Capital Flows, Exchange Rate Misalignment and Monetary Policy Trade-offs

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[1]The views expressed here are personal and do not represent those of the Bank of Canada nor the ECB.

How should monetary policy respond to capital inflows?

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...that enlarge current account deficits and appreciates the currency?

- Conventional wisdom: keep focus on inflation.
- Widespread concern: A contractionary policy in the face of a deficit may not stem the inflow, but only aggravate exchange rate misalignment (overvaluation).

- According to some evidence, actual response appears to vary.

In practice, the response to capital inflows varies

Table: Monetary policy stance over episodes of net capital inflow (NKI) surges

	Number of NKI Surge Episodes		
Monetary Policy Stance	All countries	Advanced	Emerging
Monetary Policy Easing	18	4	14
Monetary Policy Neutral	14	3	11
Monetary Policy Tightening	18	6	12
Total	50	13	37

Note. — Data Sources: Kruger and Pasricha (2016) and Pasricha (2017). The sample covers 8 small open advanced and 25 emerging economies from 1995Q1-2016Q4. Definition of episodes of inflows: (a) NKI/GDP at least one standard deviation above mean, provided it crosses 2 SDV at least once in the episode and (b) gross inflows are positive (hence ruling out episodes of CA correction driven by domestic retrenchment.

Conventional view: the natural rate

- E.g., Obstfeld and Rogoff [2010]:

  "There is a case to be made that large current account deficits, other things equal, call for a tightening of monetary policy.[...] better macro performance comes from a monetary rule that recognizes how an external deficit raises the **natural real rate of interest***."*

- **efficient** when risk sharing is perfect
  - benign view of capital flows, whether small or large
- but **inefficient** with financial frictions
  - shocks not fully insurable: cross-border borrowing/lending lead to globally inefficient imbalances and the real exchange rate becomes misaligned, independently of nominal rigidities.

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    - import share in demand

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- examines the monetary policy **trade-offs** due to inefficient capital flows, resulting from **uninsurable shocks to the natural borrowing constraint.**
- characterizes loss functions, targeting rules and optimal stabilization policy **analytically** in familiar two-country new-Keynesian models with PCP and LCP.

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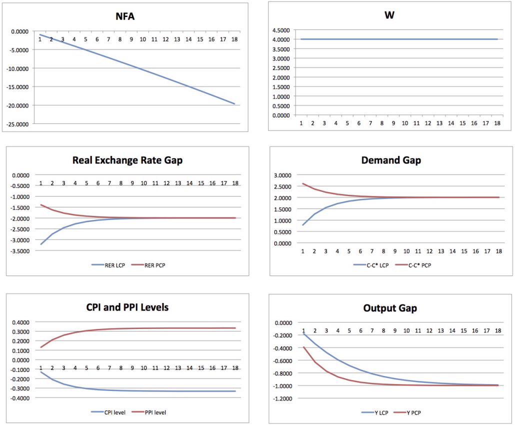
     - ...with a high pass-through, relative flexible prices, a high degree of openness
     - Stance is looser than required to strictly target (GDP deflator) inflation under PCP

A preview of optimal policy: LCP vs PCP

Shocks (anticipated 5 years) generating capital flows 1 percent of GDP



The literature: Full risk sharing

- By assuming efficient capital flows, the bulk of the existing monetary open-economy literature has side-stepped our question:
  - See Benigno and Benigno [2003], Clarida, Galí and Gertler [2002], Corsetti and Pesenti [2005], Devereux and Engel [2003], and Galí and Monacelli [2005] among others
  - benign view of capital flows,
- Engel [2011] stresses demand imbalances arising exchange rate movements may or may not substitute for flexible prices (PCP vs LCP)
  - Stickiness in local currency price of imports (LCP) distorts real exchange rate and *relative demand* across countries

The literature: Incomplete markets

- NOEM—incomplete asset markets giving rise to inefficient capital flows
  - Obstfeld and Rogoff [2002] and Devereux [2004]; Devereux and Sutherland [2007]; SOE in De Paoli [2010];
  - Benigno [2009] on valuation effects given an initial stock of debt;
- Quantitative analyses:
  - Rabitsch [2012]; Senay and Sutherland [2016]
- Growing literature on capital controls, recently with nominal rigidities and monetary policy (collateral constraints):
  - Lorenzoni [2008], Jeanne and Korinek [2010], Korinek [2010], Benigno et al. [2011], Bianchi [2011], Bianchi and Mendoza [2010], Farhi and Werning [2015]
  - Devereux and Yu [2016]—optimal monetary policy under discretion with occasionally binding constraint in SOE.

The literature: Monetary policy dilemma

- Recent contributions (e.g. Benigno et al. 2011, Rey 2013, Farhi and Werning 2015) stress circumstances that exacerbate the monetary trade-offs from capital flows
- Policy **dilemma** motivates the adoption of capital controls (or MacroPru) as additional instruments.
- Focus is on the "additional instruments", rather than on the optimal monetary policy response.

But what is this response if other instruments are not readily available?

Outline (coincides with 3 key contributions in CDL 2017)

After presenting the model:

1. Second-order accurate approximation for the **global welfare function** under cooperation (encompassing financial autarky, complete markets, or trade in any number of assets, in economies with "local currency pricing " LCP or "producers currency pricing" PCP).
2. **Optimal targeting rules** for bond economies under LCP and PCP.
3. **Analytical characterization of allocation under optimal stabilization** in response to capital flow, generated by news shocks (preference for saving, political risk, financial frictions)

Model set up

(standard and familiar NK 2 country 2 tradables)

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- Two *symmetric* countries, H and F, specialized in producing one type of tradable good each, in a continuum of varieties.
- Each variety produced by monopolistic firm which uses labor as only input, subject to technology shocks.
- Calvo-Yun price setting: Both producer currency pricing (PCP) and local currency pricing (LCP).
- Incomplete markets internationally, zero net wealth in steady state.
- Current and anticipated ("news") shocks (taste, technology, markup,...)
- Encompassing Clarida-Gali-Gertler, Obstfeld-Rogoff, Devereux-Engel, Engel, Galí-Monacelli, Benigno-Benigno and other classic NOEM contributions.

Preferences

- Separable utility ($\zeta_{C,t}$ Preference shock):

$$U(\cdot) = \zeta_{C,t} \frac{C_t^{1-\sigma}}{1-\sigma} - \varpi \frac{L_t^{1+\eta}}{1+\eta}, \qquad \sigma > 0, \eta \geq 0$$

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- Consumption CES aggregate of Home ($C_{\mathrm{H},t}$) and Foreign ($C_{\mathrm{F},t}$) varieties :

$$C = \left[a_{\mathrm{H}}^{1/\phi} C_{\mathrm{H}}^{\frac{\phi-1}{\phi}} + (1-a_{\mathrm{H}})^{1/\phi} C_{\mathrm{F}}^{\frac{\phi-1}{\phi}}\right]^{\frac{\phi}{\phi-1}}, \qquad \phi > 0$$

$$C_{\mathrm{H},t} \equiv \left[\int_0^1 C_t(h)^{\frac{\theta-1}{\theta}} dh\right]^{\frac{\theta}{\theta-1}} \qquad C_{\mathrm{F},t} \equiv \left[\int_0^1 C_t(f)^{\frac{\theta-1}{\theta}} df\right]^{\frac{\theta-1}{\theta}}$$

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- Trade parameters:
  - $\phi > 0$: Intratemporal elasticity; $1 - a_{\mathrm{H}}$: Openness

Price indexes and international prices

$$P_{\mathrm{H},t} = \left[\int_0^1 P_t(h)^{1-\theta} dh\right]^{\frac{1}{1-\theta}},$$

$$\mathbb{P}_t = \left[a_{\mathrm{H}} P_{\mathrm{H},t}^{1-\phi} + a_{\mathrm{F}} P_{\mathrm{F},t}^{1-\phi}\right]^{\frac{1}{1-\phi}}.$$

Real exchange rate and terms of trade:

$$\mathcal{Q}_t = \frac{\mathcal{E}_t \mathbb{P}_t^*}{\mathbb{P}_t}$$

$$\mathcal{T}_t = \frac{P_{\mathrm{F},t}}{\mathcal{E}_t P_{\mathrm{H},t}^*}$$

Firms: technology and firms' problem

$$Y\left(h\right)=\zeta_{Y}L\left(h\right),$$

$$Max_{\mathcal{P}(h),\mathcal{P}^{*}(h)}\ E_{t}\sum_{k=0}^{\infty}\mathcal{M}_{t,t+k}\alpha^{k}\left(\begin{array}{c}\left[\mathcal{P}_{t}(h)D_{t+k}(h)+\mathcal{E}_{t}\mathcal{P}_{t}^{*}(h)D_{t+k}^{*}(h)\right]-\\ MC_{t+k}(h)\left[D_{t+k}(h)+D_{t+k}^{*}(h)\right]\end{array}\right)$$

where $1-\alpha$ Calvo's "fairy" probability, ζ_{Y} technology shock and:

$$\begin{aligned}D_{t}(h) &= \int\left(\frac{\mathcal{P}_{t}(h)}{P_{\mathrm{H},t}}\right)^{-\theta}C_{\mathrm{H},t}dh\\ D_{t}^{*}(h) &= \int\left(\frac{\mathcal{P}_{t}^{*}(h)}{P_{\mathrm{H},t}^{*}}\right)^{-\theta}C_{\mathrm{H},t}^{*}dh\end{aligned}$$

Firms: Producer and local currency pricing

- Optimally preset price in domestic currency charged to domestic customers:

$$\mathcal{P}_t(h) = \frac{\theta}{\theta - 1} \frac{E_t \sum_{k=0}^{\infty} \alpha^k \mathcal{M}_{t,t+k} D_{t+k}(h) MC_{t+k}(h)}{E_t \sum_{k=0}^{\infty} \alpha^k \mathcal{M}_{t,t+k} D_{t+k}(h)}$$

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- PCP: $\mathcal{P}_t^*(h) = \mathcal{P}_t(h)/\mathcal{E}_t$ (law of one price holds)
- LCP: Foreign currency price $\mathcal{P}_t^*(h)$ charged to customers abroad is also sticky.

$$\mathcal{P}_t^*(h) = \frac{\theta}{\theta - 1} \frac{E_t \sum_{k=0}^{\infty} \alpha^k \mathcal{M}_{t,t+k} D_{t+k}^*(h) MC_{t+k}(h)}{E_t \sum_{k=0}^{\infty} \alpha^k \mathcal{M}_{t,t+k} \mathcal{E}_{t+k} D_{t+k}^*(h)}$$

Budget constraint

- Households trade risk-free bond paying in Home currency $B_{\mathrm{H},t}$ (denomination immaterial with zero NFA):

$$P_{\mathrm{H},t} C_{\mathrm{H},t} + P_{\mathrm{F},t} C_{\mathrm{F},t} + B_{\mathrm{H},t+1} \leq$$

$$w_t L_t + (1 + i_{t-1}) B_{\mathrm{H},t} + \int_0^1 \Pi(h) dh + T_t$$

- Define $\mathcal{B}_t \equiv \dfrac{B_{\mathrm{H},t}}{\mathbb{P}_t}$: Real NFA

Euler equations and uncovered interest parity

Combining the Euler equations for the Home and Foreign Households

$$
\begin{aligned}
\frac{U_C\left(C_t, \zeta_{C,t}\right)}{\mathbb{P}_t} &= (1+i_t)\, E_t\left[\beta \frac{U_C\left(C_{t+1}, \zeta_{C,t+1}\right)}{\mathbb{P}_{t+1}}\right] \\
\frac{U_C\left(C_t^*, \zeta_{C,t}^*\right)}{\mathcal{E}_t \mathbb{P}_t^*} &= (1+i_t)\, E_t\left[\beta \frac{U_C\left(C_{t+1}^*, \zeta_{C,t+1}^*\right)}{\mathcal{E}_{t+1} \mathbb{P}_{t+1}^*}\right]
\end{aligned}
$$

by the law of one price:

$$
E_t\left[\beta \frac{U_C\left(C_{t+1}, \zeta_{C,t+1}\right)}{U_C\left(C_t, \zeta_{C,t}\right)} \frac{\mathbb{P}_t}{\mathbb{P}_{t+1}}\right] = E_t\left[\beta \frac{U_C\left(C_{t+1}^*, \zeta_{C,t+1}^*\right)}{U_C\left(C_t^*, \zeta_{C,t}^*\right)} \frac{\mathcal{E}_t \mathbb{P}_t^*}{\mathcal{E}_{t+1} \mathbb{P}_{t+1}^*}\right]
$$

This holds in expectations only if markets are incomplete—but state by state under perfect risk sharing.

Specific to incomplete markets is a 'Wealth gap'

- Define the relative utility value of wealth (for symmetric countries), $\mathcal{W}_t$, as follows

$$\mathcal{W}_t \equiv \frac{U_C\left(C_t^*, \zeta_{C,t}^*\right)\frac{1}{\mathcal{E}_t \mathbb{P}_t^*}}{U_C\left(C_t, \zeta_{C,t}\right)\frac{1}{\mathbb{P}_t}} = \frac{U_C\left(C_t^*, \zeta_{C,t}^*\right)}{U_C\left(C_t, \zeta_{C,t}\right)}\frac{1}{\mathcal{Q}_t}$$

$\mathcal{W}_t = 1$ if complete markets, but $\mathcal{W}_t \lesseqgtr 1$ if markets are incomplete: shocks will generally result in a gap (or wedge) in the (marginal-utility) valuation of wealth across countries.

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  - $\mathcal{W}_t > 1$: given the relative price of consumption, Home demand is inefficiently high relative to Foreign.

Welfare loss function

Policy cooperation with commitment

In the log-linearized symmetric equilibrium, denoting with an upper-bar steady-state values:

- $\widehat{x}_t = \ln x_t / \overline{x}$ represents **deviations under sticky prices** ($\widehat{x}_t^{fb}$ in the first best allocation and $\widehat{x}_t^{na}$ in the natural allocation)
- We denote gaps with a tilde:
  $\widetilde{x}_t = \widehat{x}_t - \widehat{x}_t^{fb}$ denotes welfare relevant **gaps** ($\widetilde{x}_t^{na} = \widehat{x}_t - \widehat{x}_t^{na}$ from natural allocation).

(Global) Loss function

$$\mathcal{L}_t^W - \left(\mathcal{L}_t^W\right)^{fb} \ltimes -(\sigma+\eta)\left[\left(\widetilde{Y}_{H,t}\right)^2 + \left(\widetilde{Y}_{F,t}\right)^2\right] +$$

$$-\frac{\theta}{\kappa}\left[a_{\mathrm{H}}\pi_{H,t}^2 + (1-a_{\mathrm{H}})\,\pi_{F,t}^2 + a_{\mathrm{H}}\pi_{F,t}^{*2} + (1-a_{\mathrm{H}})\,\pi_{H,t}^{*2}\right] +$$

$$\boxed{\frac{2a_{\mathrm{H}}(1-a_{\mathrm{H}})}{4a_{\mathrm{H}}(1-a_{\mathrm{H}})(\sigma\phi-1)+1}\left[\begin{array}{c}(\sigma\phi-1)\,\sigma\left(\left(\widetilde{Y}_{H,t}\right)-\left(\widetilde{Y}_{F,t}\right)\right)^2 + \\ -\phi\left(\widetilde{\Delta}_t+\sigma\widetilde{D}_t-\widetilde{\mathcal{Q}}_t\right)^2\end{array}\right]}$$

$$+t.i.p. + o\left(\zeta^3\right)$$

Second order approximation to sum of country utilities depends on familiar terms in output gaps and inflation (CPI $= a_{\mathrm{H}}\pi_{H,t} + (1-a_{\mathrm{H}})\,\pi_{F,t}$), but also new terms due to *heterogeneity* in *preferences, price stickiness (LCP)* and *wealth across borders:*

The arguments in the loss function

- In addition to
  - Inflation (domestic vs imported)
  - Output gap
- the loss function includes **welfare-relevant gaps related to openness**:
  - (relative price) Misalignment
  - Demand (current account) imbalances
- With *nominal rigidities only*—natural rate allocation is efficient. but may be unattainable under LCP (prices sticky in domestic and foreign currency)
- *Add incomplete markets*—natural rate allocation is inefficient. Shocks lead to inefficient demand (current account) imbalances.

Welfare-relevant gaps in open economy

- **Relative price misalignment: real exchange rate gap**

$$\widetilde{\mathcal{Q}}_t = \widehat{\mathcal{Q}}_t - \widehat{\mathcal{Q}}_t^{fb}$$

where *RER*: $\mathcal{Q}_t \equiv \dfrac{\mathcal{E}_t \mathbb{P}_t^*}{\mathbb{P}_t}$;

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- **Imbalances: demand gap**

$$\widetilde{\mathcal{D}}_t = \left(\left(\widehat{C}_t - \widehat{C}_t^{fb} \right) - \left(\widehat{C}_t^* - \widehat{C}_t^{*fb} \right) \right)$$

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where *RER*: $\mathcal{Q}_t \equiv \dfrac{\mathcal{E}_t \mathbb{P}_t^*}{\mathbb{P}_t}$;

- **Imbalances: demand gap**

$$\widetilde{\mathcal{D}}_t = \left(\left(\widehat{C}_t - \widehat{C}_t^{fb} \right) - \left(\widehat{C}_t^* - \widehat{C}_t^{*fb} \right) \right)$$

- If **markets are incomplete**, the two above combine into a **wealth gap, which can be positive or negative** (0 under CM)

$$\widetilde{\mathcal{W}}_t = \sigma \widetilde{\mathcal{D}}_t - \widetilde{\mathcal{Q}}_t$$

From a social perspective, given the equilibrium relative price of consumption $\widetilde{\mathcal{Q}}_t$, when $\widetilde{\mathcal{W}}_t > 0$ Home demand is inefficiently high relative to Foreign.

Why and how do incomplete markets make a difference for policy design?

- **Complete Markets**: Due to sticky prices, shocks may still open demand imbalances and misalignment — but these gaps are always proportional to each other:

$$\widetilde{\mathcal{W}}_t = 0 \quad => \quad \sigma\widetilde{\mathcal{D}}_t = \widetilde{\mathcal{Q}}_t$$

- **Incomplete Markets**: $\sigma\widetilde{\mathcal{D}}_t$ and $\widetilde{\mathcal{Q}}_t$ do not move proportionally to each other:

$$\widetilde{\mathcal{W}}_t = \sigma\widetilde{\mathcal{D}}_t - \widetilde{\mathcal{Q}}_t \neq 0$$

  In general, the optimal monetary policy will have to trade-off the three gaps above with all the other gaps (inflation, output etc.).

Welfare-relevant gaps in open economy

- **Relative price misalignment also includes TOT gap and deviation from the law of one price**

$$\widetilde{\mathcal{T}}_t = \widehat{\mathcal{T}}_t - \widehat{\mathcal{T}}_t^{fb}$$

$$\widehat{\Delta}_t = (\widehat{\mathcal{E}}_t + \widehat{P}^*_{\mathrm{H},t} - \widehat{P}_{\mathrm{H},t}) = (\widehat{\mathcal{E}}_t + \widehat{P}^*_{\mathrm{F},t} - \widehat{P}_{\mathrm{F},t})$$

where *ToT*: $\mathcal{T}_t \equiv \dfrac{P_{\mathrm{F},t}}{\mathcal{E}_t P^*_{\mathrm{H},t}}$

- All gaps are a function of $\widetilde{\mathcal{W}}_t$.

Targeting rules in bond economies

Under policy cooperation with commitment/timeless perspective

At global level

- Cooperative policy targets sum of inflation and output gaps (same as CM):

$$
\begin{aligned}
0 &= \left[\widetilde{Y}_{H,t} - \widetilde{Y}_{H,t-1}\right] + \left[\widetilde{Y}_{F,t} - \widetilde{Y}_{F,t-1}\right] + \\
&\quad \theta\left[a_{\mathrm{H}}\pi_{H,t} + (1 - a_{\mathrm{H}})\,\pi_{F,t} + a_{\mathrm{H}}\pi^{*}_{F,t} + (1 - a_{\mathrm{H}})\,\pi^{*}_{H,t}\right];
\end{aligned}
$$

- Country-specific rules differ across LCP and PCP

Optimal targeting rules for bond economies: LCP

- Closed-form solution for country rules when $\eta = 0$ (infinite labor elasticity) :

$$0 = \underbrace{\boxed{\theta\left(\pi + \pi^*\right) + \left(\widetilde{\mathcal{D}}_t - \widetilde{\mathcal{D}}_{t-1}\right)}}_{CM \text{ target rule}}$$

$$+ \frac{4a_{\mathrm{H}}\left(1 - a_{\mathrm{H}}\right)\left(\sigma - 1\right)\phi}{2a_{\mathrm{H}}\left(\phi - 1\right) + 1}\left[\left(\widetilde{\mathcal{W}}_t - \widetilde{\mathcal{W}}_{t-1}\right) + \left(\widetilde{\Delta}_t - \widetilde{\Delta}_{t-1}\right)\right]$$

- For $\sigma = 1$ same formal rule as under CM. Yet different allocation, since $\widetilde{\mathcal{W}}_t$ creates trade-offs between inflation, demand and misalignment.

Optimal targeting rules for bond economies: PCP

- General closed form solution:

$$0 = \underbrace{\boxed{\theta \pi_{H,t} + \left(\widetilde{Y}_{H,t} - \widetilde{Y}_{H,t-1} \right)}}_{CM \text{ target rule}}$$

$$+ (1 - a_{\mathrm{H}}) \Gamma (\cdot) \left[\left(\widetilde{\mathcal{W}}_t - \widetilde{\mathcal{W}}_{t-1} \right) \right]$$

where $\Gamma(\cdot)$ function of σ, ϕ, η.

- When $\Gamma = 0$ (e.g., for $\sigma = \phi = 1$) same formal rule as under—but no "divine coincidence": still trade-offs between $\pi_{H,t}$ and output gap, both a function of $\widetilde{\mathcal{W}}_t \neq 0$.

A look at the Phillips Curve

$$\pi_{H,t} - \beta E_t \pi_{H,t+1} =$$
$$\frac{(1-\alpha\beta)(1-\alpha)}{\alpha}\left[\begin{array}{c} (\sigma+\eta)\widetilde{Y}_{H,t} + \widehat{\mu}_t + \\ -(1-a_{\mathrm{H}})\left[2a_{\mathrm{H}}(\sigma\phi-1)\left(\widetilde{\mathcal{T}}_t + \widetilde{\Delta}_t\right) - \widetilde{\Delta}_t - \widetilde{\mathcal{W}}_t\right] \end{array}\right]$$

$$\pi^*_{H,t} - \beta E_t \pi^*_{H,t+1} = \pi_{H,t} - \beta E_t \pi_{H,t+1} + \frac{(1-\alpha\beta)(1-\alpha)}{\alpha}\widehat{\Delta}_t,$$

- Open-economy gaps (related to LCP and incomplete markets) act much like **endogenous markup shocks**.

The optimal response to inefficient capital flows

Focus on **inflows** $\left(\widehat{\mathcal{B}}_t < 0\right)$ due to **news** shocks leading to excessive demand $\widetilde{\mathcal{W}}_t > 0$

$\sigma = 1$ and $\phi \geq 1$

shocks: anticipated changes in preferences, technology, capital controls (political risk)

Some with equivalent analytical representation

To set the stage: why are capital flows inefficient in response to new shocks?

- In standard NK model with no capital, first-best (notional) capital flows only respond to contemporaneous shocks

$$\widehat{\mathcal{B}}_t^{fb} - \beta^{-1}\widehat{\mathcal{B}}_{t-1}^{fb} = \left(1 - a_{\mathrm{H}}\right)\sigma^{-1}\left[\begin{array}{c}\left(2a_{\mathrm{H}}\left(\sigma\phi - 1\right) + 1 - \sigma\right)\widehat{\mathcal{T}}_t^{fb} \\ -\left(\widehat{\zeta}_{C,t} - \widehat{\zeta}_{C,t}^{*}\right)\end{array}\right]$$

- In bond economies, capital flows (NFA dynamics) respond also to news shocks, even under flex prices:

$$\widehat{\mathcal{B}}_t - \beta^{-1}\widehat{\mathcal{B}}_{t-1} = \left(1 - \beta^{-1}\right)\widehat{\mathcal{B}}_{t-1} +$$
$$-\left(1 - a_{\mathrm{H}}\right)\sigma^{-1}\beta\sum_{j=1}^{\infty}\beta^{j}\left\{\begin{array}{c}\left(2a_{\mathrm{H}}\left(\sigma\phi - 1\right) + 1 - \sigma\right)E_t\left(\Delta\widehat{\mathcal{T}}_{t+1+j}^{fb}\right) + \\ -E_t\left(\Delta\left(\widehat{\zeta}_{C,t+1+j} - \widehat{\zeta}_{C,t+1+j}^{*}\right)\right)\end{array}\right\},$$

Flows are invariably indicators of inefficient borrowing and lending relative to first best!

How is the wealth gap related to inefficient capital flows?

- Everything else equal, capital inflows $\widehat{\mathcal{B}}_t < 0$ leads to positive wealth gaps $\widetilde{\mathcal{W}}_t$,

$$\begin{aligned}\widetilde{\mathcal{W}}_t &= -2\sigma\left[\widehat{\mathcal{B}}_t - \beta^{-1}\widehat{\mathcal{B}}_{t-1}\right] + \\ &\quad \sigma\left[\widetilde{Y}_{H,t} + \widetilde{Y}_{F,t} - 2\left(1 - a_{\mathrm{H}}\right)\widetilde{\mathcal{T}}_t\right] - \widetilde{\mathcal{Q}}_t + shocks\end{aligned}$$

  but $\widetilde{\mathcal{W}}_t$ also depend on output gaps and misalignment. Depending on shocks and parameter values, in equilibrium $\widetilde{\mathcal{W}}_t$, may have the same sign as $\widehat{\mathcal{B}}_t$. This will be important later.

LCP economies: What can monetary policy do?

- Since market are incomplete, monetary policy cannot redress demand gap and misalignment at once:

$$\widetilde{\mathcal{W}}_t \equiv \widetilde{D}_t - \widetilde{\mathcal{Q}}_t \neq 0$$

  So it will have to optimally trade offs these with other gaps.
- Important result: for $\eta = 0$ and $\sigma = 1$, we can prove that under LCP capital flows are **as exogenous (for any trade elasticity)** to policy and macroeconomic allocation.
  - With log utility, monetary **policy cannot curb $\widehat{\mathcal{B}}_t$ nor change $\widetilde{\mathcal{W}}_t$**

LCP: Optimal response to inefficient capital inflows–inflation

In response to news shock, when $\phi \geq 1$, $\widehat{\mathcal{B}}_t < 0$ leads to $\widetilde{\mathcal{W}}_t > 0$:
Excessive domestic demand and currency overvaluation

- Home monetary stance relatively *contractionary*, negative *CPI inflation*:

$$\theta\left[a_{\mathrm{H}}\pi_{H,t_0} + (1 - a_{\mathrm{H}})\,\pi_{F,t_0}\right] = -\,(1 - a_{\mathrm{H}})\underbrace{\frac{(\beta\varkappa_2 - 1)}{\beta\varkappa_2}}_{>1}\widetilde{\mathcal{W}}_{t_0} < 0$$

- The contractionary stance leads to a *negative output gap* that is large

$$\widetilde{Y}_{H,t_0} = -\,(1 - a_{\mathrm{H}})\underbrace{\left[2a_{\mathrm{H}}\frac{(\beta\nu_2 - 1)}{\beta\nu_2} - (2a_{\mathrm{H}} - 1)\frac{(\beta\varkappa_2 - 1)}{\beta\varkappa_2}\right]}_{>1}\widetilde{\mathcal{W}}_{t_0} < 0$$

compared to CPI stabilization

$$\widetilde{Y}_{H,t_0} = -\,(1 - a_{\mathrm{H}})\,\widetilde{\mathcal{W}}_{t_0} < 0$$

LCP: Optimal response to inefficient capital inflows–demand gap

- The Home contractionary stance mitigates demand imbalances:

$$\widetilde{C}_{t_0} = (1 - a_{\mathrm{H}}) \frac{(\beta \varkappa_2 - 1)}{\beta \varkappa_2} \widetilde{\mathcal{W}}_{t_0} > 0$$

compared to CPI stabilization

$$\widetilde{C}_{t_0} = (1 - a_{\mathrm{H}}) \widetilde{\mathcal{W}}_{t_0} > 0$$

- Demand imbalance is smaller in **more open** economies (lower a_{H}) or with **more flexible** prices $\frac{(\beta \varkappa_2 - 1)}{\beta \varkappa_2} \to 1$ implying **higher pass-through**.

LCP: Optimal response to inefficient capital inflows–misalignment

- The contractionary stance however generates **greater RER appreciation**

$$\widetilde{\mathcal{Q}}_{t_0} = -\left[(2a_{\mathrm{H}} - 1)\,\frac{(\beta\varkappa_2 - 1)}{\beta\varkappa_2} + \frac{1}{\beta\varkappa_2}\right]\widetilde{\mathcal{W}}_{t_0} < 0$$

compared to CPI stabilization

$$\widetilde{\mathcal{Q}}_{t_0} = -\,(2a_{\mathrm{H}} - 1)\,\widetilde{\mathcal{W}}_{t_0} < 0$$

- Misalignments are smaller, in more open economies (smaller a_{H}) or with more flexible prices (higher pass-through):

$$\frac{(\beta\varkappa_2 - 1)}{\beta\varkappa_2} \to 1,\ \frac{1}{\beta\varkappa_2} \to 0$$

PCP: What can monetary policy do?

- Given $\widetilde{\mathcal{W}}_t$, again, monetary policy cannot redress both demand gap and misalignment, since:

$$\widetilde{\mathcal{W}}_t \equiv \widetilde{D}_t - \widetilde{\mathcal{Q}}_t \neq 0$$

  but can trade-offs these with the other gaps.
- Under PCP, stricter conditions for capital flows not to respond to monetary policy: $\sigma = 1$, but also $\phi = 1$.
- For general trade elasticities, capital flows will be endogenous: when $\phi >> 1$, a monetary expansion *reduces* the size of inflows.

PCP: Optimal response to inefficient capital inflows

Consider $\widehat{\mathcal{B}}_t < 0$ **and** $\widetilde{\mathcal{W}}_t > 0$ (for $\phi \geq 1$):
Excessive domestic demand and currency overvaluation

- Home monetary stance relatively *expansionary*, leading to positive *domestic inflation*; on impact:

$$\theta \pi_{H,t_0} = (1 - a_{\mathrm{H}}) \frac{(\beta\varkappa_2 - 1)}{\beta\varkappa_2} \frac{4a_{\mathrm{H}}(1-a_{\mathrm{H}})(\phi-1)+1}{2a_{\mathrm{H}}(\phi-1)+1} \widetilde{\mathcal{W}}_{t_0} > 0$$

- Because of expenditure switching, optimal monetary policy contains negative output gap

$$\widetilde{Y}_{H,t_0} = -(1 - a_{\mathrm{H}}) \frac{\left[\frac{\beta\varkappa_2 - 1}{\beta\varkappa_2}(2a_{\mathrm{H}}(\phi-1)+1)^2 + 4a_{\mathrm{H}}^2\phi(\phi-1)/(\beta\varkappa_2)\right]}{2a_{\mathrm{H}}(\phi-1)+1} \widetilde{\mathcal{W}}_{t_0} > 0$$

compared to natural rate — for $\phi \geq 1$:

$$\widetilde{Y}^{na}_{H,t_0} = -(1 - a_{\mathrm{H}}) \left[2a_{\mathrm{H}}(\phi - 1) + 1\right] \widetilde{\mathcal{W}}^{na}_{t_0} > 0$$

PCP: Optimal response to inefficient capital inflows

- Expansionary stance results in weaker RER appreciation (ratio < 1):

$$\widetilde{\mathcal{Q}}_{t_0} = -\left(2a_{\mathrm{H}}-1\right)\underbrace{\frac{\left[2a_{\mathrm{H}}\left(\phi-1\right)+1-2\left(1-a_{\mathrm{H}}\right)/\left(\beta\varkappa_2\right)\right]}{2a_{\mathrm{H}}\left(\phi-1\right)+1}}_{<1}\widetilde{\mathcal{W}}_{t_0} < 0$$

$$\widetilde{\mathcal{Q}}^{na}_{t_0} = -\left(2a_{\mathrm{H}}-1\right)\widetilde{\mathcal{W}}^{na}_{t_0} < 0$$

whereas lower appreciation also curbs capital inflows: $\widetilde{\mathcal{W}}_{t_0} < \widetilde{\mathcal{W}}^{na}_{t_0}$.

- Yet easier stance results in a larger domestic demand (ratio > 1):

$$\widetilde{C}_t = \frac{2\left(1-a_{\mathrm{H}}\right)\left[2a_{\mathrm{H}}\left(\phi-1\right)+1+\frac{\left(2a_{\mathrm{H}}-1\right)}{\beta\varkappa_2}\right]}{2a_{\mathrm{H}}\left(\phi-1\right)+1}\widetilde{\mathcal{W}}_t$$

$$\widetilde{C}^{na}_t = 2\left(1-a_{\mathrm{H}}\right)\widetilde{\mathcal{W}}^{na}_{t_0}$$

- Less weight on currency misalignment in **less open** economies (larger a_{H}) or with **more flexible** prices (**higher pass-through** as $\frac{\left(\beta\varkappa_2-1\right)}{\beta\varkappa_2} \to 1$ and $\frac{1}{\beta\varkappa_2} \to 0$)

A comparison between LCP and PCP: unit-elasticity benchmark

- Set $\sigma = \phi = 1$, so that $\widehat{\mathcal{B}}_t$ **and** $\widehat{\mathcal{W}}_t$ **are exogenous (hence identical) under both LCP and PCP**

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- Under PCP, when capital inflows tend to appreciate the exchange rate, competitiveness concerns play a much larger role in shaping the optimal response of monetary policy. With complete pass-through, it is optimal for monetary authorities to tolerate a short run increase in inflation, to contrast competitiveness losses and the widening of domestic output gaps.

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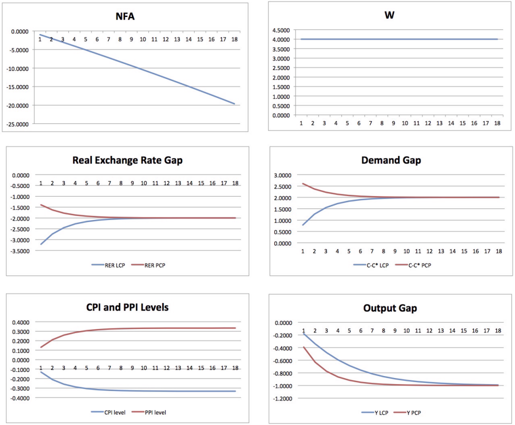
- Stance more contractionary under LCP than under PCP: under the optimal policy, **exchange rate in more volatile**, output gap smaller **if LCP**.

Optimal policy: PCP vs LCP

Shocks (anticipated 5 years) generating capital flows 1 percent of GDP



PCP: monetary policy curbs size of inflows

- While with $\sigma = 1$ capital flows are exogenous in LCP, in PCP expansion can affect capital flows via its effects on
  - exchange rate depreciation (via returns) –
  - domestic demand (affecting borrowing) $++$.
- When $\phi \geq 1$ (more in general, when $\phi \geq \frac{(2a_{\mathrm{H}}-1)}{2a_{\mathrm{H}}}$) first effect (–) dominate: monetary easing reduces capital inflows relative to the natural rate allocation.

THE ROLE OF ELASTICITY $\phi < 1$

Shocks to both preferences and productivity,

but only anticipated or "**new shocks**" (for analytical clarity)

Why do trade elasticities matter?

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  - below $\overline{\phi}$, $\widehat{\mathcal{W}}_t < 0$, stabilizing inefficiently low domestic demand becomes the key policy concern.
- Key result: if $\phi < \overline{\phi}$, **optimal monetary stance at Home is expansionary** in both LCP and PCP economies.

LCP: elasticity thresholds depend on shocks

- Conditional on **anticipated taste shocks** only, $\widehat{\mathcal{B}}_t$ and $\widehat{\mathcal{W}}_t$ have the opposite sign if:

$$\phi > \overline{\phi}^{LCP} = \frac{2a_{\mathrm{H}} - \frac{\beta\nu_2}{(\beta\nu_2 - 1)}}{2a_{\mathrm{H}}} < 1.$$

  Threshold smaller in economies that are more open ($a_{\mathrm{H}} \longrightarrow 1/2$) or where prices are stickier ($\nu_2 \longrightarrow 1/\beta$)

- Conditional on **anticipated productivity shocks**, the threshold is larger (as $\nu_1 \leq 1 < \beta^{-1} \leq \nu_2$)

$$\phi > \overline{\phi}^{LCP} = \frac{2a_{\mathrm{H}} - \frac{\beta\nu_2(1-\beta\nu_1)}{(\beta\nu_2 - 1)}}{2a_{\mathrm{H}}} < 1.$$

LCP: optimal stance 'switch to expansionary' for elasticity below thresholds

- With $\widehat{\mathcal{B}}_t < 0$ leads to $\widehat{\mathcal{W}}_t < 0$: at Home, the optimal policy response is relatively expansionary (rather than contractionary, optimal for $\widehat{\mathcal{W}}_t > 0$), up to turning the output gap *positive*

$$\left(\widehat{Y}_{H,t_0} - \widetilde{Y}^{fb}_{H,t_0}\right) = -(1 - a_{\mathrm{H}}) \underbrace{\left[2a_{\mathrm{H}}\frac{(\beta\nu_2 - 1)}{\beta\nu_2} - (2a_{\mathrm{H}} - 1)\frac{(\beta\varkappa_2 - 1)}{\beta\varkappa_2}\right]}_{>1} \widehat{\mathcal{W}}_{t_0}$$

$$\left(\widetilde{Y}^{na}_{H,t_0} - \widetilde{Y}^{fb}_{H,t_0}\right) = -(1 - a_{\mathrm{H}}) \widehat{\mathcal{W}}_{t_0} > 0$$

Relative to strict CPI stabilization aggregate demand and economic activity are higher, and the RER undervalued

PCP: threshold is unique, so is the sign of the optimal monetary stance (expansionary)

$$\phi \leq \overline{\phi}^{PCP} = \frac{2a_{\mathrm{H}} - 1}{2a_{\mathrm{H}}} < 1.$$

smaller the higher openness ($a_{\mathrm{H}} \to 1/2$), higher than both $\overline{\phi}^{LCP}$.

- For $\phi \leq \overline{\phi}^{PCP}$, on the face of a capital inflows, Home monetary policy **remains more expansionary than under PPI price stability**, as for $\phi \geq 1$:

$$\theta \pi_{H,t_0} = (1 - a_{\mathrm{H}}) \frac{(\beta \varkappa_2 - 1)}{\beta \varkappa_2} \underbrace{\frac{[4a_{\mathrm{H}}(1 - a_{\mathrm{H}})(\phi - 1) + 1] \widehat{\mathcal{W}}_{t_0}}{2a_{\mathrm{H}}(\phi - 1) + 1}}_{>0} > 0$$

  But monetary easing now targets insufficient domestic demand: it turns **output gap positive** and further weakens the exchange rate.
- Because of its effects on demand, the **external deficits actually rises**.

Conclusions

- Optimal monetary policy resolves the trade-offs raised by inefficient capital flows and exchange rate misalignment differently, depending on the degree of exchange rate pass-through, openness and the price elasticity of exports to the terms of trade (or the real exchange rate)
- Incomplete markets important and useful starting point to understand monetary policy implications of inefficient capital flows. Key directions of future research
  - Asymmetric pass through (dollar pricing)
  - different forms of financial frictions
- Complementary to dilemma literature: though better tools could exist (MacroPru), monetary policy may still be needed.

How should monetary policy respond to capital inflows?