Capital controls: the case for international policy cooperation[1]

Bianca De Paoli, Anna Lipińska

Federal Reserve Bank of New York and Federal Reserve Board

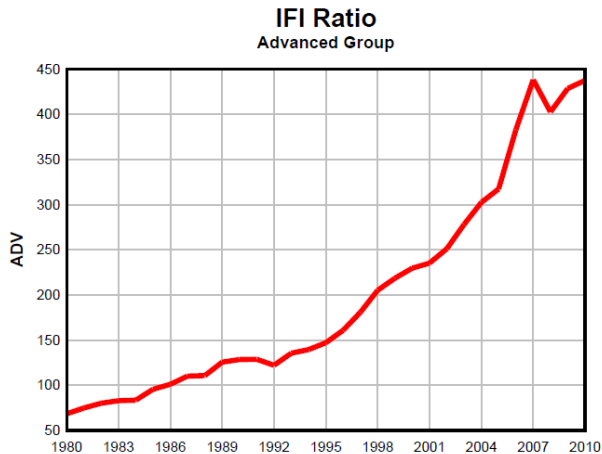# Motivation

- Large capital flows during the past decades
  - debate global imbalances
  - role of financial globalization and the financial crisis
  - role of surge in capital inflows to emerging markets and subsequent crisis

- Large literature emerging on capital controls
  - emphasis on potential prudential role of capital controls

- IMF endorsing capital controls (2011)
  - abandoning the traditional view in favor of free capital flow

IFI ratio: sum of foreign assets and foreign liabilities as a percentage of GDP
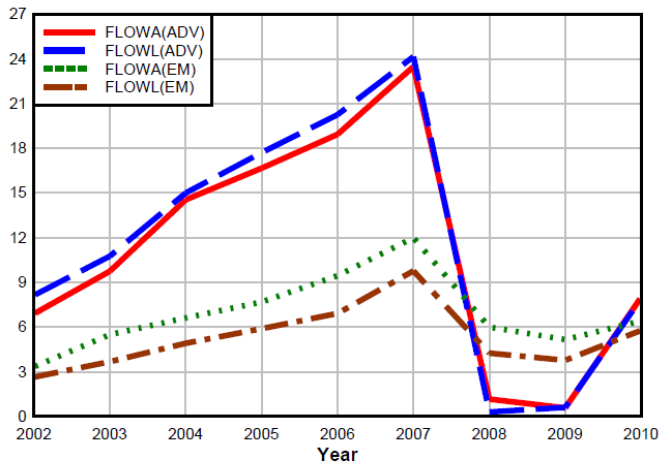
Figure 1 IFI Ratio: Advanced Economies

IFI Ratio
Advanced Group

Capital Flows

Figure 4. Gross International Financial Flows, 2002-2010

Cross-Border Capital Flows, 2002-2010

Legend:
- FLOWA(ADV)
- FLOWL(ADV)
- FLOWA(EM)
- FLOWL(EM)

X-axis: Year (2002–2010)

Source: Lane (2012), based on IMF BOPS data.

- ▶ Prudential role of capital controls
  - ▶ Models with collateral constraints and collateral value is taken as given by individuals – asset price externality
  - ▶ Capital controls should limit overborrowing and overspending during booms
  - ▶ Lorenzoni, 2008; Korinek 2010; Jeanne and Korinek, 2011; Bianchi, 2011; Bianchi and Mendoza, 2010 and 2013; Benigno, Chen, Otrok, and Rebucci, 2012a,b; and Uribe, 2006 (among others)

- ▶ Capital controls are desirable from the individual countries but also from a global perspective

- ▶ Argument counterbalancing the classical view that capital mobility helps cross-country risk-sharing

The literature
Empirical evidence

- ▶ Traditional literature focuses on the effect of capital controls on output
  - ▶ No assessment of strategic behavior
  - ▶ Ostry et al., 2010; Klein, 2012; and Forbes, Fratzscher, and Straub, 2013, among many others
- ▶ Fernandez, Rebucci and Uribe (2014): Do countries in practice apply capital controls prudentially as suggested by the new theories?
  - ▶ No: capital controls do not seem to move countercyclically
  - ▶ Conclusion: policymakers are either unaware or unconvinced (they might know better!)

This paper
Accounting for fundamental externalities in open economy

- ▶ Step back from prudential arguments
- ▶ Analyze the possible set backs of uncoordinated capital controls
- ▶ Can they be beggar thy neighbor?

- ▶ Open economy fundamental externalities: individual countries can try to
  - ▶ manipulate intertemporal terms of trade: Obstfeld and Rogoff (1996), Costinot et al (2013)
  - ▶ manipulate intratemporal terms of trade: Corsetti and Pesenti (2001), Benigno and Benigno (2003), Sutherland (2006) among others.

Our approach

- Analyze different versions of workhorse open economy model in which there is a role for capital flows (departs from Cole and Obstfeld (1991))

- Develop a welfare-based analysis of whether and how countries should tax international borrowing/lending

  - Policy that maximizes local welfare.
  - Policy that maximizes global welfare (or the coordinated policy).
  - Nash equilibrium (or the uncoordinated policy).

Some results

- Unilateral policy is beggar thy neighbor
- Externalities give rise to capital control wars (Nash - beggar thy self)
- "Nontrivial" gains from cooperation
- Cooperative solution: capital controls are acyclical when there are flexible prices (or optimal monetary policy).
- Coordinated use of capital controls is cyclical and improves welfare under constrained monetary policy (e.g. currency unions)

Model

Two-country model specifications:

- One-good endowment model – highlight intertemporal terms of trade externality

- Two-good endowment economy – introducing another international relative price

- Two-good production economy – a small open economy special case

- Two-good sticky-price production economy – introducing another inefficiency

- The case of local currency pricing

Model

- ▶ Asset Markets: households have access to a non-state contingent international real bond (incomplete markets)

- ▶ Stochastic environment: persistent domestic and foreign endowment/productivity shocks.

- ▶ Solution method: Incomplete markets without closed-form solution
  - ▶ Rely on quantitative simulation
  - ▶ Welfare: second order approximation of all equilibrium conditions and first order conditions
  - ▶ Some state contingency in discounting: stationary solution with unique steady state
  - ▶ Analytical solution of welfare function is work in progress

Households

- Home Utility:

$$U_t = E_t \sum_{s=t}^{\infty} \tilde{\beta}_t^{s-t} \left[\frac{C_s^{1-\rho}}{1-\rho} - \frac{N_s^{1+\eta}}{1+\eta} \right].$$

- Uzawa preferences $\tilde{\beta}_t = \beta C_t^{-\alpha}$ (to guarantee stationary eq. and uniqueness of ss)
- Production linear in labor

$$Y_t = A_t N_t$$

- Home bias: $v^* = n\lambda$ and $(1-v) = (1-n)\lambda$

$$C = \left[v^{\frac{1}{\theta}} C_H^{\frac{\theta-1}{\theta}} + (1-v)^{\frac{1}{\theta}} C_F^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}.$$

Households

- Analogous utility for Foreign (denoted with a star)
- Home: measure n
- Foreign: measure $1 - n$
- "Global utility"

$$U_t = nU_t + (1 - n)U_t^*$$

Asset Markets

Households' budget constraint

$$C_t + B_{F,t} \leq B_{F,t-1} \frac{Q_t R^*_{t-1}(1 + \tau_{t-1})}{Q_{t-1}} + w_t N_t + Tr_t$$

$$C^*_t + B^*_{F,t} \leq B^*_{F,t-1} R^*_{t-1}(1 + \tau^*_{t-1}) + w^*_t N^*_t + Tr^*_t$$

- ▶ $B_{F,t} < 0$, $\tau_t > 0$: Tax on international borrowing/capital inflow
- ▶ $B_{F,t} < 0$, $\tau_t < 0$: Subsidy on international borrowing/capital inflow
- ▶ $B_{F,t} > 0$, $\tau_t > 0$: Subsidy on international lending/capital outflow
- ▶ $B_{F,t} > 0$, $\tau_t < 0$: Tax on international lending/capital outflow

- ▶ Home (Foreign) taxes rebated to Home (Foreign) households as transfers.
- ▶ **Also consider different types of bonds**

Demand and Supply conditions

- Demand for Home goods:

$$Y_{H,t} = v \left[\frac{P_{H,t}}{P_t} \right]^{-\theta} C_t \text{ and } Y_{H,t}^* = v^* \left[\frac{P_{H,t}^*}{P_t^*} \right]^{-\theta} C_t^*$$

- Demand for Foreign goods:

$$Y_{F,t} = (1-v) \left[\frac{P_{F,t}}{P_t} \right]^{-\theta} C_t \text{ and } Y_{F,t}^* = (1-v^*) \left[\frac{P_{F,t}^*}{P_t^*} \right]^{-\theta} C_t^*$$

- Flexible prices: labor-leisure relationship

$$\frac{P_{H,t}}{P_t} A_t = w_t = N_t^\eta C_t^\rho$$

Firms: the case of sticky prices

- Producer currency pricing (Sutherland 2001)

$$\frac{1 - \omega \left(\Pi_{Ht}\right)^{\sigma - 1}}{1 - \omega} = \left[\kappa \frac{\sigma - 1}{\sigma} \frac{PB_t}{PA_t}\right]^{\sigma - 1}$$

$$PCP : P_{H,t} = S_t P_{H,t}^*$$

$$PA_t = A_t^{-1} w_t C_t^{-\rho} (Y_{H,t} + Y_{H,t}^*) + \omega \beta E_t PA_{t+1} \Pi_{H,t+1}^\sigma$$

$$PB_t = C_t^{-\rho} (Y_{H,t} + Y_{H,t}^*) \frac{P_{H,t}}{P_t} + \omega \beta E_t PB_{t+1} \Pi_{H,t+1}^{\sigma - 1}$$

Firms: the case of sticky prices

- Local currency pricing (Engel 2011)

$$LCP : \frac{1 - \omega_1 \left(\Pi_{Ht}^* \right)^{\sigma-1}}{1 - \omega_1} = \left[\kappa \frac{\sigma - 1}{\sigma} \frac{PD_t}{PC_t} \right]^{\sigma-1}$$

$$PC_t = A_t^{-1} w_t C_t^{-\rho} Y_{H,t}^* + \omega \beta E_t PC_{t+1} \Pi_{H,t+1}^{*\sigma}$$

$$PD_t = C_t^{-\rho} Y_{H,t}^* \frac{P_{H,t}^*}{P_t^*} Q_t + \omega \beta E_t PD_{t+1} \Pi_{H,t+1}^{*\sigma-1}$$

- To close the model under sticky prices: monetary policy rule

Calibration

Parameter Values Used in the Quantitative Analysis

Parameter	Value	Notes
β	0.99	Quarterly model with 4% ss real int. rate
η	$\infty/0.47$	Endowment./Rot. and Wood. (1997)
ρ	1	Log utility
λ	0.5/1	Home bias/Symmetric preferences
θ	$\infty/3/0.75$	One good/Substitutes/Complements goods
ω	0/0.25/0.66	Duration bet price adj from 0 and 3 quarters
α	0.00001/0	Stationary model/ non-stationary model
$sdv(\hat{\varepsilon})$	1%	
κ^{ε}	0.66	

Economic Inefficiencies

▶ Inability to fully share risk with the rest of the world.

$$U_C \left(C_t \right) Q_t \neq U_C \left(C_t^* \right)$$

▶ Pecuniary externality: private agents do not internalize the effects of their actions on prices (Geanakoplos and Polemarchakis (1986)).

    ▶ inefficient borrowing / saving in the competitive equilibrium..

▶ Sticky-prices/ Pricing to market

Externalities and Welfare reversals

Welfare losses (measured in consumption equivalent): one-good endowment economies
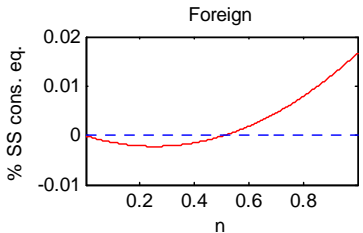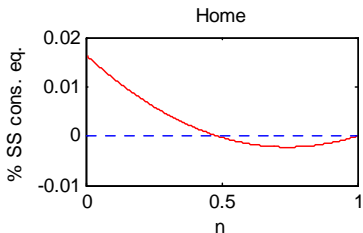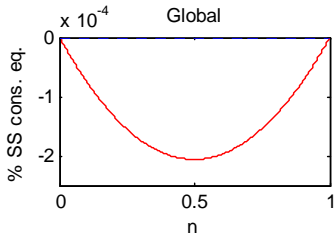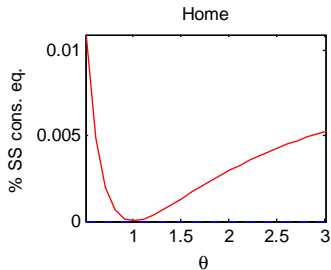
Externalities and Welfare reversals

- Non-spurious welfare reversals (contrast with Kim&Kim 2003): second order approx. to entire model ensures effect of volatility on mean
  ⇒Method: 2nd order perthubation evaluation of conditional welfare (Caldara, Villaverde, Rubio-Ramirez,and Yao (2012))
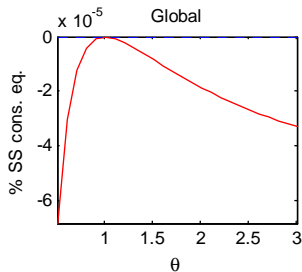
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- Agents do not internalize the effect of consumption in interest rate: underconsume when it is a lender, overconsume when it is a borrower
  $\Rightarrow$ Externality larger in big economy: interest rate too low (high) when big economy is lender (borrower).
  $\Rightarrow$ Positive spillover to small economy: interest rate low (high) when small economy is borrower (lender).
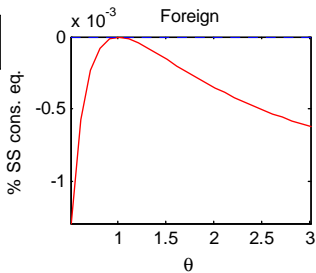
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- ▶ Cannot get pareto improvement from complete markets but one economy may be better off with reduced risk sharing
  ⇒These already hint to problems related to allowing for capital controls

Externalities and Welfare reversals

Welfare losses (measured in consumption equivalent): two-goods flexible price economies (n=0.1)

Externalities and Welfare reversals

- Two good economy: externality is eliminated only under a knife-edge specification where relative prices ensure current account balance in every period (Cole and Obstfeld (1991))
- Losses from lack of risk sharing are high when relative prices cannot perform risk sharing role
- Exactly in these case small economy is better off under incomplete markets

The Global Planner's Incentives
The case of flexible prices

- In equilibrium:

$$\frac{1+\tau_t}{1+\tau_t^*} = \frac{\tilde{\beta}_t E_t \left(\frac{U_C(C_{t+1})}{U_C(C_t)} \frac{Q_{t+1}}{Q_t} \right)}{\tilde{\beta}_t^* E_t \left(\frac{U_C(C_{t+1}^*)}{U_C(C_t^*)} \right)}$$
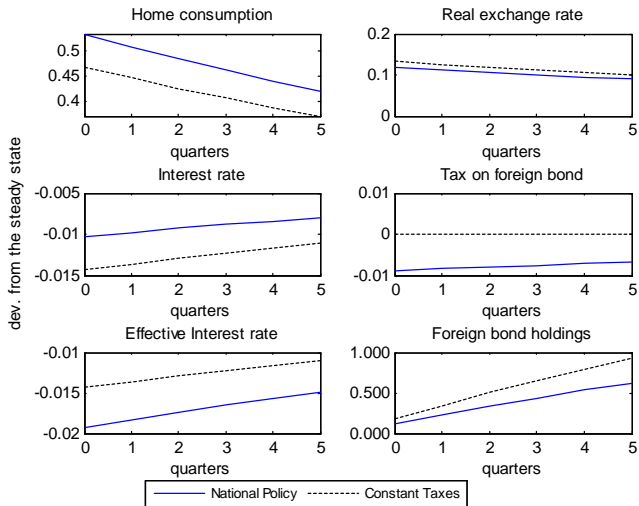
- Policy that minimizes global welfare ($U^G = nU + (1-n)U^*$)

$$\tau_t = \tau_t^* = 0$$

- Global planner keep taxes constant to minimize deviations from full risk sharing
- Cyclical taxes on borrowing cannot improve upon competitive equilibrium solution

The National Planner's Incentives

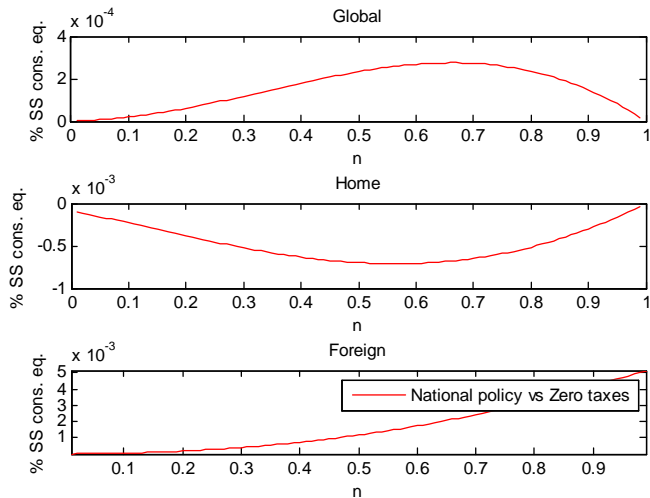The case of flexible price, symmetric endowment economies

The National Planner's Incentives
The case of flexible price, endowment economies

- Social planner in each country has an incentive to move taxes
  - Symmetric country size but still have dynamic externality
- Positive shock to productivity at home:
  - Home is a net lender: National planner induces higher consumption via a tax on capital outflow – resulting in higher interest rates
  - Home is a net seller (trade surplus): terms of trade appreciation from tax on capital outflows is beneficial
  - Both higher interest rates and ToT/RER appreciation benefit lender at the expense of the borrower – beggar thy-neighbor
  - Risk-sharing is also affected – reducing global welfare (mean variance trade-off)

Welfare implications

Welfare losses (expressed as consumption equivalent)
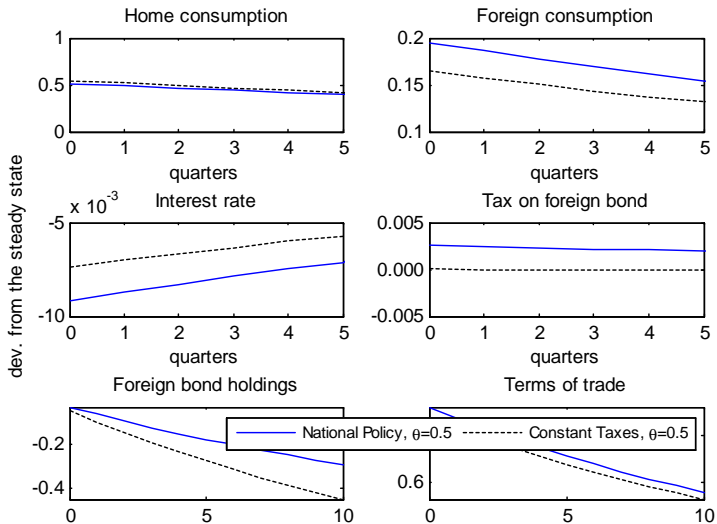
The National Planner's Incentives

The role of home bias

- ▶ Home bias: increases ToT effect of capital flow taxation (intertemporal externality reinforces intratemporal one).
- ▶ But when lambda is too low, economy is relatively closed – so little intertemporal/intratemporal trade to take advantage.
- ▶ When there is foreign bias ($\lambda > 1$), the terms of trade response reverse (higher consumption, ToT depreciation) as λ approaches 2, the intertemporal and intratemporal effects offset each other.
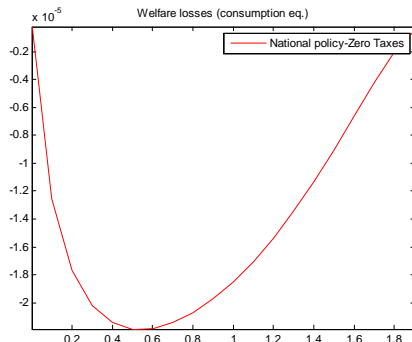
Welfare losses (consumption eq.)

The National Planner's Incentives

The case of flexible prices, endowment economies, complement goods, symmetric countries

The National Planner Incentives

The case of flexible prices, endowment economies, complement goods

- Terms of trade depreciation implies home becomes a borrower after an increase in productivity
- Tax capital inflow
- In both cases policy is restricting capital flows and risk sharing
- The relevant determinant of policy is the sign of the current account
- (Could be different if valuation effect were incorporated?)

The Nash equilibrium

The case of flexible prices, symmetric endowment economies
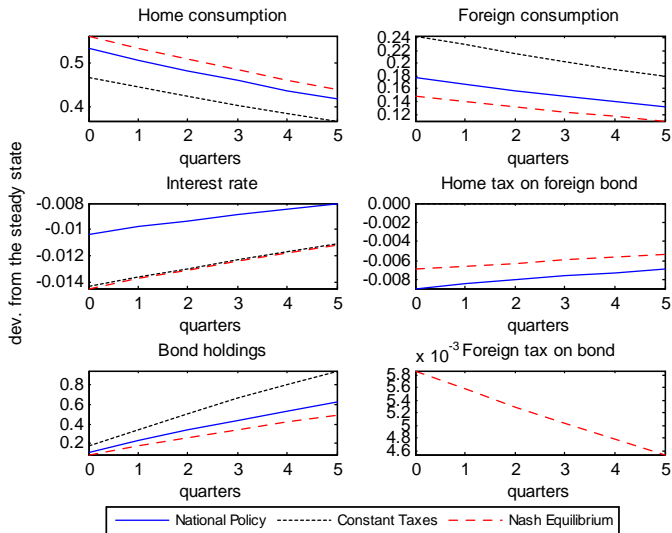
The Nash equilibrim

- Interest rate pretty identical to constant taxes
- Nash equilibrium makes both economies worse off, only reducing risk sharing
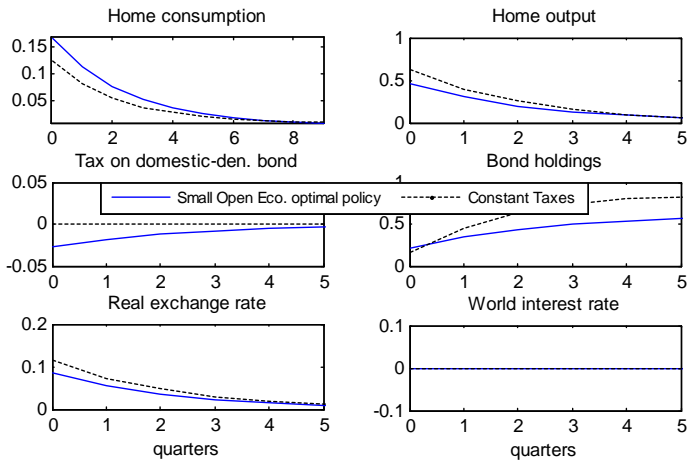- Only sufficiently large economies could potentially affect intertemporal prices even with "retaliation"

The Nash equilibrim

Costly "captital control wars"
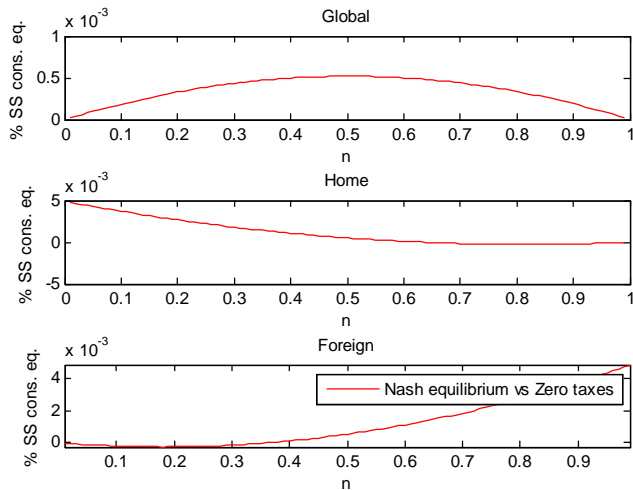
A special case

Optimal policy in a small open production economy

# A special case
Optimal policy in a small open production economy

- Although it is not possible to influence world interest rates, as a producer of Home goods, the small economy can still influence its terms of trade
- By engineering an appreciation of the terms of trade (and real exchange rate), the SOE's purchasing power is boosted
- The economy can produce less (more leisure) and consume more

The Global Planner's Incentives in a Currency Union
The case of sticky prices, production economies under producer currency pricing
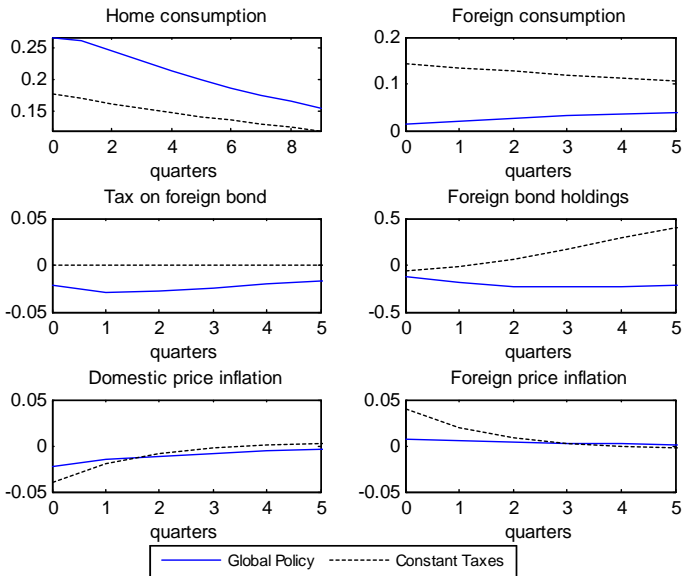
Welfare implications

Cumulative	Flexible price		PCP $(\omega = 0.25)$	
$*1/(1-\beta)$	$n = 0.1$	$n = 0.9$	$n = 0.1$	$n = 0.9$
$L_{np}^w - L_{\tau=0}^w$	0.0006	0.0028	-0.0009	-0.00001
$L_{np} - L_{\tau=0}$	-0.0075	-0.0055	-0.0020	-0.0034
$L_{np}^* - L_{\tau=0}^*$	0.0015	0.0772	-0.0008	0.0309
$L_{gp}^w - L_{nash}^w$	-0.0038		-0.0018	
$L_{gp} - L_{nash}$	-0.0671		-0.0453	
$L_{gp}^* - L_{nash}^*$	0.0032		0.0030	

The Global / National planner's incentives
The case of sticky prices, production economies under producer currency pricing

- ▶ Global planner subsidizes borrowing to reduce demand imbalances, stabilize inflation
  - ▶ But the "optimal global policy" is not a pareto improvement - raising questions of implementability
- ▶ But incentives get more aligned when one introduces sticky prices
  - ▶ National policy need not be beggar thy neighbor (if country is small and there is no retaliation)

Welfare implications

Cumulative ($n = 0.1$)	PCP		LCP	
$*1/(1-\beta)$	$\theta = 3$	$\theta = 0.75$	$\theta = 3$	$\theta = 0.75$
$L_{np}^w - L_{\tau=0}^w$	-0.0009	0.0567	-0.0008	0.1346
$L_{np} - L_{\tau=0}$	-0.0020	-0.0786	-0.00009	-0.1340
$L_{np}^* - L_{\tau=0}^*$	-0.0008	0.0717	-0.0008	0.1678

Conclusions

- Uncoordinated policy limits international risk sharing and reduces global welfare

- Negative spillover increases with countries' ability to influence intertemporal or intratemporal terms of trade

- Capital control "wars" – most countries worse off (only significantly large ones would not be affected by "retaliation").

- There is a clear role for policy coordination and gains may be significant when goods are complements

- Sticky prices introduce another role for capital controls: managing demand/supply imbalances when monetary policy is constrained (currency union)

- But how to implement cooperation when individual country's have an incentive to limit risk sharing?

Further steps

- ▶ Analytical derivation of the loss function of national policymaker and global planner.

- ▶ Assess effectiveness of capital controls (versus other instruments) in a DSGE model with additional frictions.

Costinot et al

- Policy prescription does not account for global implications
- No analysis of welfare implications
- Focuses on national policy and intertemporal externality
- Different role of international relative prices: Home does not have the monopoly over production of home goods (both countries produce both goods)
- Cannot characterize small economy
- Do not point to welfare reversals