Liquidity Traps and Capital Flows

Sushant Acharya [1] Julien Bengui[2]

[1]Federal Reserve Bank of New York

[2]Université de Montréal

Secular Stagnation Conference at EUI
June 2015

motivation

- Loose monetary policy in advanced economies
  - deficient demand
  - period of binding zero lower bound (ZLB) on interest rate
- During early stage of liquidity trap, capital flows from advanced to emerging economies increased markedly
  - appreciation of emerging mkt currencies
  - some emerging mkts: imposed controls to limit currency appreciation
- Accusations of currency wars

motivation

- Loose monetary policy in advanced economies
  - deficient demand
  - period of binding zero lower bound (ZLB) on interest rate
- During early stage of liquidity trap, capital flows from advanced to emerging economies increased markedly
  - appreciation of emerging mkt currencies
  - some emerging mkts: imposed controls to limit currency appreciation
- Accusations of currency wars

motivation

- Loose monetary policy in advanced economies
  - deficient demand
  - period of binding zero lower bound (ZLB) on interest rate
- During early stage of liquidity trap, capital flows from advanced to emerging economies increased markedly
  - appreciation of emerging mkt currencies
  - some emerging mkts: imposed controls to limit currency appreciation
- Accusations of currency wars

risk of currency wars

... "The industrial economies are using ultra-loose monetary policy, while the emerging markets are using currency intervention and capital controls. (...) The tools they are using will create distortions – both ultra-loose monetary policy and intervention risk creating excess liquidity and asset price bubbles. If capital is too cheap, we will tend to use it too much. If the exchange rate is too low, we will focus on producing for exports. And if tempers boil over, we could get ugly protectionism."

- Raghuram Rajan (2010)

questions

1. What role do capital flows and exchange rates play during regional liquidity traps?
2. What are the multilateral implications of capital flow management in response to loose monetary policy?
   - Can a regime of capital flow management raise welfare of all parties involved?
   - Should countries not subject to a liquidity trap optimally manage inflows of capital?

questions

1. What role do capital flows and exchange rates play during regional liquidity traps?

2. What are the multilateral implications of capital flow management in response to loose monetary policy?
   - Can a regime of capital flow management raise welfare of all parties involved?
   - Should countries not subject to a liquidity trap optimally manage inflows of capital?

motivation

- Following Fleming (1962) and Mundell (1963): common perception that no role for capital account management with flexible exchange rates
- Recently Mundell-Fleming view has been challenged
  - by policy makers: IMF revised stance, stated in Ostry et al. 2010, emerging market governments
  - academics: argument based on financial frictions, nominal rigidities, terms-of-trade management

motivation

- Following Fleming (1962) and Mundell (1963): common perception that no role for capital account management with flexible exchange rates
- Recently Mundell-Fleming view has been challenged
  - by policy makers: IMF revised stance, stated in Ostry et al. 2010, emerging market governments
  - academics: argument based on financial frictions, nominal rigidities, terms-of-trade management

this paper

- Environment
  1. micro-founded multi-country model with nominal rig. and flex exchng rates
  2. region of world economy experiences a liquidity trap
  3. monetary policy is set non-cooperatively by each country
- Key insights: In a liquidity trap...
  1. non-coop. monetary policy by a country imposes AD externality on world economy
  2. free capital flows are Pareto inefficient
     - capital flows "too slowly"
     - doesn't induce enough demand reallocation & expenditure switching
  3. welfare gains not achievable by non-cooperative capital flow management

this paper

- Environment
  1. micro-founded multi-country model with nominal rig. and flex exchng rates
  2. region of world economy experiences a liquidity trap
  3. monetary policy is set non-cooperatively by each country
- Key insights: In a liquidity trap...
  1. non-coop. monetary policy by a country imposes AD externality on world economy
  2. free capital flows are Pareto inefficient
     - capital flows "too slowly"
     - doesn't induce enough demand reallocation & expenditure switching
  3. welfare gains not achievable by non-cooperative capital flow management

related literature

1. Optimal monetary policy at ZLB
   - closed economy: Krugman (1998), Svensson (2001, 2003, 2004), Eggertsson and Woodford (2003), Werning (2012)
   - open economy: Jeanne (2009), Fujiwara et. al (2013), Haberis and Lipinska (2012), Cook and Devereux (2013), Devereux and Yetman (2014)
2. (Management of) capital flows
   - empirical: Calvo, Leiderman and Reinhart (1993, 1996)
   - theoretical
     - financial market frictions:
     - goods market frictions:
3. Aggregate demand externalitites (general): Mankiw (1985), Akerlof and Yellen (1985), Blanchard and Kiyotaki (1987), Farhi and Werning (2012b, 2013), Korinek and Simsek (2014)

related literature

1. Optimal monetary policy at ZLB
   - closed economy: Krugman (1998), Svensson (2001, 2003, 2004), Eggertsson and Woodford (2003), Werning (2012)
   - open economy: Jeanne (2009), Fujiwara et. al (2013), Haberis and Lipinska (2012), Cook and Devereux (2013), Devereux and Yetman (2014)

2. (Management of) capital flows
   - empirical: Calvo, Leiderman and Reinhart (1993, 1996)
   - theoretical
     - financial market frictions: Caballero and Krishnamurthy (2001), Korinek (2010, 2013), Bianchi (2011), Brunnermeier and Sannikov (2014), Heathcoate and Perri (2014)
     - goods market frictions: Schmitt-Grohe and Uribe (2012, 2014), Farhi and Werning (2012a, 2014), Costinot et. al (2014), De Paoli and Lipinska (2014)

3. Aggregate demand externalitites (general): Mankiw (1985), Akerlof and Yellen (1985), Blanchard and Kiyotaki (1987), Farhi and Werning (2012b, 2013), Korinek and Simsek (2014)

related literature

1. Optimal monetary policy at ZLB
   - closed economy: Krugman (1998), Svensson (2001, 2003, 2004), Eggertsson and Woodford (2003), Werning (2012)
   - open economy: Jeanne (2009), Fujiwara et. al (2013), Haberis and Lipinska (2012), Cook and Devereux (2013), Devereux and Yetman (2014)

2. (Management of) capital flows
   - empirical: Calvo, Leiderman and Reinhart (1993, 1996)
   - theoretical
     - financial market frictions: Caballero and Krishnamurthy (2001), Korinek (2010, 2013), Bianchi (2011), Brunnermeier and Sannikov (2014), Heathcoate and Perri (2014)
     - goods market frictions: Schmitt-Grohe and Uribe (2012, 2014), Farhi and Werning (2012a, 2014), Costinot et. al (2014), De Paoli and Lipinska (2014)

3. Aggregate demand externalitites (general): Mankiw (1985), Akerlof and Yellen (1985), Blanchard and Kiyotaki (1987), Farhi and Werning (2012b, 2013), Korinek and Simsek (2014)

model summary

- Unit mass of small open economies making up world economy :
  - measure x of Northern economies
  - measure $1 - x$ of Southern economies
- Nominal rigidities in price setting by firms in each country
- Flexible exchange rates
- No uncertainty
- Nominal bonds in each currency

model: preferences

Country k preferences

$$\int_0^\infty e^{-\int_0^t (\rho + \zeta_{k,h}) dh} \left\{ \frac{\left(\mathbb{C}_{k,t}\right)^{1-\sigma}}{1-\sigma} - \frac{\left(N_{k,t}\right)^{1+\phi}}{1+\phi} \right\} dt,$$

- ϕ: inverse frisch elsaticity of labor supply
- ρ: discount rate
- $\zeta_{k,h} < 0$: negative demand shifter

model: nested CES goods structure

Monopolistic competitive firms. Each produces a different variety

- consumption basket

$$\mathbb{C}_{k,t} \equiv \left[(1-\alpha)^{\frac{1}{\eta}} \left(C_{k,t}^{H} \right)^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} \left(C_{k,t}^{F} \right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

- $1-\alpha$: degree of home-bias
  - $\alpha = 0$: extreme home bias
  - $\alpha = 1$: no home bias
- home goods

$$C_k^H \equiv \left[\int_0^1 C_k^H(l)^{\frac{\epsilon-1}{\epsilon}} dl \right]^{\frac{\epsilon}{\epsilon-1}}$$

- foreign goods

$$C_k^F \equiv \left[\int_0^1 C_k^{j\,\frac{\gamma-1}{\gamma}} dj \right]^{\frac{\gamma}{\gamma-1}}$$

model: nested CES goods structure

Monopolistic competitive firms. Each produces a different variety

- consumption basket

$$\mathbb{C}_{k,t} \equiv \left[(1-\alpha)^{\frac{1}{\eta}} \left(C^H_{k,t} \right)^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} \left(C^F_{k,t} \right)^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

- $1-\alpha$: degree of home-bias
  - $\alpha = 0$: extreme home bias
  - $\alpha = 1$: no home bias
- home goods

$$C^H_k \equiv \left[\int_0^1 C^H_k(l)^{\frac{\epsilon-1}{\epsilon}} dl \right]^{\frac{\epsilon}{\epsilon-1}}$$

- foreign goods

$$C^F_k \equiv \left[\int_0^1 C^j_k{}^{\frac{\gamma-1}{\gamma}} dj \right]^{\frac{\gamma}{\gamma-1}}$$

model: price indices

- domestic CPI

$$\mathbb{P}_{k,t} \equiv \left[(1-\alpha)\left(P^H_{k,t}\right)^{1-\eta} + \left(P^F_{k,t}\right)^{1-\eta}\right]^{\frac{1}{1-\eta}}$$

- domestic PPI

$$P^H_k \equiv \left[\int_0^1 P^H_k(l)^{1-\epsilon} dl\right]^{\frac{1}{1-\epsilon}}$$

- foreign PPI

$$P^F_k \equiv \left[\int_0^1 P^j_k{}^{1-\gamma} dj\right]^{\frac{1}{1-\gamma}}$$

some additional constraints on structure

- Price of each variety is **fully rigid** in own currency
  - **fixed PPI** in own currency
  - not essential but simplifies analysis
  - PPI fixed, but **flexible exchange rates** $\rightarrow$ **CPI not fixed**
- Cole-Obstfeld (1991) parametrization ($\sigma = \eta = \gamma = 1$)
  - results in highly tractable framework, exact non-linear solution.

some additional constraints on structure

- Price of each variety is **fully rigid** in own currency
  - **fixed PPI** in own currency
  - not essential but simplifies analysis
  - PPI fixed, but **flexible exchange rates** $\rightarrow$ **CPI not fixed**

- Cole-Obstfeld (1991) parametrization ($\sigma = \eta = \gamma = 1$)
  - results in highly tractable framework, exact non-linear solution.

model

- Terms of Trade:

$$\mathcal{S}^k_{j,t} \equiv \frac{\mathcal{E}^j_{k,t} P^j_{j,t}}{P^k_{k,t}} \xrightarrow{\text{rigid PPI}} \mathcal{E}^j_{k,t}$$

- Real Exchange Rate

$$\mathcal{Q}^j_k \equiv \frac{\mathcal{E}^j_k \mathbb{P}_j}{\mathbb{P}_k} \xrightarrow{\text{rigid PPI}} (\mathcal{E}^j_k)^{1-\alpha}$$

- Backus-Smith condition:

$$\Theta^j_{k,t} \equiv \frac{\mathcal{Q}^j_{k,t} \mathbb{C}_{k,t}}{\mathbb{C}_{j,t}}$$

with

$$\frac{\dot{\Theta}^j_{k,t}}{\Theta^j_{k,t}} = \tau_k - \tau_j + \zeta_j - \zeta_k$$

model

- Terms of Trade:

$$\mathcal{S}^k_{j,t} \equiv \frac{\mathcal{E}^j_{k,t} P^j_{j,t}}{P^k_{k,t}} \xrightarrow{\text{rigid PPI}} \mathcal{E}^j_{k,t}$$

- Real Exchange Rate

$$\mathcal{Q}^j_k \equiv \frac{\mathcal{E}^j_k \mathbb{P}_j}{\mathbb{P}_k} \xrightarrow{\text{rigid PPI}} (\mathcal{E}^j_k)^{1-\alpha}$$

- Backus-Smith condition:

$$\Theta^j_{k,t} \equiv \frac{\mathcal{Q}^j_{k,t} \mathbb{C}_{k,t}}{\mathbb{C}_{j,t}}$$

with

$$\frac{\dot{\Theta}^j_{k,t}}{\Theta^j_{k,t}} = \tau_k - \tau_j + \zeta_j - \zeta_k$$

model

- Terms of Trade:

$$\mathcal{S}^k_{j,t} \equiv \frac{\mathcal{E}^j_{k,t} P^j_{j,t}}{P^k_{k,t}} \xrightarrow{\text{rigid PPI}} \mathcal{E}^j_{k,t}$$

- Real Exchange Rate

$$\mathcal{Q}^j_k \equiv \frac{\mathcal{E}^j_k \mathbb{P}_j}{\mathbb{P}_k} \xrightarrow{\text{rigid PPI}} (\mathcal{E}^j_k)^{1-\alpha}$$

- Backus-Smith condition:

$$\Theta^j_{k,t} \equiv \frac{\mathcal{Q}^j_{k,t} \mathbb{C}_{k,t}}{\mathbb{C}_{j,t}}$$

with

$$\frac{\dot{\Theta}^j_{k,t}}{\Theta^j_{k,t}} = \tau_k - \tau_j + \zeta_j - \zeta_k$$

liquidity trap experiment

- Large unanticipated negative demand shock at $t = 0$ in North

$$\zeta_{n,t} = \begin{cases} -\bar{\zeta} & \text{if } 0 \leq t \leq T \\ 0 & \text{if } t > T \end{cases}$$

while $\zeta_{s,t} = 0$ for all $t \geq 0$

- Pick shock size $\bar{\zeta}$ such that under free capital flows, ZLB binds in North but not in South

- All countries **set monetary policy independently and optimally** (subject to ZLB constraint)

liquidity trap experiment

- Large unanticipated negative demand shock at $t = 0$ in North

$$\zeta_{n,t} = \begin{cases} -\bar{\zeta} & \text{if } 0 \leq t \leq T \\ 0 & \text{if } t > T \end{cases}$$

while $\zeta_{s,t} = 0$ for all $t \geq 0$

- Pick shock size $\bar{\zeta}$ such that under free capital flows, ZLB binds in North but not in South

- All countries **set monetary policy independently and optimally** (subject to ZLB constraint)

monetary policy in a liquidity trap

- Objective of monetary authority: domestic output gap stabilization
- Closed economy
  - without ZLB, demand shocks can be fully stabilized.
  - large demand shock → ZLB binds. real interest rate cannot fall enough → recession and deflation follow
  - opt. mon. policy: keep nominal interest rate at zero past the liquidity trap [optimal delay, Eggertson-Woodford(2003), Werning (2012)]
- Open economy
  - desire to save can be satisfied by lending abroad (accumulating NFA)
  - capital flows and exchange rate play key role in adjustment

monetary policy in a liquidity trap

- Objective of monetary authority: domestic output gap stabilization
- Closed economy
  - without ZLB, demand shocks can be fully stabilized.
  - large demand shock $\rightarrow$ ZLB binds. real interest rate cannot fall enough $\rightarrow$ recession and deflation follow
  - opt. mon. policy: keep nominal interest rate at zero past the liquidity trap [optimal delay, Eggertson-Woodford(2003), Werning (2012)]
- Open economy
  - desire to save can be satisfied by lending abroad (accumulating NFA)
  - capital flows and exchange rate play key role in adjustment

monetary policy in a liquidity trap

- Objective of monetary authority: domestic output gap stabilization
- Closed economy
  - without ZLB, demand shocks can be fully stabilized.
  - large demand shock → ZLB binds. real interest rate cannot fall enough → recession and deflation follow
  - opt. mon. policy: keep nominal interest rate at zero past the liquidity trap [optimal delay, Eggertson-Woodford(2003), Werning (2012)]
- Open economy
  - desire to save can be satisfied by lending abroad (accumulating NFA)
  - capital flows and exchange rate play key role in adjustment

Problem of the Monetary Authority

problem of the monetary authority in country k

$$\max_{i_{k,t}} \int_0^\infty e^{-(\rho+\zeta_{k,h})dh} \left\{ \log \mathbb{C}_{k,t} - \frac{1}{1+\phi} \left(\frac{Y_{k,t}}{A} \right)^{1+\phi} \right\}$$

subject to:

$$\begin{aligned}
i_{k,t} &\geq 0 \\
\frac{\dot{\mathbb{C}}_{k,t}}{\mathbb{C}_{k,t}} &= (1-\alpha) i_{k,t} + \alpha x i_{n,t} + \alpha \tau_{k,t} + \alpha(1-x)\left[i_{s,t} - \tau_{s,t} \right] - \rho - \zeta_{k,t} \\
Y_{k,t} &= \left[(1-\alpha)\Theta^n_{k,t} + \alpha x + \alpha(1-x)\Theta^n_{s,t} \right] \left(\mathcal{E}^s_{n,t} \right)^{\alpha(1-x)} \left(\frac{\mathbb{C}_{k,t}}{\Theta^n_{k,t}} \right)^{-\frac{1}{1-\alpha}} \left(\mathbb{C}_{n,t} \right)^{-\frac{\alpha}{1-\alpha}}
\end{aligned}$$

optimal monetary policy at zlb

Proposition

- Without ZLB: nominal interest rate set to keep output gap at 0.

- With ZLB:

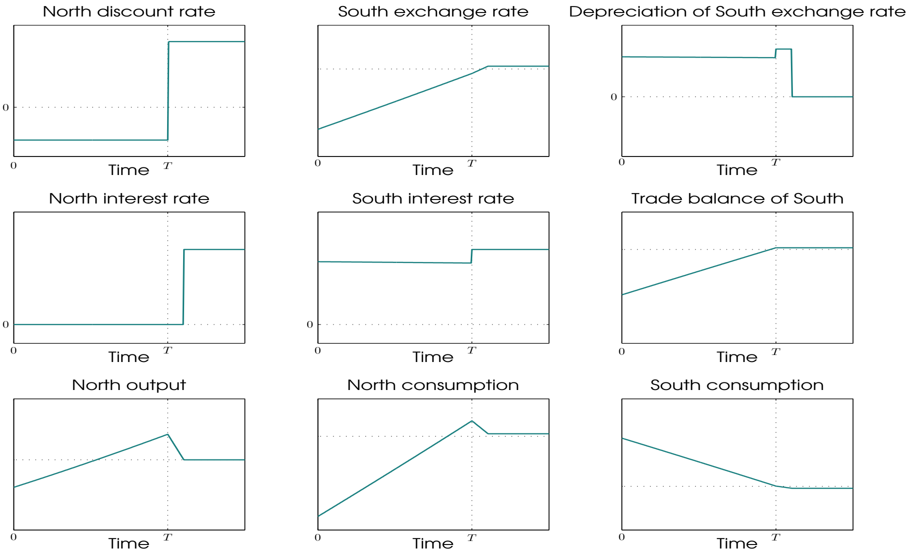
$$i_{k,t} = \begin{cases} 0 & \text{if } 0 \leq t \leq \widehat{T}_k \\ \rho & \text{if } t > \widehat{T}_k \end{cases}$$

where $\widehat{T}_k >> T$ is defined implicitly by:

$$0 = \int_0^{\widehat{T}_k} e^{-\int_0^h (\rho + \zeta_{k,h}) dh} \left\{ 1 - \left[\frac{Y_{k,h}}{\overline{Y}_{opt}} \right]^{1+\phi} \right\}$$

▸ Details...

optimal monetary policy at zlb



Exchng rates dynamics and expenditure switching

- At ZLB, UIP requires expected appreciation of North currency:

$$\underset{0}{i_{n,t}} = \underset{+}{i_{s,t}} - \underset{+}{\frac{\dot{\mathcal{E}}_s^n}{\mathcal{E}_s^n}}$$

⇒ North currency depreciation on impact, leading to expenditure switching toward North good

- Interest rate cut by South entails spillovers
  - curtails North depreciation on impact
  - reduces expenditure switching away from South goods

How do capital flows influence macro adjustment at the ZLB?

capital flow management at ZLB

- Capital flow taxes/subsidies can "break" UIP condition

$$\underset{0}{i_{n,t}} = \underset{++}{i_{s,t}} - \underbrace{\tau_{s,t}}_{+/-} - \underset{+/+++}{\frac{\dot{\mathcal{E}}_s^n}{\mathcal{E}_s^n}}$$

⇒ CFM can mitigate/reinforce North appreciation on impact & weaken/reinforce expenditure switching

- Special case: $\tau_{s,t} = -\zeta_{n,t} \forall t \geq 0$ results in closed capital accounts ($\frac{\dot{\Theta}_{s,t}^n}{\Theta_{s,t}^n} = 0$)

capital flow management at ZLB

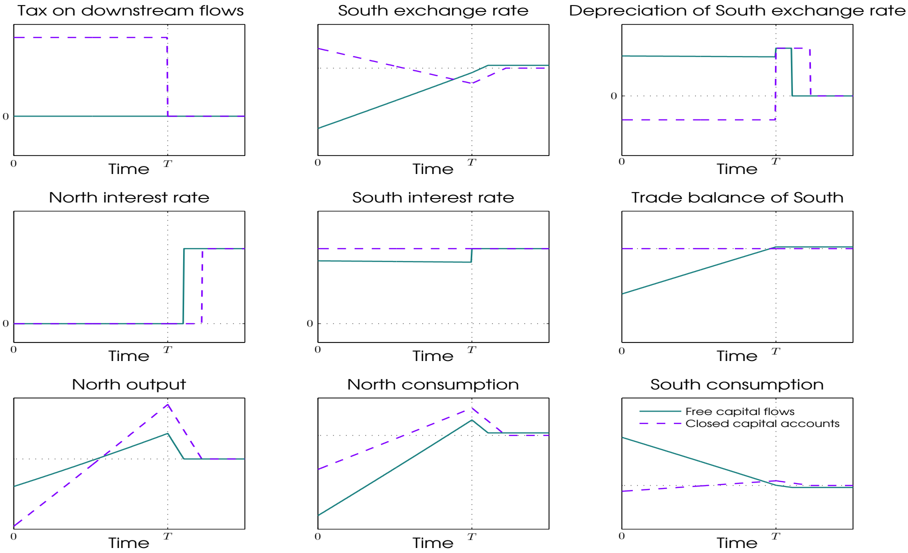
- Capital flow taxes/subsidies can “break” UIP condition

$$\underset{0}{i_{n,t}} = \underset{++}{i_{s,t}} - \underbrace{\tau_{s,t}}_{+/-} - \underset{+/+++}{\frac{\dot{\mathcal{E}}_s^n}{\mathcal{E}_s^n}}$$

⇒ CFM can mitigate/reinforce North appreciation on impact & weaken/reinforce expenditure switching

- Special case: $\tau_{s,t} = -\zeta_{n,t} \forall t \geq 0$ results in closed capital accounts ($\frac{\dot{\Theta}_{s,t}^n}{\Theta_{s,t}^n} = 0$)

free capital flows vs closed capital account



Are free capital flows efficient at the ZLB?

constrained pareto problem

- Consider global planner who can tax/subsidize capital flows from North to South
- Planner's problem is to maximize welfare of North subject to:
  1. guaranteeing South at least same welfare as in free capital flow regime
  2. interest rate policy set by domestic monetary authorities
  3. further implementability constraints reflecting privately optimal intratemporal choices and market clearing

constrained pareto problem

- Consider global planner who can tax/subsidize capital flows from North to South
- Planner's problem is to maximize welfare of North subject to:
  1. guaranteeing South at least same welfare as in free capital flow regime
  2. interest rate policy set by domestic monetary authorities
  3. further implementability constraints reflecting privately optimal intratemporal choices and market clearing

constrained pareto problem

- Consider global planner who can tax/subsidize capital flows from North to South
- Planner's problem is to maximize welfare of North subject to:
  1. guaranteeing South at least same welfare as in free capital flow regime
  2. interest rate policy set by domestic monetary authorities
  3. further implementability constraints reflecting privately optimal intratemporal choices and market clearing

constrained pareto problem

$$\max_{\tau_{s,t}} \int_0^\infty e^{-(\rho+\zeta_{k,h})dh} \left\{ \log \mathbb{C}_{n,t} - \frac{1}{1+\phi} \left(\frac{Y_{n,t}}{A} \right)^{1+\phi} \right\}$$

subject to:

$$\int_0^\infty e^{-\rho t} \left\{ \log \mathbb{C}_{s,t} - \frac{1}{1+\phi} \left(\frac{Y_{s,t}}{A} \right)^{1+\phi} \right\} \geq \overline{W}_{e,0}$$

$$\begin{aligned}
i_{k,t} &= \mathcal{I}_k(\cdot) \\
\frac{\dot{\mathbb{C}}_{k,t}}{\mathbb{C}_{k,t}} &= (1-\alpha) i_{k,t} + \alpha x i_{n,t} + \alpha \tau_{k,t} + \alpha(1-x)\left[i_{s,t} - \tau_{s,t}\right] - \rho - \zeta_{k,t} \\
Y_{k,t} &= \left[(1-\alpha)\Theta^n_{k,t} + \alpha x + \alpha(1-x)\Theta^n_{s,t}\right] \left(\mathcal{E}^s_{n,t}\right)^{\alpha(1-x)} \left(\frac{\mathbb{C}_{k,t}}{\Theta^n_{k,t}} \right)^{-\frac{1}{1-\alpha}} \left(\mathbb{C}_{n,t}\right)^{-\frac{\alpha}{1-\alpha}} \\
\frac{\dot{\Theta}^n_{s,t}}{\Theta^n_{s,t}} &= \tau_{s,t} + \zeta_{n,t}
\end{aligned}$$

for $k \in \{n, s\}$.

▸ Pareto Problem without Transfers

free capital flows are pareto inefficient

Proposition (Inefficiency of free capital flow)

Regime of **free capital flows** is **Pareto dominated** by an appropriately chosen regime of capital flow management

- Source of inefficiency: **aggregate demand externality** due to nominal rigidity + constraints on monetary policy
- Result does not hinge on use of compensating transfers across countries

free capital flows are pareto inefficient

Proposition (Inefficiency of free capital flow)

Regime of **free capital flows** is **Pareto dominated** by an appropriately chosen regime of capital flow management

- Source of inefficiency: **aggregate demand externality** due to nominal rigidity + constraints on monetary policy
- Result does not hinge on use of compensating transfers across countries

free capital flows are pareto inefficient

Proposition (Inefficiency of free capital flow)

Regime of **free capital flows** is **Pareto dominated** by an appropriately chosen regime of capital flow management

- Source of inefficiency: **aggregate demand externality** due to nominal rigidity + constraints on monetary policy
- Result does not hinge on use of compensating transfers across countries

efficient capital flow management

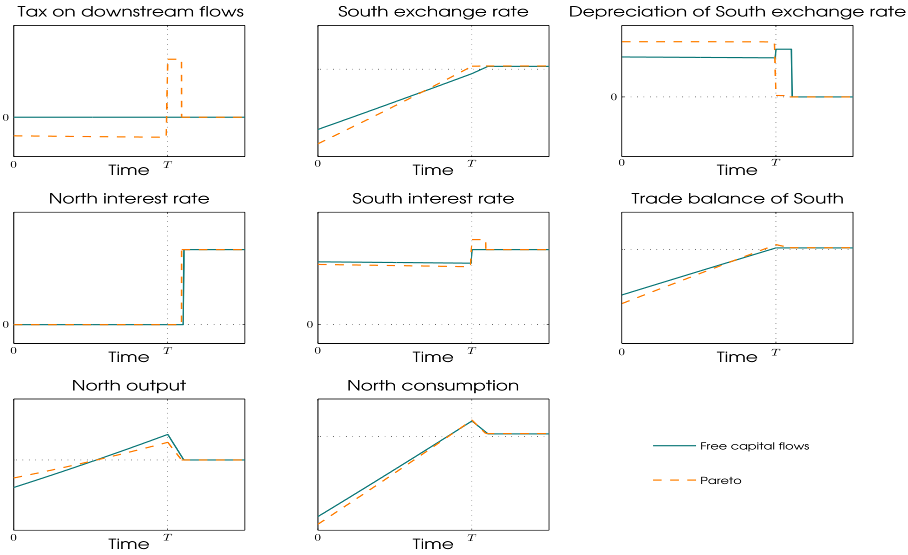
Proposition (Efficient capital flows)

Efficiency commands (i) positive tax on downstream flows between end of liquidity trap and ZLB exit, (ii) zero tax after ZLB exit:

$$\tau_{s,t} \begin{cases} > 0 & \text{for } T < t \leq \widehat{T} \\ = 0 & \text{for } t > \widehat{T} \end{cases}$$

- For "small enough" α or "large enough" x, $\tau_{s,t} < 0$ initially
- Capital flows "too slowly" under free capital flows, resulting in **inefficiently low reallocation of demand** in global economy

efficient capital flow management



Are these welfare gains achievable if we allow countries to set "capital controls" independently?

optimal non-cooperative capital flow management

- Local planner sets tax/subsidy on capital inflows in South country
- Planner's problem is to maximize domestic welfare, subject to
  1. demand curve for home country's variety
  2. interest rate policy set by monetary authority
  3. country budget constraint
- Key differences vis-à-vis global planner
  - does not put any weight on welfare of other countries
  - since country k is small, does not internalize aggregate demand externality

optimal non-cooperative capital flow management

- Local planner sets tax/subsidy on capital inflows in South country
- Planner's problem is to maximize domestic welfare, subject to
  1. demand curve for home country's variety
  2. interest rate policy set by monetary authority
  3. country budget constraint
- Key differences vis-à-vis global planner
  - does not put any weight on welfare of other countries
  - since country k is small, does not internalize aggregate demand externality

optimal non-cooperative capital flow management

- Local planner sets tax/subsidy on capital inflows in South country
- Planner's problem is to maximize domestic welfare, subject to
  1. demand curve for home country's variety
  2. interest rate policy set by monetary authority
  3. country budget constraint
- Key differences vis-à-vis global planner
  - does not put any weight on welfare of other countries
  - since country k is small, does not internalize aggregate demand externality

optimal non-cooperative capital flow management

$$\max_{\tau_{k,t}} \int_0^\infty e^{-(\rho+\zeta_{k,h})dh} \left\{ \log \mathbb{C}_{k,t} - \frac{1}{1+\phi} \left(\frac{Y_{k,t}}{A} \right)^{1+\phi} \right\}$$

subject to:

$$\begin{aligned}
i_{k,t} &= \mathcal{I}_k(\cdot) \\
\frac{\dot{\mathbb{C}}_{k,t}}{\mathbb{C}_{k,t}} &= (1-\alpha)i_{k,t} + \alpha x i_{n,t} + \alpha\tau_{k,t} + \alpha(1-x)\left[i_{s,t} - \tau_{s,t}\right] - \rho - \zeta_{k,t} \\
Y_{k,t} &= \left[(1-\alpha)\Theta^n_{k,t} + \alpha x + \alpha(1-x)\Theta^n_{s,t}\right] \left(\mathcal{E}^s_{n,t}\right)^{\alpha(1-x)} \left(\frac{\mathbb{C}_{k,t}}{\Theta^n_{k,t}} \right)^{-\frac{1}{1-\alpha}} \left(\mathbb{C}_{n,t}\right)^{-\frac{\alpha}{1-\alpha}} \\
\frac{\dot{\Theta}^n_{k,t}}{\Theta^n_{k,t}} &= \tau_{k,t} + \zeta_{n,t} \\
B_{k,0} &= \alpha \int_0^\infty e^{-(\rho+\zeta_{n,h})dh}\left[\Theta^n_{k,t} - x - (1-x)\Theta^n_{s,t}\right]dt
\end{aligned}$$

where k is a South economy.

optimal non-cooperative capital flow management

Proposition (Optimal non-cooperative controls by South)

Optimal tax on inflow is positive during liquidity trap:

$$\tau_{s,t} \begin{cases} > 0 & \text{if } 0 \leq t \leq T \\ = 0 & \text{if } t > T \end{cases}$$

Furthermore, optimal tax slows down rather than fully stops inflows during liquidity trap ($0 < \tau_{s,t} < \bar{\zeta}$).

- Capital flows "too fast" under free capital flows from perspective of a South country

optimal non-cooperative capital flow management

Proposition (Optimal non-cooperative controls by South)

Optimal tax on inflow is positive during liquidity trap:

$$\tau_{s,t} \begin{cases} > 0 & \text{if } 0 \leq t \leq T \\ = 0 & \text{if } t > T \end{cases}$$

Furthermore, optimal tax slows down rather than fully stops inflows during liquidity trap ($0 < \tau_{s,t} < \bar{\zeta}$).

- Capital flows "too fast" under free capital flows from perspective of a South country

optimal non-cooperative capital flow management

- Rationale for controls by South is dynamic terms of trade management (Costinot et al. 2014)
  - Smooth terms-of-trade path
  - Limit initial exchange rate appreciation
- Yields smaller depreciation of North currency on impact
  - Delays optimal ZLB exit time in North
  - Makes North labor wedge more (rather than less) volatile
- Non-cooperative controls do not achieve Pareto improvements
  - North worse-off compared to free capital flows regime

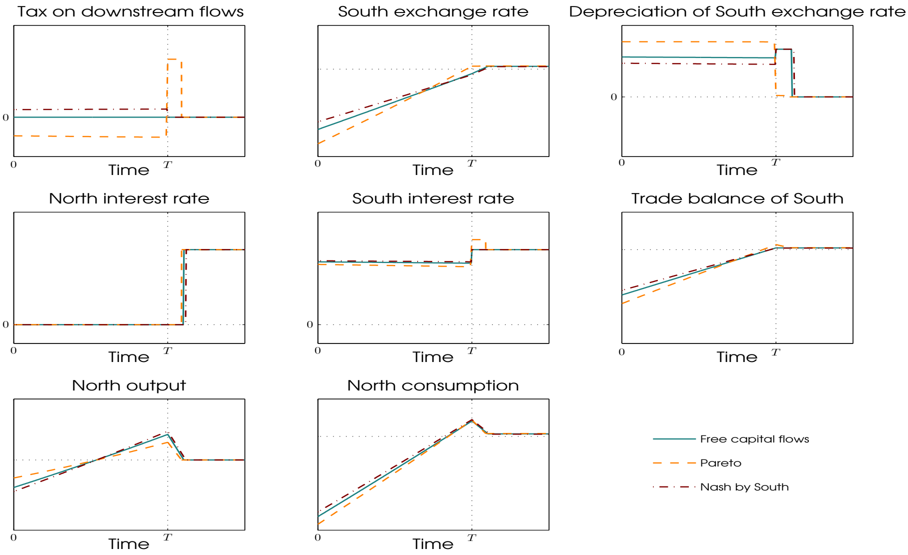
optimal non-cooperative capital flow management

- Rationale for controls by South is dynamic terms of trade management (Costinot et al. 2014)
  - Smooth terms-of-trade path
  - Limit initial exchange rate appreciation
- Yields smaller depreciation of North currency on impact
  - Delays optimal ZLB exit time in North
  - Makes North labor wedge more (rather than less) volatile
- Non-cooperative controls do not achieve Pareto improvements
  - North worse-off compared to free capital flows regime

optimal non-cooperative capital flow management

- Rationale for controls by South is dynamic terms of trade management (Costinot et al. 2014)
    - Smooth terms-of-trade path
    - Limit initial exchange rate appreciation
- Yields smaller depreciation of North currency on impact
    - Delays optimal ZLB exit time in North
    - Makes North labor wedge more (rather than less) volatile
- Non-cooperative controls do not achieve Pareto improvements
    - North worse-off compared to free capital flows regime

optimal non-cooperative capital controls



conclusion

- At ZLB, non-cooperative monetary policy imposes a negative AD externality on RoW
- Free capital flows are Pareto inefficient during a liquidity trap episode in the world economy
  - inefficiently low global reallocation of demand
- Non-cooperative capital flow management by inflow recipient countries have adverse multilateral implication: delay optimal ZLB exit time and deepen recession in advanced countries
- Inefficiency of free capital flows under nominal rigidities applies more generally when monetary policy does not achieve first best (ongoing work: Acharya and Bengui, 2015b)

The End

BACKUP SLIDES

optimal monetary policy

- In a Southern economy k, ZLB does not bind. Interest rates are given by:

$$\mathcal{I}_k(\cdot) \equiv \rho + \frac{(1-\alpha)\,\Theta^n_{k,t}}{\Lambda(\Theta^n_{k,t},\Theta^n_{s,t})}\zeta_{k,t} + \frac{\alpha x}{\Lambda(\Theta^n_{k,t},\Theta^n_{s,t})}\zeta_{n,t} + \frac{\alpha x + \alpha\,(1-x)\,\Theta^n_{s,t}}{\Lambda(\Theta^n_{k,t},\Theta^n_{s,t})}\tau_{k,t} - \frac{\alpha\,(1-x)\,\Theta^n_{s,t}}{\Lambda(\Theta^n_{k,t},\Theta^n_{s,t})}\tau_{s,t}$$

where

$$\Lambda(\Theta^n_{k,t},\Theta^n_{s,t}) = (1-\alpha)\,\Theta^n_{k,t} + \alpha x + \alpha\,(1-x)\,\Theta^n_{s,t}$$

- In a Northern economy k, the optimal interest rate path is given by:

$$i_{k,t} = \begin{cases} 0 & \text{if } 0 \le t \le \widehat{T}_k \\ \mathcal{I}_k() & \text{if } t > \widehat{T}_k \end{cases}$$

▸ Back

constrained pareto problem without transfers

$$\max_{\tau_{s,t}} \int_0^\infty e^{-(\rho+\zeta_{k,h})dh} \left\{ \log \mathbb{C}_{n,t} - \frac{1}{1+\phi} \left(\frac{Y_{n,t}}{A} \right)^{1+\phi} \right\}$$

subject to:

$$\int_0^\infty e^{-\rho t} \left\{ \log \mathbb{C}_{s,t} - \frac{1}{1+\phi} \left(\frac{Y_{s,t}}{A} \right)^{1+\phi} \right\} \geq \overline{W}_{e,0}$$

$$\begin{aligned}
i_{k,t} &= \mathcal{I}_k(\cdot) \\
\frac{\dot{\mathbb{C}}_{k,t}}{\mathbb{C}_{k,t}} &= (1-\alpha) i_{k,t} + \alpha x i_{n,t} + \alpha \tau_{k,t} + \alpha(1-x) \left[i_{s,t} - \tau_{s,t} \right] - \rho - \zeta_{k,t} \\
Y_{k,t} &= \left[(1-\alpha)\Theta^n_{k,t} + \alpha x + \alpha(1-x)\Theta^n_{s,t} \right] \left(\mathcal{E}^s_{n,t} \right)^{\alpha(1-x)} \left(\frac{\mathbb{C}_{k,t}}{\Theta^n_{k,t}} \right)^{-\frac{1}{1-\alpha}} (\mathbb{C}_{n,t})^{-\frac{\alpha}{1-\alpha}} \\
\frac{\dot{\Theta}^n_{s,t}}{\Theta^n_{s,t}} &= \tau_{s,t} + \zeta_{n,t} \\
B_{n,0} &= \alpha(1-x) \int_0^\infty e^{-(\rho+\zeta_{n,h})dh} [1 - \Theta^n_{s,t}] dt \\
B_{s,0} &= -\alpha x \int_0^\infty e^{-(\rho+\zeta_{n,h})dh} [1 - \Theta^n_{s,t}] dt
\end{aligned}$$

where $k \in \{n, s\}$ Back