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>
<thead>
<tr>
<th>Monetary Policy Stance</th>
<th>All countries</th>
<th>Advanced</th>
<th>Emerging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monetary Policy Easing</td>
<td>18</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Monetary Policy Neutral</td>
<td>14</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Monetary Policy Tightening</td>
<td>18</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>13</strong></td>
<td><strong>37</strong></td>
</tr>
</tbody>
</table>

**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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- trade elasticity
- exchange rate pass through
- import share in demand
The paper(s) underling the talk: CDL

- Joint work with Luca Dedola (European Central Bank and CEPR) and Sylvain Leduc (Bank of Canada):
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- "tip-of-the-iceberg" paper building on CDL 2008 RESTUD (theory), 2008 JME (DSGEs) and CDL 2010 Handbook (policy).

- examines the monetary policy **trade-offs** due to inefficient capital flows, resulting from **uninsurable shocks to the natural borrowing constraint.**
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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.
Main take away

- Consider capital inflows leading to excessive demand and appreciation
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  - **stabilizing aggregate demand and inflation**, at the cost of exacerbating real currency overvaluation
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  - ...with low exchange-rate pass-through, relatively sticky prices and a low degree of openness
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  - **Stance is tighter than required to strictly target (CPI) inflation under LCP** (unless trade elasticity is low)
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- Consider **capital inflows** leading to **excessive demand** and appreciation
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Main take away

- Consider **capital inflows** leading to **excessive demand** and **appreciation**

- Policy trade-offs are optimized in favor of
  1. Stabilizing aggregate **demand and inflation**, at the cost of exacerbating real currency overvaluation
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  2. Leaning against real appreciation and loss of **competitiveness**, at the cost of higher demand and some inflation,
     - ...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):
  - Devereux and Yu [2016]—optimal monetary policy under discretion with occasionally binding constraint in SOE.
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?
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)
Model set up

- 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):

$$U(\cdot) = \zeta_{C,t} \frac{C_t^{1-\sigma}}{1-\sigma} - \omega \frac{L_t^{1+\eta}}{1+\eta}, \quad \sigma > 0, \eta \geq 0$$
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- Consumption CES aggregate of Home ($C_{H,t}$) and Foreign ($C_{F,t}$) varieties:
  \[
  C = \left[ a_H^{\phi-1} C_H^\phi + (1 - a_H)^{\phi-1} C_F^\phi \right]^{\phi/(\phi-1)}, \quad \phi > 0
  \]
  \[
  C_{H,t} \equiv \left[ \int_0^1 C_t(h) \frac{\theta-1}{\theta} \, dh \right]^{\theta/(\theta-1)} \quad C_{F,t} \equiv \left[ \int_0^1 C_t(f) \frac{\theta-1}{\theta} \, df \right]^{\theta/(\theta-1)}
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- Trade parameters:
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- Trade parameters:

- $\phi > 0$: Intratemporal elasticity; $1 - a_H$: Openness
Price indexes and international prices

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

\[ \Pi_t = \left[ a_H P_{H,t}^{1-\phi} + a_F P_{F,t}^{1-\phi} \right]^{\frac{1}{1-\phi}}. \]

Real exchange rate and terms of trade:

\[ Q_t = \frac{\mathcal{E}_t P^*_t}{\Pi_t} \]

\[ T_t = \frac{P_{F,t}}{\mathcal{E}_t P^*_H} \]
Firms: technology and firms’ problem

\[ Y(h) = \zeta_Y L(h), \]

\[ \max_{p(h), p^*(h)} E_t \sum_{k=0}^{\infty} \mathcal{M}_{t, t+k} \alpha^k \left( \frac{p_t(h)D_{t+k}(h) + \mathcal{E}_t p^*_t(h)D^*_{t+k}(h)}{MC_{t+k}(h)[D_{t+k}(h) + D^*_{t+k}(h)]} - \right) \]

where \( 1 - \alpha \) Calvo’s “fairy” probability, \( \zeta_Y \) technology shock and:

\[ D_t(h) = \int \left( \frac{p_t(h)}{P_{H, t}} \right)^{-\theta} C_{H, t} dh \]

\[ D^*_t(h) = \int \left( \frac{p^*_t(h)}{P^*_{H, t}} \right)^{-\theta} C^*_{H, t} dh \]
Firms: Producer and local currency pricing

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

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

- PCP: \( \mathcal{P}_t^*(h) = \mathcal{P}_t(h)/E_t \) (law of one price holds)
Firms: Producer and local currency pricing

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

\[ P_t(h) = \frac{\theta}{\theta - 1} \frac{E_t \sum_{k=0}^{\infty} \alpha^k M_{t,t+k} D_{t+k}(h) MC_{t+k}(h)}{E_t \sum_{k=0}^{\infty} \alpha^k M_{t,t+k} D_{t+k}(h)} \]

- PCP: \( P_t^*(h) = P_t(h) / \varepsilon_t \) (law of one price holds)

- LCP: Foreign currency price \( P_t^*(h) \) charged to customers abroad is also sticky.

\[ P_t^*(h) = \frac{\theta}{\theta - 1} \frac{E_t \sum_{k=0}^{\infty} \alpha^k M_{t,t+k} D_{t+k}^* (h) MC_{t+k}(h)}{E_t \sum_{k=0}^{\infty} \alpha^k M_{t,t+k} \varepsilon_{t+k} D_{t+k}^*(h)} \]
Households trade risk-free bond paying in Home currency $B_{H,t}$ (denomination immaterial with zero NFA):

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

Define $B_t \equiv \frac{B_{H,t}}{P_t} : \text{Real NFA}$
Euler equations and uncovered interest parity

Combining the Euler equations for the Home and Foreign Households

\[
\frac{UC(C_t, \zeta_{C,t})}{P_t} = (1 + i_t) \beta \frac{UC(C_{t+1}, \zeta_{C,t+1})}{P_{t+1}}
\]

\[
\frac{UC(C^*_t, \zeta^*_{C,t})}{E_t P^*_t} = (1 + i_t) \beta \frac{UC(C^*_{t+1}, \zeta^*_{C,t+1})}{E_{t+1} P^*_{t+1}}
\]

by the law of one price:

\[
E_t \left[ \beta \frac{UC(C_{t+1}, \zeta_{C,t+1})}{UC(C_t, \zeta_{C,t})} \frac{P_t}{P_{t+1}} \right] = E_t \left[ \beta \frac{UC(C^*_{t+1}, \zeta^*_{C,t+1})}{UC(C^*_t, \zeta^*_{C,t})} \frac{E_t P^*_t}{E_{t+1} P^*_{t+1}} \right]
\]

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

$$
\mathcal{W}_t \equiv \frac{U_C(C^*_t, \zeta^*_C, t)}{U_C(C_t, \zeta^*_C, t)} \frac{1}{P_t^*} = \frac{U_C(C^*_t, \zeta^*_C, t)}{U_C(C_t, \zeta^*_C, t)} \frac{1}{Q_t}
$$

$\mathcal{W}_t = 1$ if complete markets, but $\mathcal{W}_t \leq 1$ 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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- $\mathcal{W}_t$ enters the loss function and the optimal targeting rule (see e.g. Woodford 2011, closed economy with agents heterogeneity).
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- Define the relative utility value of wealth (for symmetric countries), \( \mathcal{W}_t \), as follows

\[
\mathcal{W}_t \equiv \frac{U_C(C_t^*, \zeta_{C,t}) \frac{1}{\varepsilon_t P_t^*}}{U_C(C_t, \zeta_{C,t}) \frac{1}{P_t}} = \frac{U_C(C_t^*, \zeta_{C,t})}{U_C(C_t, \zeta_{C,t})} \frac{1}{Q_t}
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- It is welfare-relevant gap, with straightforward interpretation in terms of (global) imbalances:
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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:

- $\hat{x}_t = \ln x_t / \bar{x}$ represents **deviations under sticky prices** ($\hat{x}^{fb}_t$ in the first best allocation and $\hat{x}^{na}_t$ in the natural allocation)

- We denote gaps with a tilde:
  $\tilde{x}_t = \hat{x}_t - \hat{x}^{fb}_t$ denotes welfare relevant **gaps** ($\tilde{x}^{na}_t = \hat{x}_t - \hat{x}^{na}_t$ from natural allocation).
(Global) Loss function

\[
L_t^W - \left( L_t^W \right)^{fb} \times - (\sigma + \eta) \left[ \left( \tilde{Y}_{H,t} \right)^2 + \left( \tilde{Y}_{F,t} \right)^2 \right] + \\
- \frac{\theta}{\kappa} \left[ a_H \pi_H^2, t + (1 - a_H) \pi_F^2, t + a_H \pi_F^*^2, t + (1 - a_H) \pi_H^*, t \right] + \\
\frac{2a_H(1-a_H)}{4a_H(1-a_H)(\sigma\phi-1)+1} \left[ (\sigma\phi - 1) \sigma \left( \left( \tilde{Y}_{H,t} \right) - \left( \tilde{Y}_{F,t} \right) \right)^2 \right. \\
- \left. \phi \left( \tilde{\Delta}_t + \sigma \tilde{D}_t - \tilde{Q}_t \right)^2 \right] + t.i.p. + o \left( \zeta^3 \right)
\]

Second order approximation to sum of country utilities depends on familiar terms in output gaps and inflation (\( \text{CPI} = a_H \pi_H,t + (1 - a_H) \pi_F,t \)), but also new terms due to heterogeneity in preferences, price stickiness (\( \text{LCP} \)) 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.
Relative price misalignment: real exchange rate gap

\[ \tilde{Q}_t = \hat{Q}_t - \hat{Q}_{fb} \]

where \( RER \): \( Q_t \equiv \frac{E_t P^*_t}{P_t} \).
Welfare-relevant gaps in open economy

- **Relative price misalignment: real exchange rate gap**
  \[ \tilde{Q}_t = \hat{Q}_t - \hat{Q}_t^{fb} \]

  where \( RER: Q_t \equiv \frac{E_t P^*_t}{P_t} \);

- **Imbalances: demand gap**
  \[ \tilde{D}_t = \left( \left( \hat{C}_t - \hat{C}_t^{fb} \right) - \left( \hat{C}_t^* - \hat{C}_t^{*fb} \right) \right) \]

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

From a social perspective, given the equilibrium relative price of consumption $e Q_t$, when $f W_t > 0$ Home demand is inefficiently high relative to Foreign.
Welfare-relevant gaps in open economy

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

- If markets are incomplete, the two above combine into a **wealth gap**, which can be positive or negative (0 under CM)
  \[
  \tilde{W}_t = \sigma \tilde{D}_t - \tilde{Q}_t
  \]

From a social perspective, given the equilibrium relative price of consumption \( \tilde{Q}_t \), when \( \tilde{W}_t > 0 \) 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:

  \[ \tilde{W}_t = 0 \quad \Rightarrow \quad \sigma \tilde{D}_t = \tilde{Q}_t \]

- **Incomplete Markets**: \( \sigma \tilde{D}_t \) and \( \tilde{Q}_t \) do not move proportionally to each other:

  \[ \tilde{W}_t = \sigma \tilde{D}_t - \tilde{Q}_t \neq 0 \]

In general, the optimal monetary policy will have to trade-off the three gaps above with all the other gaps (inflation, output etc.).
Relative price misalignment also includes TOT gap and deviation from the law of one price

\[ \hat{T}_t = \hat{T}_t - \hat{T}_t^{fb} \]

\[ \hat{\Delta}_t = (\hat{E}_t + \hat{P}^*_H,t - \hat{P}_H,t) = (\hat{E}_t + \hat{P}^*_F,t - \hat{P}_F,t) \]

where ToT: \( T_t \equiv \frac{P_F,t}{\varepsilon_t P^*_H,t} \)

All gaps are a function of \( \hat{\mathcal{W}}_t \).
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):

\[ 0 = \left( \tilde{Y}_{H,t} - \tilde{Y}_{H,t-1} \right) + \left( \tilde{Y}_{F,t} - \tilde{Y}_{F,t-1} \right) + \theta \left[ a_H \pi_{H,t} + (1 - a_H) \pi_{F,t} + a_H \pi_{F,t}^* + (1 - a_H) \pi_{H,t}^* \right]; \]

- Country-specific rules differ across LCP and PCP
Closed-form solution for country rules when $\eta = 0$ (infinite labor elasticity):

$$0 = \theta (\pi + \pi^*) + \left( \tilde{D}_t - \tilde{D}_{t-1} \right)$$

CM target rule

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

For $\sigma = 1$ same formal rule as under CM. Yet different allocation, since $\tilde{\mathcal{W}}_t$ creates trade-offs between inflation, demand and misalignment.
Optimal targeting rules for bond economies: PCP

- General closed form solution:

\[ 0 = \theta \pi_{H,t} + \left( \tilde{\mathit{Y}}_{H,t} - \tilde{\mathit{Y}}_{H,t-1} \right) + (1 - a_H) \Gamma (\cdot) \left[ \left( \tilde{\mathit{W}}_t - \tilde{\mathit{W}}_{t-1} \right) \right] \]

where \( \Gamma (\cdot) \) function of \( \sigma, \phi, \eta \).

- 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 \( \tilde{\mathit{W}}_t \neq 0 \).
A look at the Phillips Curve

\[
\pi_{H,t} - \beta E_t \pi_{H,t+1} = \frac{(1 - \alpha \beta) (1 - \alpha)}{\alpha} \left[ (\sigma + \eta) \tilde{Y}_{H,t} + \tilde{\mu}_t + - (1 - a_H) \left[ 2a_H (\sigma \phi - 1) \left( \tilde{T}_t + \tilde{\Delta}_t \right) - \tilde{\Delta}_t - \tilde{\mathcal{W}}_t \right] \right]
\]

\[
\pi_{H,t}^* - \beta E_t \pi_{H,t+1}^* = \pi_{H,t} - \beta E_t \pi_{H,t+1} + \frac{(1 - \alpha \beta) (1 - \alpha)}{\alpha} \tilde{\Delta}_t,
\]

- 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 \( B_t < 0 \) due to news shocks leading to excessive demand \( \tilde{N}_t > 0 \)
\[
\sigma = 1 \text{ and } \phi \geq 1
\]
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

\[
\hat{B}_{t}^{\text{fb}} - \beta^{-1} \hat{B}_{t-1}^{\text{fb}} = (1 - a_H) \sigma^{-1} \left[ (2a_H (\sigma \phi - 1) + 1 - \sigma) \hat{T}_{t}^{\text{fb}} - \left( \hat{\zeta}_{C,t} - \hat{\zeta}_{C,t}^{*} \right) \right]
\]

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

\[
\hat{B}_{t} - \beta^{-1} \hat{B}_{t-1} = (1 - \beta^{-1}) \hat{B}_{t-1} + (1 - a_H) \sigma^{-1} \beta \sum_{j=1}^{\infty} \beta^{j} \left\{ \left( 2a_H (\sigma \phi - 1) + 1 - \sigma \right) E_t \left( \Delta \hat{T}_{t+1+j}^{\text{fb}} \right) + E_t \left( \Delta \left( \hat{\zeta}_{C,t+1+j} - \hat{\zeta}_{C,t+1+j}^{*} \right) \right) \right\},
\]

Flows are invariably indicators of inefficient borrowing and lending relative to first best!
Everything else equal, capital inflows $\hat{B}_t < 0$ leads to positive wealth gaps $\tilde{W}_t$,

$$\tilde{W}_t = -2\sigma \left[ \hat{B}_t - \beta^{-1} \hat{B}_{t-1} \right] +$$

$$\sigma \left[ \tilde{Y}_{H,t} + \tilde{Y}_{F,t} - 2 (1 - a_{H}) \tilde{\tau}_t \right] - \tilde{Q}_t + \text{shocks}$$

but $\tilde{W}_t$ also depend on output gaps and misalignment. Depending on shocks and parameter values, in equilibrium $\tilde{W}_t$, may have the same sign as $\hat{B}_t$. This will be important later.
Since market are incomplete, monetary policy cannot redress demand gap and misalignment at once:

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

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 $$\tilde{B}_t$$ nor change $$\tilde{\mathcal{W}}_t$$
LCP: Optimal response to inefficient capital inflows—
inflation

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

- Home monetary stance relatively contractionary, negative CPI inflation:

$$\theta \left[ a_H \pi_{H,t_0} + (1 - a_H) \pi_{F,t_0} \right] = - (1 - a_H) \frac{(\beta \kappa_2 - 1)}{\beta \kappa_2} \hat{\mathcal{W}}_{t_0} < 0$$

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

$$\tilde{Y}_{H,t_0} = - (1 - a_H) \left[ 2a_H \frac{(\beta \nu_2 - 1)}{\beta \nu_2} - (2a_H - 1) \frac{(\beta \kappa_2 - 1)}{\beta \kappa_2} \right] \hat{\mathcal{W}}_{t_0} < 0$$

compared to CPI stabilization

$$\tilde{Y}_{H,t_0} = - (1 - a_H) \hat{\mathcal{W}}_{t_0} < 0$$
LCP: Optimal response to inefficient capital inflows—demand gap

- The Home contractionary stance mitigates demand imbalances:

\[
\tilde{C}_t_0 = (1 - a_H) \frac{\beta \nu_2 - 1}{\beta \nu_2} \tilde{N}_{t_0} > 0
\]

compared to CPI stabilization

\[
\tilde{C}_t_0 = (1 - a_H) \tilde{N}_{t_0} > 0
\]

- Demand imbalance is smaller in more open economies (lower \(a_H\)) or with more flexible prices \(\frac{\beta \nu_2 - 1}{\beta \nu_2} \to 1\) implying higher pass-through.
LCP: Optimal response to inefficient capital inflows—misalignment

- The contractionary stance however generates greater RER appreciation

\[
\tilde{Q}_{t_0} = - \left[ (2a_H - 1) \frac{(\beta \kappa_2 - 1)}{\beta \kappa_2} + \frac{1}{\beta \kappa_2} \right] \tilde{\mathcal{W}}_{t_0} < 0
\]

compared to CPI stabilization

\[
\tilde{Q}_{t_0} = - (2a_H - 1) \tilde{\mathcal{W}}_{t_0} < 0
\]

- Misalignments are smaller, in more open economies (smaller \(a_H\)) or with more flexible prices (higher pass-through):

\[
\frac{(\beta \kappa_2 - 1)}{\beta \kappa_2} \to 1, \quad \frac{1}{\beta \kappa_2} \to 0
\]
Given $\hat{W}_t$, again, monetary policy cannot redress both demand gap and misalignment, since:

$$\hat{W}_t \equiv \tilde{D}_t - \tilde{Q}_t \neq 0$$

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 $\phi \gg 1$, a monetary expansion reduces the size of inflows.
Consider $\hat{B}_t < 0$ and $\tilde{\mathcal{N}}_t > 0$ (for $\phi \geq 1$):

**Excessive domestic demand and currency overvaluation**

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

$$\theta \pi_{H,t_0} = (1 - a_H) \frac{(\beta \kappa_2 - 1)}{\beta \kappa_2} \frac{4a_H(1-a_H)(\phi-1)+1}{2a_H(\phi-1)+1} \tilde{\mathcal{N}}_{t_0} > 0$$

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

$$\tilde{\mathcal{Y}}_{H,t_0} = - (1 - a_H) \left[ \frac{\beta \kappa_2 - 1}{\beta \kappa_2} \left( 2a_H (\phi-1) + 1 \right)^2 + 4a_H^2 \phi (\phi-1) / (\beta \kappa_2) \right] \tilde{\mathcal{N}}_{t_0} > 0$$

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

$$\tilde{\mathcal{Y}}_{H,t_0}^{na} = - (1 - a_H) \left[ 2a_H (\phi - 1) + 1 \right] \tilde{\mathcal{N}}_{t_0}^{na} > 0$$
PCP: Optimal response to inefficient capital inflows

- Expansionary stance results in weaker RER appreciation (ratio < 1):
  \[
  \tilde{Q}_{t_0} = - (2a_H - 1) \left[ \frac{2a_H(\phi-1)+1-2(1-a_H)/(\beta\kappa_2)}{2a_H(\phi-1)+1} \right] \tilde{W}_{t_0} < 0
  \]
  whereas lower appreciation also curbs capital inflows: \( \tilde{W}_{t_0} < \tilde{W}_{t_0}^{na} \).

- Yet easier stance results in a larger domestic demand (ratio > 1):
  \[
  \tilde{C}_t = \frac{2(1-a_H) \left[ 2a_H(\phi-1)+1+(\frac{2a_H-1}{\beta\kappa_2}) \right]}{2a_H(\phi-1)+1} \tilde{W}_t
  \]
  \[
  \tilde{C}_{t}^{na} = 2 \left( 1 - a_H \right) \tilde{W}_{t_0}^{na}
  \]

- Less weight on currency misalignment in less open economies (larger \( a_H \)) or with more flexible prices (higher pass-through as \( \frac{\beta\kappa_2 - 1}{\beta\kappa_2} \to 1 \) and \( \frac{1}{\beta\kappa_2} \to 0 \))
A comparison between LCP and PCP: unit-elasticity benchmark

- Set $\sigma = \phi = 1$, so that $\hat{B}_t$ and $\hat{W}_t$ are exogenous (hence identical) under both LCP and PCP.
A comparison between LCP and PCP: unit-elasticity benchmark

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

- Under LCP, the optimal monetary response to an inefficiently high capital inflow leans against the suboptimal aggregate demand boom, allowing the real exchange rate to be overvalued.

- 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.

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

Shocks (anticipated 5 years) generating capital flows 1 percent of GDP
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 $\phi \geq \frac{(2a_H-1)}{2a_H}$) 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?

- For $\phi$ low enough, inflows $\hat{B}_t < 0$ may be associated with inefficiently low Home demand: $\hat{W}_t < 0$
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  - With low $\phi$, domestic and foreign goods are highly complementary (see CDL 2008 Restud), wealth effects of exchange rates dominates expenditure switching effects.

Key result: if $\phi < \bar{\phi}$, optimal monetary stance at Home is expansionary in both LCP and PCP economies.
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- Key result: if $\phi < \bar{\phi}$, optimal monetary stance at Home is expansionary in both LCP and PCP economies.
Conditional on **anticipated taste shocks** only, $\tilde{\beta}_t$ and $\tilde{\psi}_t$ have the opposite sign if:

$$
\phi > \phi^{LCP} = \frac{2a_H - \frac{\beta \nu_2}{(\beta \nu_2 - 1)}}{2a_H} < 1.
$$

Threshold smaller in economies that are more open ($a_H \rightarrow 1/2$) or where prices are stickier ($\nu_2 \rightarrow 1/\beta$)

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

$$
\phi > \phi^{LCP} = \frac{2a_H - \frac{\beta \nu_2 (1 - \beta \nu_1)}{(\beta \nu_2 - 1)}}{2a_H} < 1.
$$
LCP: optimal stance ‘switch to expansionary’ for elasticity below thresholds

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

$$
(\hat{Y}_{t_0} - \hat{Y}_{t_0}^{fb}) = -(1 - a_{H}) \left[ 2a_{H} \frac{\beta \nu_2 - 1}{\beta \nu_2} - (2a_{H} - 1) \frac{\beta \kappa_2 - 1}{\beta \kappa_2} \right] \hat{\mathcal{W}}_{t_0} > 1
$$

$$
(\tilde{Y}_{t_0}^{na} - \tilde{Y}_{t_0}^{fb}) = -(1 - a_{H}) \hat{\mathcal{W}}_{t_0} > 0
$$

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)

\[ \phi \leq \phi^{PCP} = \frac{2a_H - 1}{2a_H} < 1. \]

smaller the higher openness \((a_H \rightarrow 1/2)\), higher than both \(\phi^{LCP}\).

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

\[
\theta \pi_{H,t_0} = (1 - a_H) \frac{(\beta \kappa_2 - 1)}{\beta \kappa_2} \left[ \frac{4a_H (1 - a_H) (\phi - 1) + 1}{2a_H (\phi - 1) + 1} \right] \hat{W}_{t_0} > 0
\]

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?