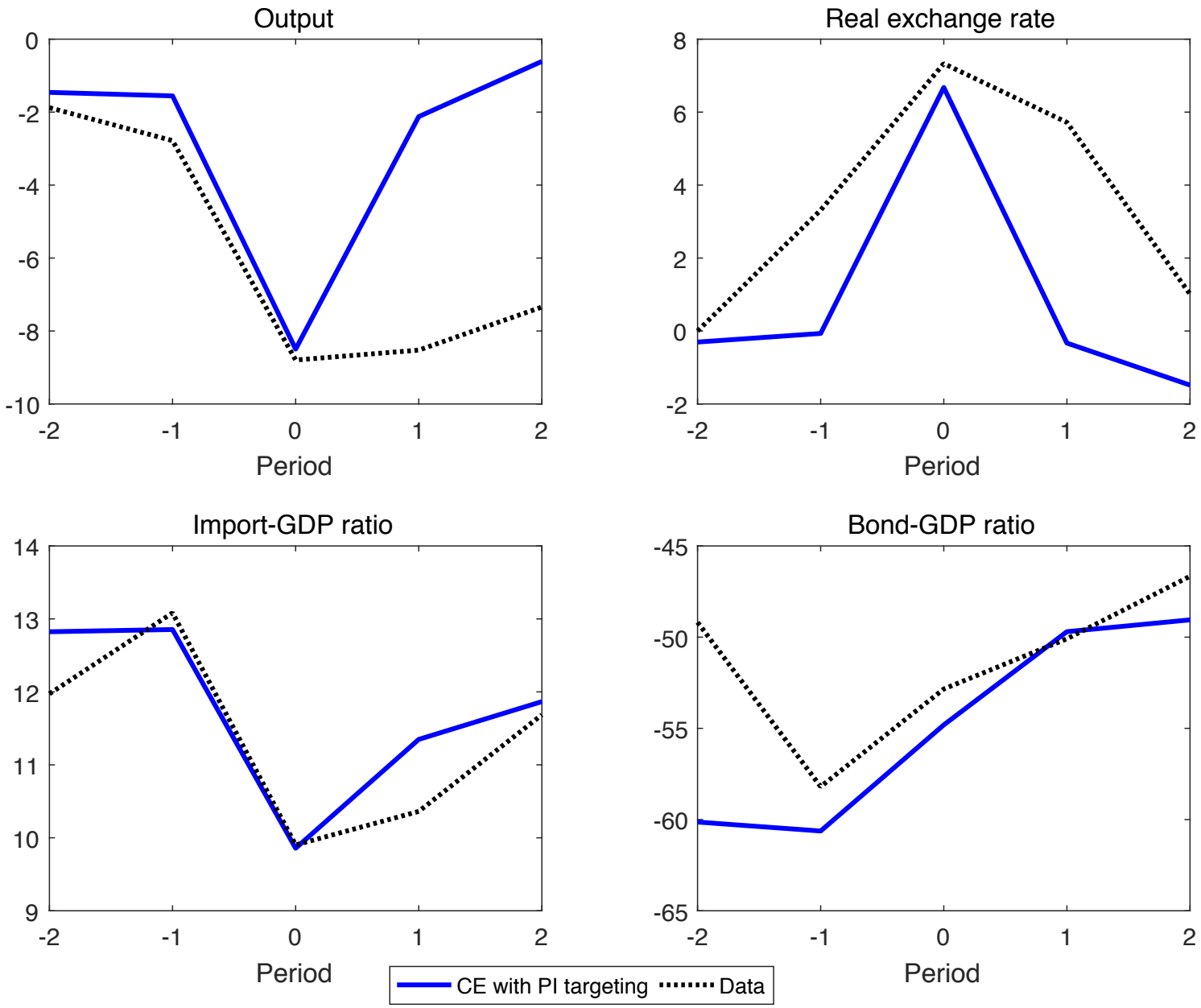
Quantitative evaluation

Data sample: 26 emerging market economies during 1980-2014

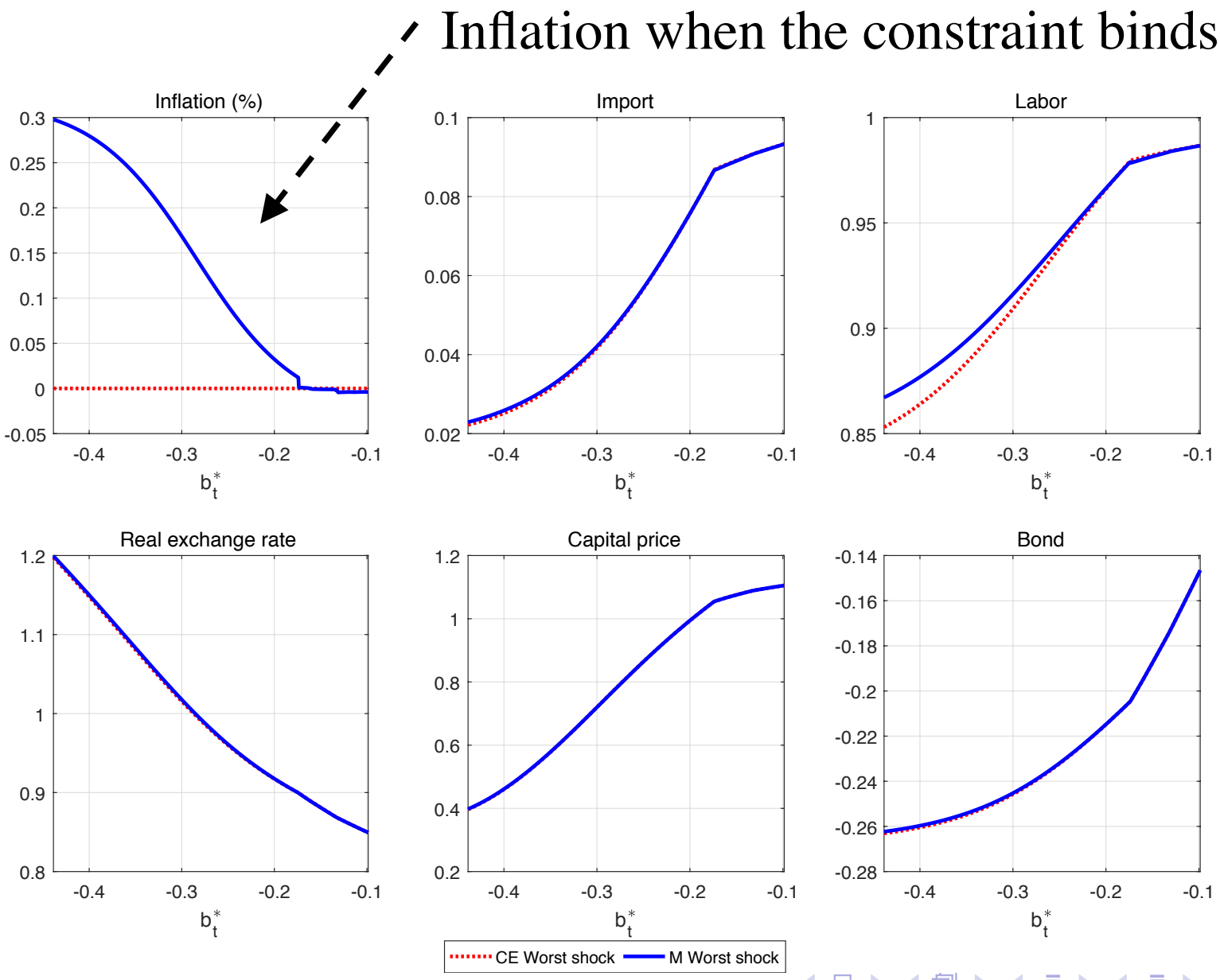
Table: Parameter values

Parameter		Values
Preference		
β	Subjective discount factor	0.90
σ	Relative risk aversion	2
ν	Inverse of Frisch labor supply elasticity	1
Production		
α_F	Intermediate input share in production	0.145
α_L	Labor share in production	0.57
α_K	Capital share in production	0.14
ϑ	Share of working capital	1.4
ϕ_P	Price adjustment cost	76
γ	Asymmetry of price adjustment cost	-100
θ	Elasticity of substitution among varieties	10
ρ	Trade elasticity of substitution	5
Shocks		
ρ_A	Persistence of TFP shocks	0.60
σ_A	Standard deviation of TFP shocks	0.0295
ρ_R	Persistence of foreign interest rate shocks	0.42
σ_R	Standard deviation of foreign interest rate shocks	0.0133
$p_{H,H}$	Transitional probability of high leverage to high leverage	0.9722
$p_{L,L}$	Transitional probability of low leverage to low leverage	0.7323

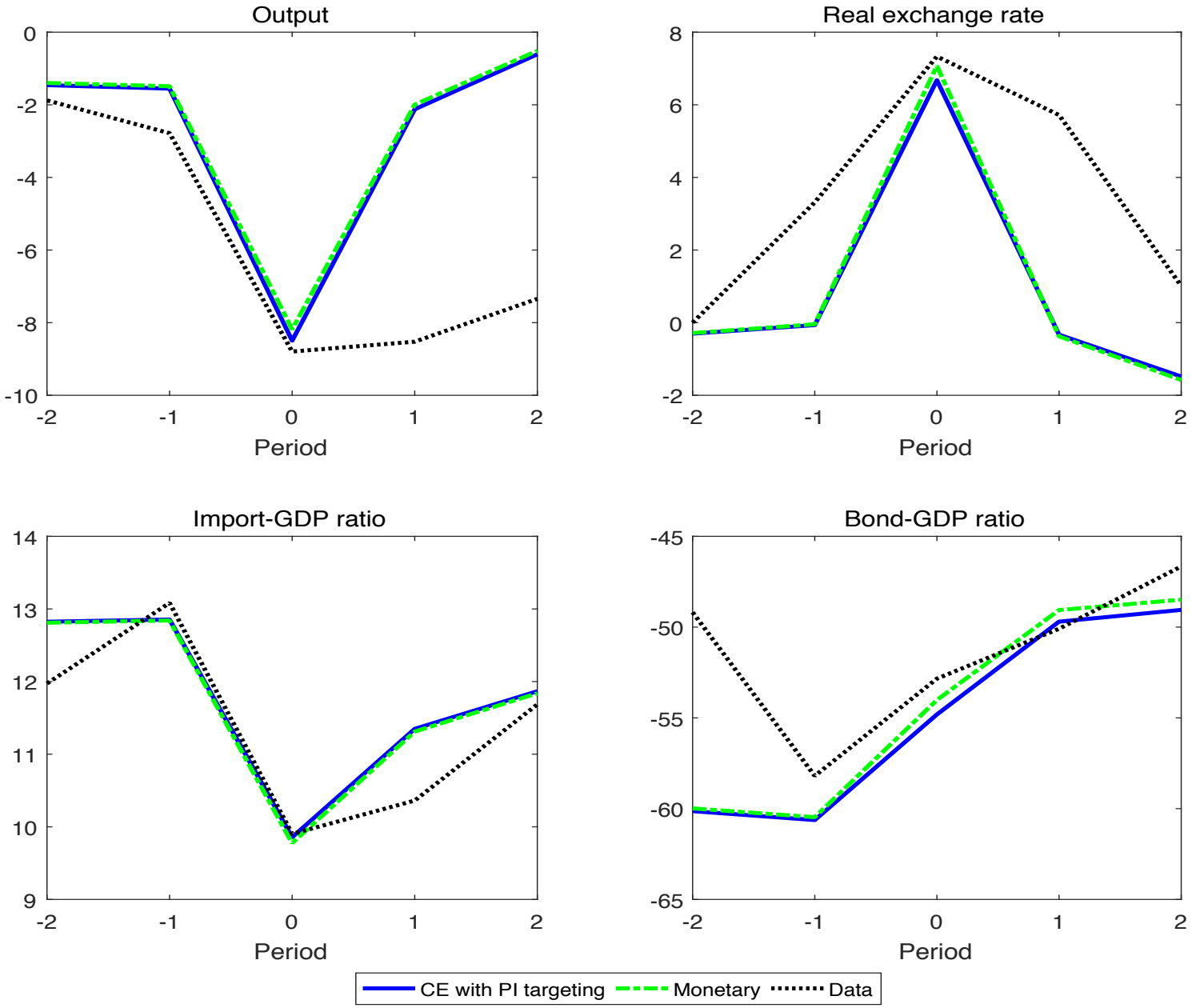
Crisis 'event': CC binds at $t = 0$ Policy=price stability



Optimal monetary policy



Event analysis: CE vs. optimal monetary policy



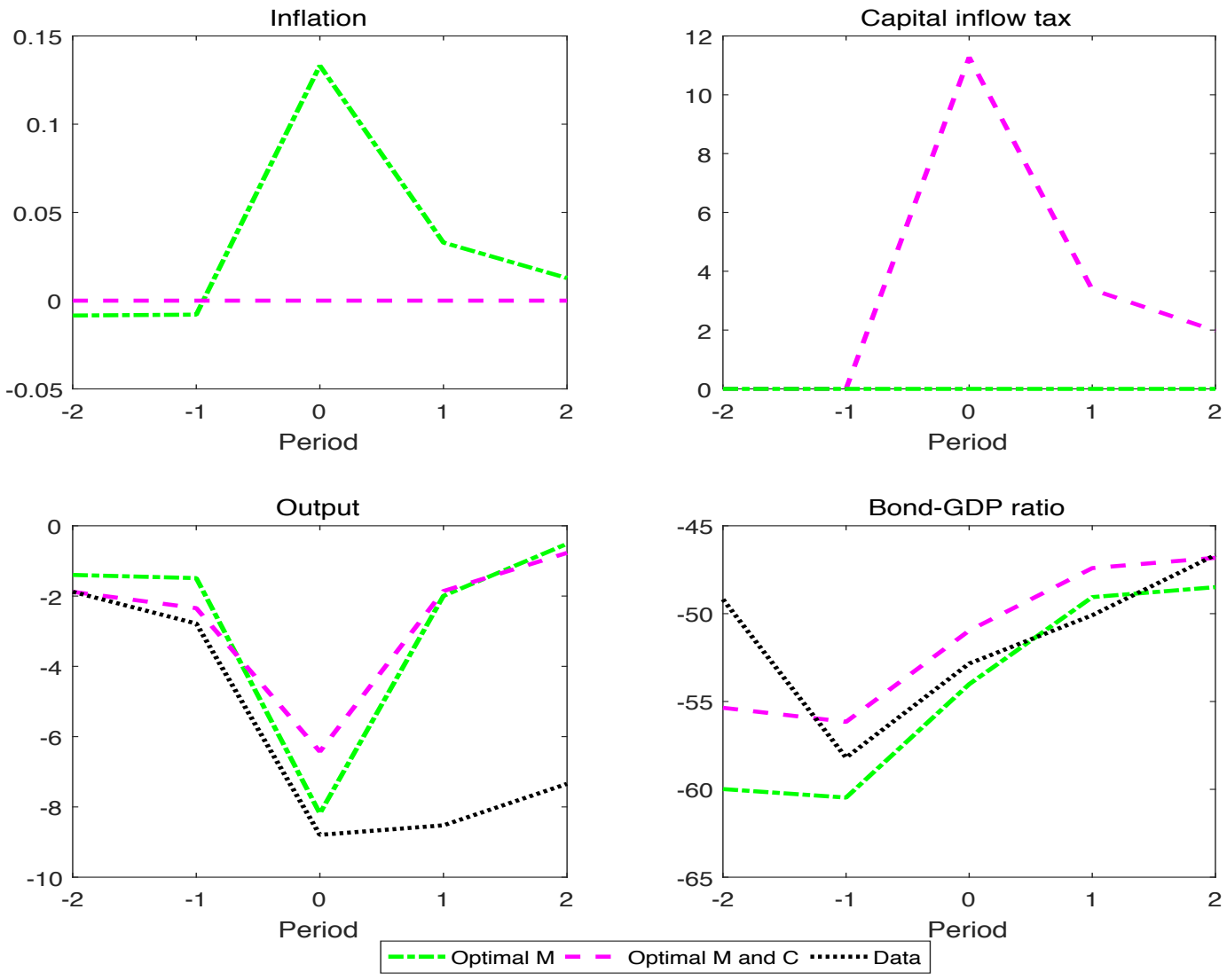
Key findings

- Outside of crises , price stability is optimal
  - No macro-prudential interest rate activity
- During crisis (when $\mu_t > 0$) generate inflation
- But has only small effect on real economy
- Small effects on q or b^*

Now allow for capital Controls

- When $\mu_t > 0$, policy maker imposes capital inflow tax?
- In baseline calibration, this raises $E_t \frac{q_{t+1}}{e_{t+1}}$, relaxes constraint

Optimal monetary vs. monetary & capital control policies

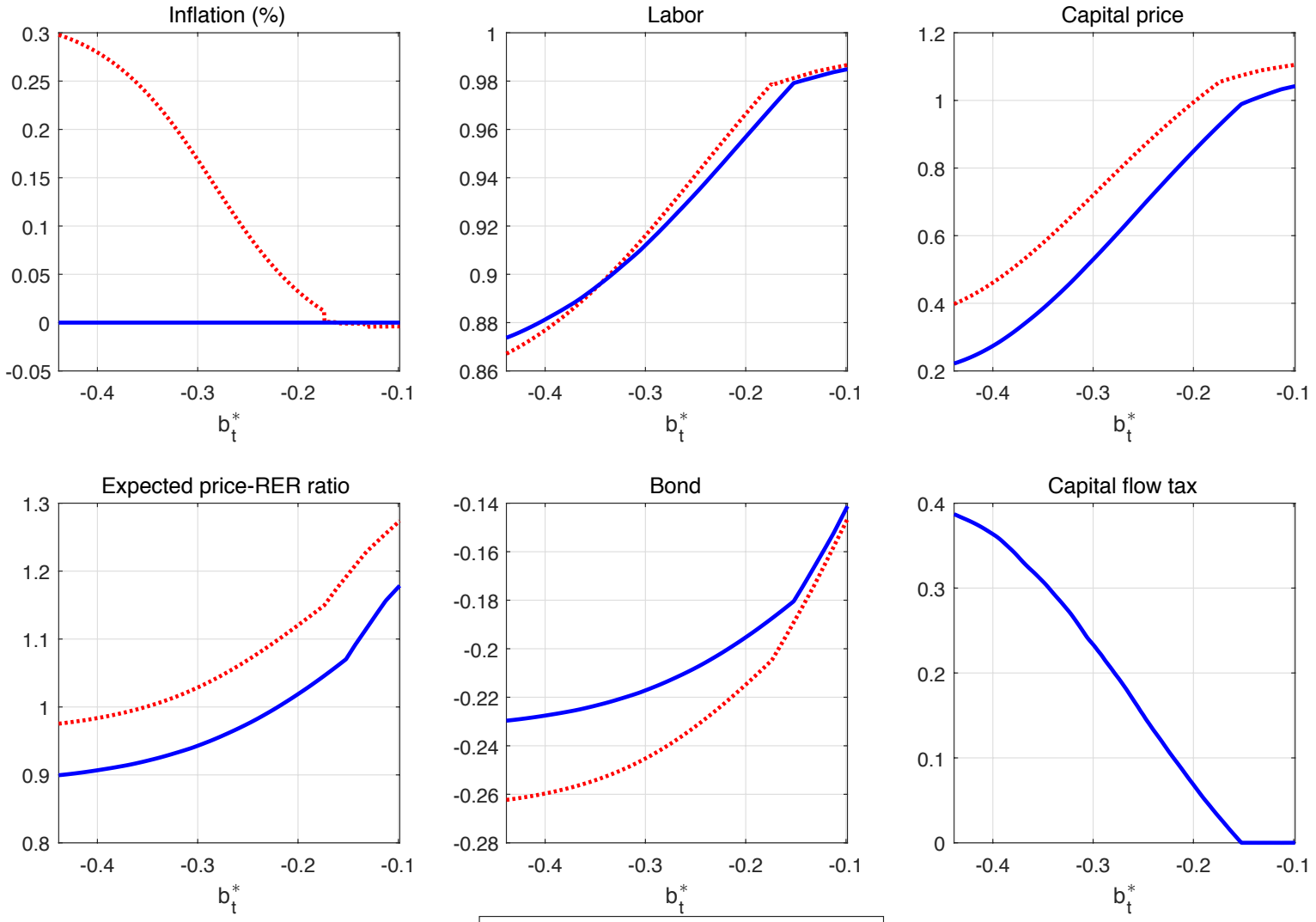


Capital inflow taxes reduce the fall in output during a crisis

- By reducing borrowing, relax the credit constraint
- But in a time-consistent equilibrium, borrowing turns out to be inefficiently low

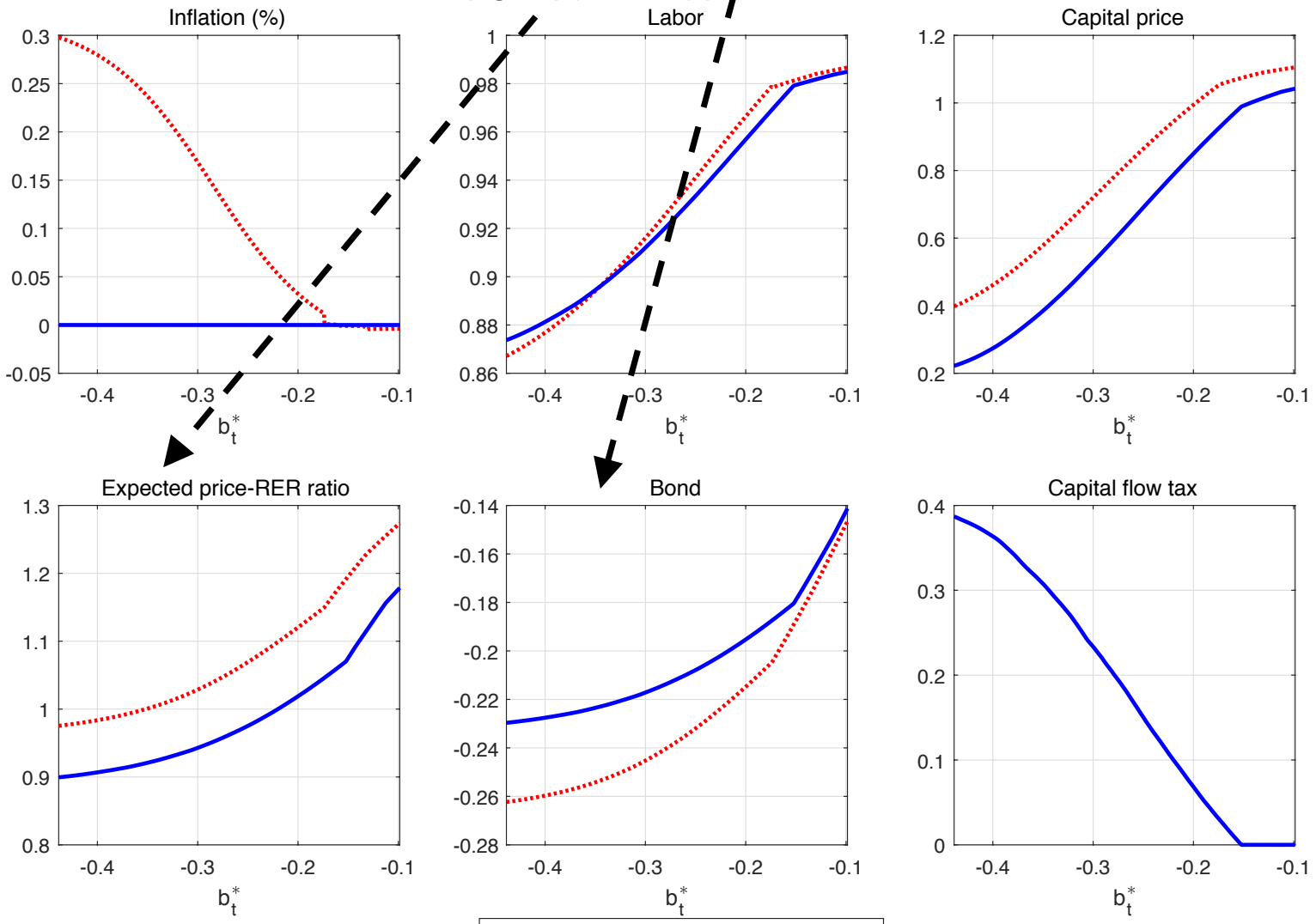
Equilibrium time consistent policy functions

Lower equilibrium capital price

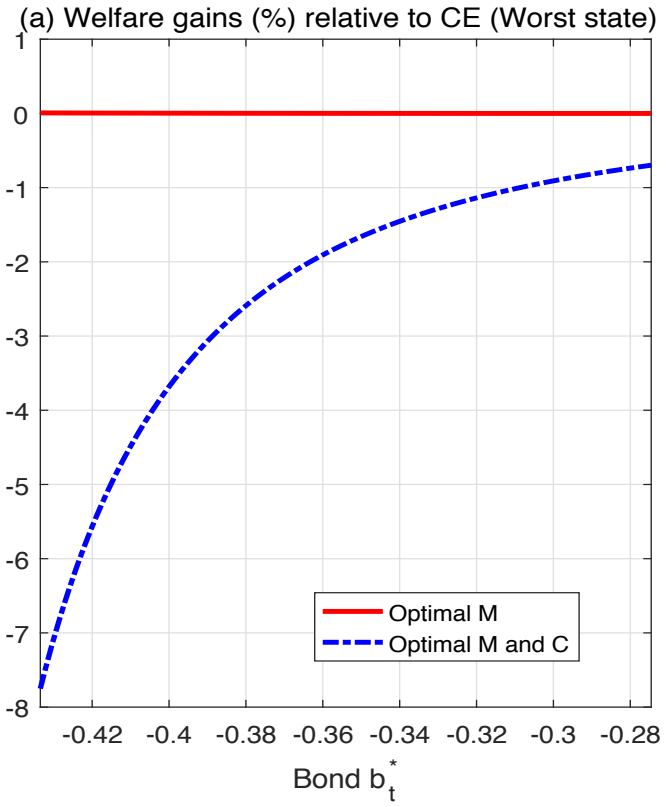


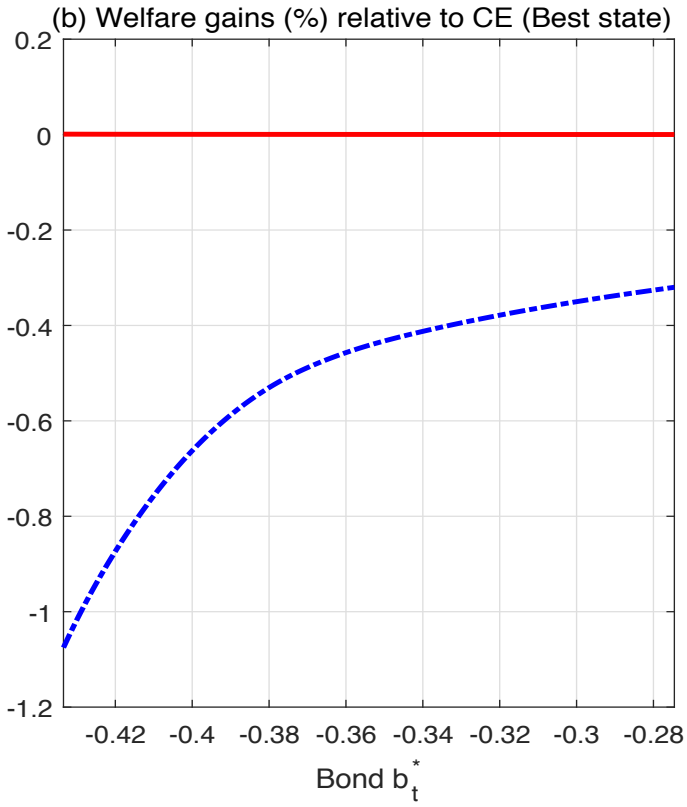
Equilibrium time consistent policy functions

In equilibrium, lower borrowing, and tighter borrowing constraints,



Conditional welfare gains





Conclusion: time consistent capital controls reduce welfare

- Policymaker corrects current pecuniary externality - 'overborrowing' in order to raise $E(q_{t+1})$ and relax constraint
  - But ignores the effect on q_t
- In equilibrium, lower q_t and inefficiently low debt
  - In equilibrium, the economy is 'underborrowing'

- But what taxes are optimal with commitment?

Policy under commitment: A simplified perfect foresight model

- Consider a special path with

$$\mu_{t-2} = \mu_{t-1} = 0, \quad \mu_t > 0, \quad \mu_{t+1} = \mu_{t+2} = 0$$

- Optimal Policy:
  - Tax inflows in period t

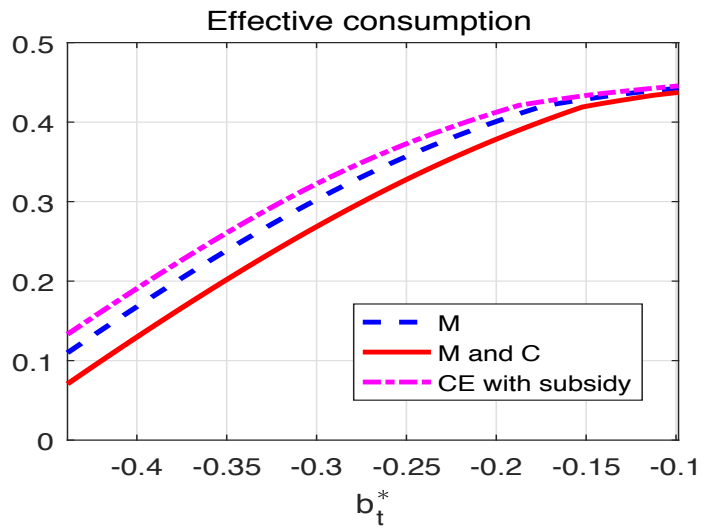
$$\tau_{c,t} > 0$$

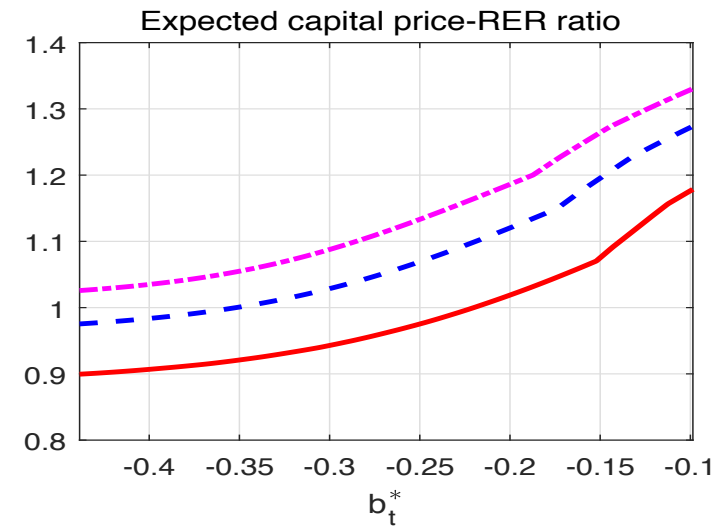
  - Subsidize inflows at period $t+1$

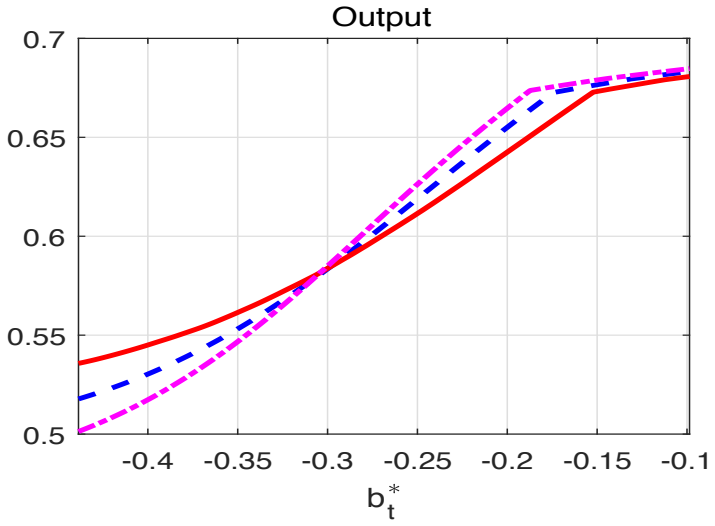
$$\tau_{c,t+1} < 0$$

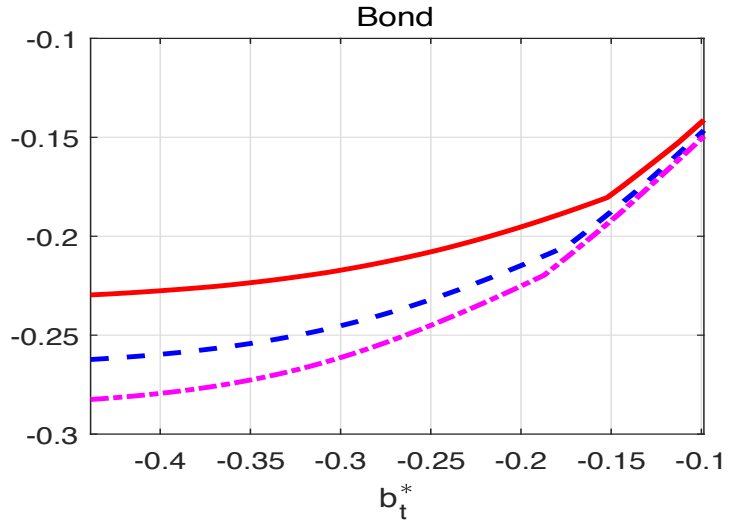
Policy under commitment: Ad hoc capital inflow subsidies

Let's conjecture simple rule $\tau_{c,t} = -\varsigma\mu_t$ with $\varsigma = 0.2$



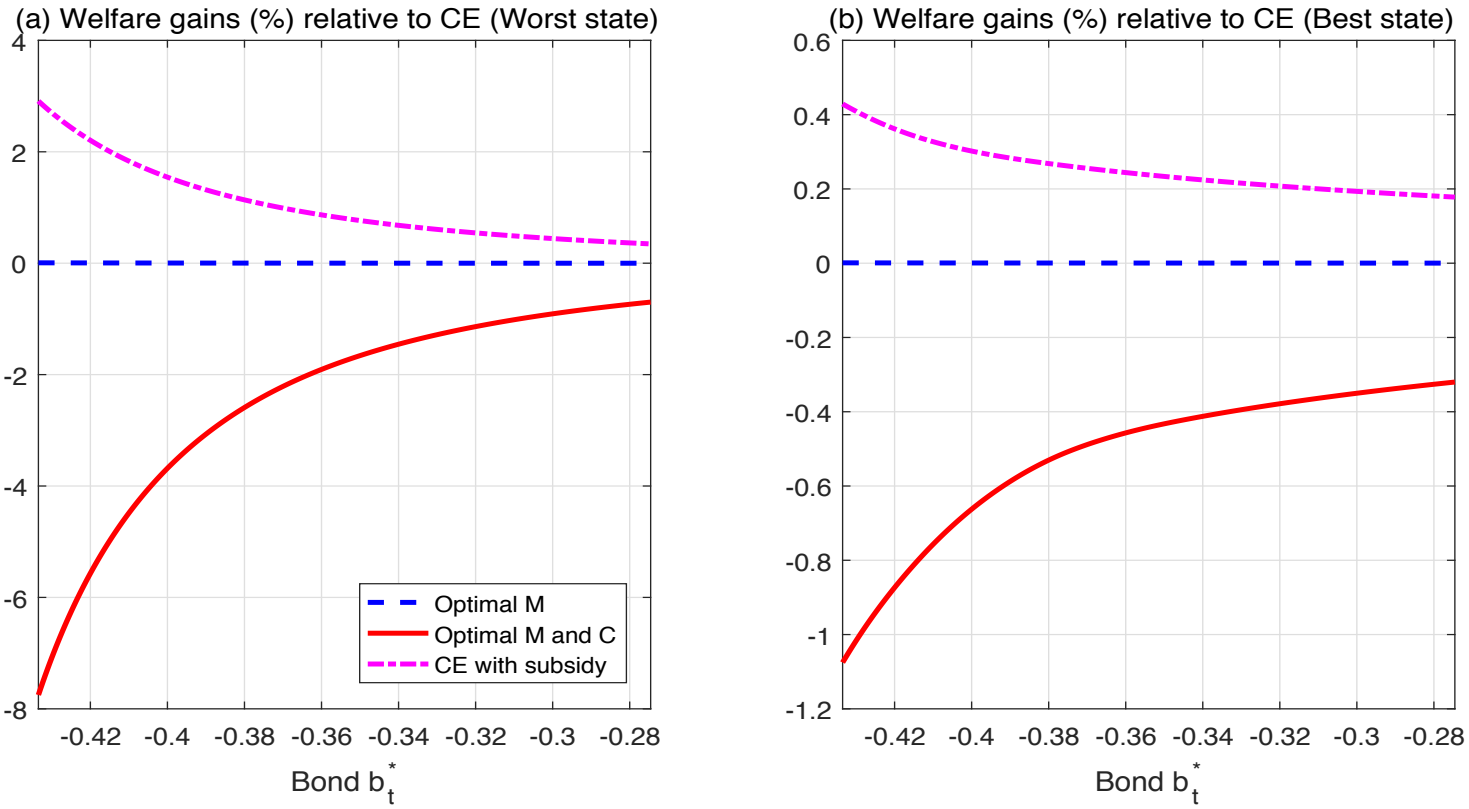






Policy under commitment: Ad hoc capital inflow subsidies

Figure: $\tau_{c,t} = -\varsigma\mu_t$ with $\varsigma = 0.2$



Conclusions

- Monetary policy should generate inflation during a crisis, even though it depreciates the currency
- Capital controls are welfare-reducing and should be kept out of the control of the central bank
- Arguments for prudential policymaking depend critically on nature of borrowing constraint