Optimal Policy under Dollar Pricing

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“Dominant currency paradigm”

— world prices set in dollars (Goldberg-Tille'08)
— world prices sticky in dollars (Gopinath'15)
— asymmetric transmission of shocks (Gopinath et al’20)
Motivation

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— world prices **set in dollars** (Goldberg-Tille’08)
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What is the optimal policy under DCP?

1. **float vs. peg?** (Friedman’53)
2. **capital controls?** (Blanchard’17)
3. **gains from cooperation? from currency areas?** (Mundell’61)
4. **Fed’s policy?** (Bernanke’17, Obstfeld’19)
5. **exorbitant privilege?** (Gourinchas-Rey’07)

Relevant from both normative and positive perspectives

— can DCP rationalize policies followed by open economies?
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This Paper

- New Keynesian open economy model
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- **Key ingredients:**
  - exporters use DCP
  - local firms use PCP
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  - exporters use DCP \[\Rightarrow\] high ERPT into *border* prices
  - local firms use PCP
  - foreign intermediates \[\Rightarrow\] low ERPT into *retail* prices

Otherwise general setup:
- arbitrary assets, preferences, technology, nominal rigidities, shocks
- fully non-linear stochastic solution

Main findings:
1. optimality of inflation targeting for non-U.S. economies
2. partial peg to the dollar and global monetary cycle
3. no case for capital controls
4. conflict of interests between the U.S. and RoW
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Relation to the Literature

- **Empirical evidence:**
  - prices are sticky in dollars: Goldberg & Tille (2008), Gopinath & Rigobon (2008), Gopinath, Itskhoki & Rigobon (2010), Gopinath (2016)

- **Theories of currency choice:**

- **Optimal policy in open economy:**
    - much more general setup, different intuition, new results... cf
SETUP
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  - U.S. is symmetric except for DCP
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- Households:
  - demand for products, labor supply and risk-sharing
  - nested CES w/ macro elasticity $\theta$, micro elasticity $\varepsilon$, home bias $1 - \gamma$

- Firms:
  - CRS production from labor and intermediates
  - Rotemberg price setting: PCP in local market + DCP in exports

Lemma: the flexible-price equilibrium:
(a) is efficient from the perspective of individual economy,
(b) can be implemented under PCP by targeting $\pi_{it} = 0$. 
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- To isolate new policy motives assume:
  
  **A1:** production subsidies $\tau_i = \frac{\varepsilon-1}{\varepsilon}$, $\tau_i^* = 1$ and no markup shocks
  
  $\Rightarrow$ eliminate monopolistic distortion and the terms-of-trade externality

  **A2:** payoffs of assets $D^h_t$ are independent from monetary policies
  
  $\Rightarrow$ monetary policy does not aim to complete asset markets
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OPTIMAL NON-U.S. POLICY
Proposition (Non-U.S. policy)

The optimal monetary policy in a non-U.S. economy stabilizes prices of domestic producers $\pi_{iit} = 0$. The resulting allocation is not efficient.
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   — PCP: given export prices, MP achieves optimal exports $Y_{it}^* = h_t(P_{iit}/E_{it})$
   — DCP: given export prices, MP cannot affect exports $Y_{it}^* = h_t(P_{it}^*)$
   — Lemma: decentralized export prices are constrained efficient under DCP
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4. Policy is robust to endogenous currency choice
Global Monetary Cycle

- Does targeting $\pi_{iit} = 0$ mean the optimal policy is *inward-looking*?
  - yes in CP’2007, DSX’2007, GT’2009, CDGG’2018
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- **Corollary**: The optimal policy is generically *outward-looking*

\[ i_{US} \uparrow \Rightarrow \varepsilon_{it} \uparrow \Rightarrow \begin{cases} 
  P_{it} \uparrow \Rightarrow \{ \text{intermediates} \} \Rightarrow MC_{it} \uparrow \Rightarrow i_{it} \uparrow 
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i) Global Monetary Cycle: all countries respond to U.S. shocks

— higher pass-through in countries with more DCP

— Zhang’2018
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i) **Global Monetary Cycle**: all countries respond to U.S. shocks
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ii) **partial peg to the dollar**
  - DCP contributes to the “fear of floating”  
    ▶ IRR’2018
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  iii) **Trilemma**: trade-off is worse under DCP, but fixed ER is suboptimal
ADDITIONAL FISCAL INSTRUMENTS
Can capital controls insulate from U.S. spillovers?

- Blanchard’2017: “the use of capital controls by EMs allows AEs to use monetary policy to increase domestic demand, while shielding EMs of the undesirable exchange rate effects.”

- Farhi-Werning’2016: if MP cannot achieve the first best under sticky prices, the risk sharing is generically inefficient due to "AD externality". Augment monetary policy with state-contingent capital controls.

Proposition (Capital controls)

Given the optimal monetary policy, capital controls do not insulate other economies from U.S. spillovers and are not used by the planner.

Optimal subsidy from Farhi-Werning’2016:

$$
\tau_{hit} = P_{iti}C_{Iit}, \bar{\tau}_{iti} > 0
$$

$$
\bar{\tau}_{iti}, \bar{\tau}_{iti} \neq 0 + E_{iti}P^{*}_{iti}C^{*}_{Iit}, \bar{\tau}_{iti} > 0
$$

Corollary: The optimal cooperative capital controls are generically non-zero and target economies that import depressed/overheated goods.
Can capital controls insulate from U.S. spillovers?

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Augment monetary policy with state-contingent capital controls

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\[ \tau_{it}^h = P_{iit} C_{iit} \tilde{\tau}_{iit} + \xi_{it} P_{it}^* C_{iit}^* \tilde{\tau}_{it}^* \]
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\]

\[
\begin{align*}
= & 0 & \neq 0
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$$\tau_{it}^h = P_{iit} C_{I,iit} \bar{\tau}_{iit} + \varepsilon_{it} P_{iit}^* C_{I,iit}^* \bar{\tau}_{iit}^*$$

where:
- $P_{iit}$ and $P_{iit}^*$ are prices
- $C_{I,iit}$ and $C_{I,iit}^*$ are consumption
- $\varepsilon_{it}$ is a shock
- $\bar{\tau}_{iit}$ and $\bar{\tau}_{iit}^*$ are state-contingent capital controls
- $>0$, $=0$, $=0$, $\neq 0$ indicate conditions under which certain terms are active.
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Optimal subsidy from Farhi-Werning’2016:

\[ \tau_{it}^h = P_{iit} C_{l,iit} \bar{r}_{iit} + \varepsilon_{it} P_{iit}^* C_{l,ii}^* \bar{r}_{iit}^* \]

\[ \begin{align*}
&> 0 \quad = 0 \\
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⇒ capital controls are not a panacea against all kinds of foreign spillovers
Can capital controls insulate from U.S. spillovers?

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Can trade policy overcome limitations of MP and capital controls?

- fiscal policy can restore efficient allocation under LCP (Chen-Devereux-Xu-Shi’2018)
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**Lemma**: The non-cooperative first-best allocation can be implemented with

1. monetary policy stabilizing $P_{iit}$
2. export tax $\tau^E_{it}$ stabilizing $\tau^E_{it} \mathcal{E}_{it} P^*_it$
3. production subsidy to exporters $\tau^{*}_{it}$ stabilizing $P^*_it$
Trade Tariffs

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- The optimal policy is “robust” in terms of targets (cf. FGI’2014)
  - invariant to parameters/details of the model
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- Can be implemented with alternative instruments...
  - but export tax is crucial as the Lerner symmetry does not hold
    (Barbiero-Farhi-Gopinath-Itskhoki’2019)
OPTIMAL U.S. POLICY
Proposition (U.S. policy)

Assume fully sticky prices and complete markets. Then optimal U.S. monetary policy rule balances three motives:

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\Gamma \cdot p_{it} + \gamma \Xi \cdot \int p^*_j \, dj + \gamma \epsilon \cdot n_{x_it} = 0.
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3. **Dynamic ToT manipulation**: borrow cheaply and save at higher rate
   - as if U.S. economy is large (cf. Costinot-Lorenzoni-Werning'2014)
   - absent in previous literature that focused on \( nx_{it} = 0 \)

Proposition (Welfare)

In the special case, if countries’ openness \( \gamma \) is sufficiently low, then the welfare of the U.S. under DCP is higher relative to other countries.
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General case: the U.S. can benefit or lose from DCP relative to RoW

Special case: complete markets + log-linear preferences + no intermediates

Proposition (Welfare)

In the special case, if countries' openness $\gamma$ is sufficiently low, then the welfare of the U.S. under DCP is higher relative to other countries.
Cooperative Policy

- Global planner maximizes total welfare across countries
  - *U.S. welfare* is a trivial fraction of global welfare
  - *U.S. monetary policy* has global effects

Proposition (Cooperative policy)

Assume complete asset markets and $\tau^*_i = \tau_i = \epsilon^{-1}$. Then the optimal cooperative policy implements $\pi_{iit} = 0$, $\forall i \neq \text{U.S.}$ and

$$\int \varpi_{it} \cdot P_{iit} E_{it} P^*_{it} dt = 1, \ varpi_{it} \equiv \left( P^*_{it} P_{it} \right)^{\epsilon^{-1}}.$$

Monetary cooperation harms the U.S. and benefits the RoW:
- country-specific shocks ⇒ conflict of interests, no first-best
- common shocks ⇒ cooperation = non-cooperation = first-best

Corollary: forming currency union can benefit its members
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Monetary cooperation harms the U.S. and benefits the RoW:

- country-specific shocks $\Rightarrow$ conflict of interests, no first-best
- common shocks $\Rightarrow$ cooperation = non-cooperation = first-best

**Corollary**: forming currency union can benefit its members
Conclusion

1. Optimality of Inflation Targeting
   — robust and simple non-U.S. policy despite inefficient ToT & output gap

2. Global Monetary Cycle
   — “fear of floating” and *partial* peg to the dollar

3. No Case for Capital Controls
   — inefficient against U.S. spillovers despite AD externalities

4. Motives of U.S. Policy
   — optimal to partially internalize spillovers on the RoW

5. Benefits from Cooperation
   — currency union as a substitute for unsustainable global cooperation
Source: Ilzetzki, Reinhart and Rogoff (2017)
Source: Gopinath (2016)
Pass-Through into Border and Retail Prices

Source: Auer, Burstein, and Lein (2018)
Pass-Through into Border and Retail Prices

Source: Auer, Burstein, and Lein (2018)
Households

Preferences:
\[ E \sum_{t=0}^{\infty} \beta^t U(C_{it}, N_{it}, \xi_{it}) \]

Consumption aggregator:
\[ C_{it} = \left[ \left( 1 - \gamma \right)^{\frac{1}{\theta}} C_{iit}^{\frac{\theta - 1}{\theta}} + \gamma^\frac{1}{\theta} C^*_{it}^{\frac{\theta - 1}{\theta}} \right]^{\frac{\theta}{\theta - 1}}, \quad C^*_{it} = \left( \int C_{jit}(\omega)^{\frac{\varepsilon - 1}{\varepsilon}} \, d\omega \, dj \right)^{\frac{\varepsilon}{\varepsilon - 1}} \]

- macro elasticity $\theta$ vs. micro elasticity $\varepsilon > 1$

Budget constraint:
\[ P_{it} C_{it} + \varepsilon_{it} \sum_{h \in H_t} Q^h B^h_{it+1} + \frac{B^i_{it+1}}{R_{it}} = W_{it} N_{it} + \Pi_{it} + \varepsilon_{it} \sum_{h \in H_{t-1}} (Q^h + D^h) B^h_{it} + B^i_{it} + \psi_{it} \]

- $\varepsilon_{it}$ is the nominal exchange rate against the dollar
- $B^i_{it}$ is domestic nominal bond
- arbitrary set $H_t$ of internationally traded assets
- wealth/ToT/commodity/financial shock $\psi_{it}$
Firms

- **CRS technology:**
  \[ Y_{it} = A_{it} F(L_{it}, X_{it}) \]
  for simplicity, same bundle of intermediates \( X_{it} \) as in consumption

- **Rotemberg price setting:**

  1. **Local currency** in domestic market:
     \[
     \max_{\{P_t\}} \mathbb{E} \sum_{t=0}^{\infty} \Theta_{it} \left[ \left( P_t - \tau_i MC_{it} \right) \left( \frac{P_t}{P_{iit}} \right)^{-\varepsilon} Y_{iit} - (1 - \gamma) \frac{\varphi}{2} \left( \frac{P_t}{P_{t-1}} - 1 \right)^2 W_{it} \right]
     \]

  2. **Dollars** in foreign markets:
     \[
     \max_{\{P_t\}} \mathbb{E} \sum_{t=0}^{\infty} \Theta_{it} \left[ \left( \mathcal{E}_{it} P_t - \tau_i^* MC_{it} \right) \left( \frac{P_t}{P_{it}} \right)^{-\varepsilon} Y_{iit}^* - \gamma \frac{\varphi}{2} \left( \frac{P_t}{P_{t-1}} - 1 \right)^2 W_{it} \right]
     \]

  - \( \Theta_{it} \equiv \beta^t \frac{U_{Cit}}{P_{it}} \) is the nominal SDF
  - \( Y_{iit} \equiv C_{iit} + X_{iit} \) and \( Y_{iit}^* \equiv \int (C_{ijt} + X_{ijt}) \, dj \) are demand shifters
  - \( \tau_i \) and \( \tau_i^* \) are time-invariant subsidies to domestic firms and exporters
Market Clearing

- **Goods market:**
  \[ A_{it} F(L_{it}, X_{it}) = (1 - \gamma) \left( \frac{P_{it}}{P_{it}^*} \right)^{-\theta} (C_{it} + X_{it}) + \gamma \left( \frac{P_{it}^*}{P_{t}^*} \right)^{-\varepsilon} \int \left( \frac{\mathcal{E}_{jt} P_t^*}{P_{jt}^*} \right)^{-\theta} (C_{jt} + X_{jt}) \, dj \]

- **Labor market:**
  \[ N_{it} = L_{it} + \frac{\psi}{2} (1 - \gamma) \pi_{iit}^2 + \frac{\psi}{2} \gamma \pi_{it}^2 \]

- **Asset markets:**
  \[ \int B_{it+1}^h \, di = 0, \quad \forall h \in H_t, \quad B_{it}^i = 0 \]

- **Country’s budget constraint:**
  \[ \sum_{h \in H_t} Q_t^h B_{it+1}^h - \sum_{h \in H_{t-1}} (Q_t^h + D_t^h) B_{it}^h = \gamma \left[ P_{it}^* \left( \frac{P_{it}^*}{P_t^*} \right)^{-\varepsilon} \int \left( \frac{\mathcal{E}_{jt} P_t^*}{P_{jt}^*} \right)^{-\theta} (C_{jt} + X_{jt}) \, dj - P_t^* \left( \frac{\mathcal{E}_{it} P_t^*}{P_{it}^*} \right)^{-\theta} (C_{it} + X_{it}) \right] + \psi_{it}. \]
Equilibrium

- Ramsey approach: nominal interest rates $R_{it}$ as monetary instrument

Lemma 1: the same equilibrium in a large set of games

To isolate new policy motives assume:

$A_1$: production subsidies $\tau_i = \varepsilon - 1$, $\tau^*_i = 1$ and no markup shocks

$A_2$: payoffs of assets $D_h$ are independent from monetary policies

$\Rightarrow$ eliminate monopolistic distortion and the terms-of-trade externality

Lemma 2: the flexible-price equilibrium $\phi = 0$

(a) is efficient from the perspective of individual country,

(b) can be implemented under PCP by targeting $\pi_{it} = 0$. 

back
Equilibrium

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**Definition:** solve for a SPNE of the following game

- countries choose domestic inflation $\pi_{iit}$
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- full commitment

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(a) is efficient from the perspective of individual country,
(b) can be implemented under PCP by targeting \( \pi_{iit} = 0 \).
Fully sticky prices:

- Corsetti-Pesenti’2007, Devereux et al.’2007, Goldberg-Tille’2009
- ToT are constant and \textit{exogenous} to monetary policy
Intuition

1. Fully sticky prices:
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   - ToT are constant and **exogenous** to monetary policy

2. Complete markets, log-linear utility, no intermediates:
   - Casas-Diez-Gopinath-Gourinchas’2018
   - ToT are time-varying, but still **exogenous** to monetary policy

\[
\frac{MC_{it}}{E_{it}} = \frac{W_{it}}{A_{it}E_{it}} = \frac{P_{it}C_{it}}{A_{it}P_{0t}C_{0t}} = \frac{P_{0t}C_{0t}}{A_{it}}
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   \]

3. General case:
   - monetary policy **can** affect ToT, but finds it **optimal** to target $\pi_{iit}$
   - planner can change ToT only indirectly via exporters’ $MC_{it}$ (cf. PCP)
   - conditional on optimal $P_{iit}$, exporters set prices efficiently
Domestic Dollarization

- EMs often face dollarization of domestic prices (Drenik-Perez’18)
- Extend model to have both PCP and DCP in home market
Domestic Dollarization

- EMs often face dollarization of **domestic** prices (Drenik-Perez’18)
- Extend model to have both PCP and DCP in home market

**Proposition (Domestic dollarization)**

The optimal policy stabilizes local-currency prices \( \pi_{iit} = 0 \) and imposes capital controls and export tariffs \( \tau_{it}^C \propto E_{it}P^*_{iit} - P_{iit} \).
EMs often face dollarization of domestic prices (Drenik-Perez’18)
Extend model to have both PCP and DCP in home market

**Proposition (Domestic dollarization)**

*The optimal policy stabilizes local-currency prices $\pi_{iit} = 0$ and imposes capital controls and export tariffs $\tau_{c_{it}} \propto \varepsilon_{it} P_{iit}^* - P_{iit}$.*

1. **Optimal monetary target:**
   - currency of invoicing $\gg$ country of origin

2. **Capital controls:**
   - AD externality
   - subsidize assets that pay in states with $\varepsilon_{it} P_{iit}^* > P_{iit}$

3. **Export tariffs:**
   - AD externality
   - boost exports in states with $\varepsilon_{it} P_{iit}^* > P_{iit}$
Endogenous Currency Choice

Extend the baseline model:

1. heterogeneous import share $\gamma_c, \gamma_d, \gamma_e$
2. heterogeneous use of intermediates $\phi_d, \phi_e$
3. Kimball aggregator w/ price complementarities $\alpha_d, \alpha_e$
4. endogenous currency choice

Proposition (Currency choice)

If price linkages across exporters $\alpha_e$ and $\phi_e \gamma_e$ are strong enough, then

(a) firms choose PCP locally and DCP abroad,
(b) the optimal policy targets $\pi_{iit} = 0$.

- policy targets $\pi_{iit} = 0$ ⇒ local firms choose PCP
- strong complementarities ⇒ exporters coordinate on DCP (Mukhin'2018)
- currency choice is efficient ⇒ policy targets $\pi_{iit} = 0$
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- currency choice is efficient $\Rightarrow$ policy targets $\pi_{iit} = 0$
DCP vs. Response to Fed’s Shocks

Source: Zhang (2018)
### Comparison to the Literature

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<th>Environment:</th>
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Non-U.S. Planner’s Problem

\[
\max_{\{\varepsilon_{it}, B_{it}^h, C_{it}, L_{it}, \pi_{iit}, \pi_{it}^*\}} \mathbb{E} \sum_{t=0}^{\infty} \beta^t U(C_{it}, L_{it} + \frac{\varphi}{2}(1 - \gamma)\pi_{iit}^2 + \frac{\varphi}{2} \gamma \pi_{it}^* \xi_{it})
\]

(RS) \[ \mathbb{E}_t \Theta_{it, t+1} \frac{\varepsilon_{it+1}^h}{\varepsilon_{it}^h} \frac{Q_{t+1}^h}{Q_t^h} + D_{t+1}^h = 1 \]

(BC) \[ \sum_{h \in H_t} Q_t^h B_{it+1}^h - \sum_{h \in H_{t-1}} (Q_t^h + D_t^h) B_{it}^h = \gamma \left[P_{it}^* \left(\frac{P_{it}^*}{P_t^*}\right)^{-\varepsilon} \int \left(\frac{\varepsilon_{jt} P_t^*}{P_{jt}^*}\right)^{-\theta} (C_{jt} + X_{jt}) \, dj - P_t^* \left(\frac{\varepsilon_{it} P_t^*}{P_{it}}\right)^{-\theta} (C_{it} + X_{it})\right] + \psi_{it} \]

(MC) \[ A_{it} F(L_{it}, X_{it}) = (1 - \gamma) \left(\frac{P_{iit}}{P_{it}}\right)^{-\theta} (C_{it} + X_{it}) + \gamma \left(\frac{P_{it}^*}{P_t^*}\right)^{-\varepsilon} \int \left(\frac{\varepsilon_{jt} P_t^*}{P_{jt}^*}\right)^{-\theta} (C_{jt} + X_{jt}) \, dj \]

(PC) \[ \pi_{iit} (\pi_{iit} + 1) W_{it} = -\kappa \left(P_{iit} - \frac{\varepsilon \tau_i}{\varepsilon - 1} MC_{it}\right) \frac{Y_{iit}}{1 - \gamma} + \beta \mathbb{E}_t \Theta_{it, t+1} \pi_{iit+1} (\pi_{iit+1} + 1) W_{it+1} \]

(PC) \[ \pi_{it}^* (\pi_{it}^* + 1) W_{it} = -\kappa \left(\varepsilon_{it} P_{it}^* - \frac{\varepsilon \tau_{it}^*}{\varepsilon - 1} MC_{it}\right) \frac{Y_{it}^*}{\gamma} + \beta \mathbb{E}_t \Theta_{it, t+1} \pi_{it+1}^* (\pi_{it+1}^* + 1) W_{it+1} \]

where \[ \frac{X_{it}}{L_{it}} = g \left(\frac{-U_{Nit}}{U_{Cit}}\right), \quad \Theta_{it, t+\tau} = \beta^\tau U_{Cit+\tau} P_{it}, \quad MC_{it} = \frac{h\left(\frac{-U_{Nit}}{U_{Cit}}\right)}{A_{it}}, \quad Y_{it}^* = \int (C_{iit} + X_{iit}) \, dj \]
Planner’s Problem w/ Capital Controls

\[
\max_{\{E_{it}, \tau_{it+1}, B_{it}^h, C_{it}, L_{it}, \pi_{iit}, \pi_{iit}^*\}} \quad \mathbb{E} \sum_{t=0}^{\infty} \beta^t U(C_{it}, L_{it} + \frac{\varphi}{2}(1-\gamma)\pi_{iit}^2 + \frac{\varphi}{2}\gamma\pi_{iit}^*2, \xi_{it})
\]

\[
(RS) \quad \mathbb{E}_t \Theta_{it,t+1} \frac{E_{it+1}^h + D_{it+1}^h}{E_{it}^h (1 - \tau_{it+1}^h) E_{it}^h} = 1
\]

\[
(BC) \quad \sum_{h \in H_t} Q_{it}^h B_{it+1}^h - \sum_{h \in H_{t-1}} (Q_{it}^h + D_{it}^h) B_{it}^h = \gamma \left[ P_{it}^* \left( \frac{P_{it}^*}{P_{it}} \right)^{-\varepsilon} \int \left( \frac{E_{jt} P_{jt}^*}{P_{jt}} \right)^{-\theta} (C_{jt} + X_{jt}) \, dj - P_{it}^* \left( \frac{E_{jt} P_{jt}^*}{P_{jt}} \right)^{-\theta} (C_{jt} + X_{jt}) \right] + \psi_{it}
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\frac{X_{it}}{L_{it}} = g \left( \frac{-U_{N_{it}}}{U_{Cit}} \right), \quad \Theta_{it,t+\tau} = \beta^\tau \frac{U_{Cit+\tau} P_{it}}{U_{Cit} P_{it+\tau}} , \quad MC_{it} = \frac{h \left( \frac{-U_{N_{it}}}{U_{Cit}} \right)}{A_{it}} , \quad Y_{iit}^* \equiv \int (C_{ijt} + X_{ijt}) \, dj
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