Optimal Policy under Dollar Pricing

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Motivation

- "Dominant currency paradigm"
  - world prices set in dollars (Goldberg-Tille'08) show
  - world prices sticky in dollars (Gopinath'15)
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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)
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  5. exorbitant privilege? (Gourinchas-Rey'07)

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- Relevant from both normative and positive perspectives
  - can DCP rationalize policies followed by open economies?

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- Otherwise general setup:
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  - 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

Relation to the Literature

- Empirical evidence:
  - prices are sticky in dollars: Goldberg & Tille (2008), Gopinath & Rigobon (2008), Gopinath, Itskhoki & Rigobon (2010), Gopinath (2016)
  - international spillovers under DCP: Cravino (2014), Zhang (2018), Ilzetzki, Reinhart & Rogoff (2019), Gopinath et al (2020)
- Theories of currency choice:
  - Krugman (1980), Corsetti & Pesenti (2002), Bacchetta & van Wincoop (2005), Engel (2006), Goldberg & Tille (2008), Chahrour & Valchev (2017), Gopinath & Stein (2017), Drenik, Kirpalani & Perez (2018), Mukhin (2018)
- Optimal policy in open economy:
  - PCP/LCP: Clarida, Gali & Gertler (2001, 2002), Devereux & Engel (2003), Benigno & Benigno (2003), Gali & Monacelli (2005), De Paoli (2009), Engel (2011), Corsetti, Dedola & Leduc (2010, 2018)
  - DCP: Corsetti & Pesenti (2007), Devereux, Shi & Xu (2007), Goldberg & Tille (2009), Casas, Diez, Gopinath & Gourinchas (2017)

    $\Rightarrow$ much more general setup, different intuition, new results... cf
  - capital controls: Jeanne & Korinek (2010), Bianchi (2011), Schmitt-Grohe & Uribe (2016), Farhi & Werning (2012, 2013, 2016, 2017), Costinot, Lorenzoni & Werning (2014), Basu et al. (2020)

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- Firms: show
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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*

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  $\Rightarrow$ *monetary policy does not aim to complete asset markets*
- **Lemma**: the flexible-price equilibrium show
  (a) is efficient from the perspective of individual economy,
  (b) can be implemented under PCP by targeting $\pi_{iit} = 0$.

OPTIMAL NON-U.S. POLICY

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4. Policy is robust to endogenous currency choice show

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  iii) Trilemma: trade-off is worse under DCP, but fixed ER is suboptimal
     - — *cf.* Rey'2013, Gourinchas'2018, Kalemli-Ozcan'2019

ADDITIONAL FISCAL INSTRUMENTS

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$\Rightarrow$ capital controls are not a panacea against all kinds of foreign spillovers

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- **Corollary**: The optimal cooperative capital controls are generically non-zero and target economies that import depressed/overheated goods

Trade Tariffs

- Can trade policy overcome limitations of MP and capital controls?
  - fiscal policy can replicate effects of monetary depreciation (Adao-Correia-Teles'2009, Farhi-Gopinath-Itskhoki'2014)
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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)

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U.S. Policy and Welfare

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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- 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 γ is sufficiently low, then the welfare of the U.S. under DCP is higher relative to other countries.

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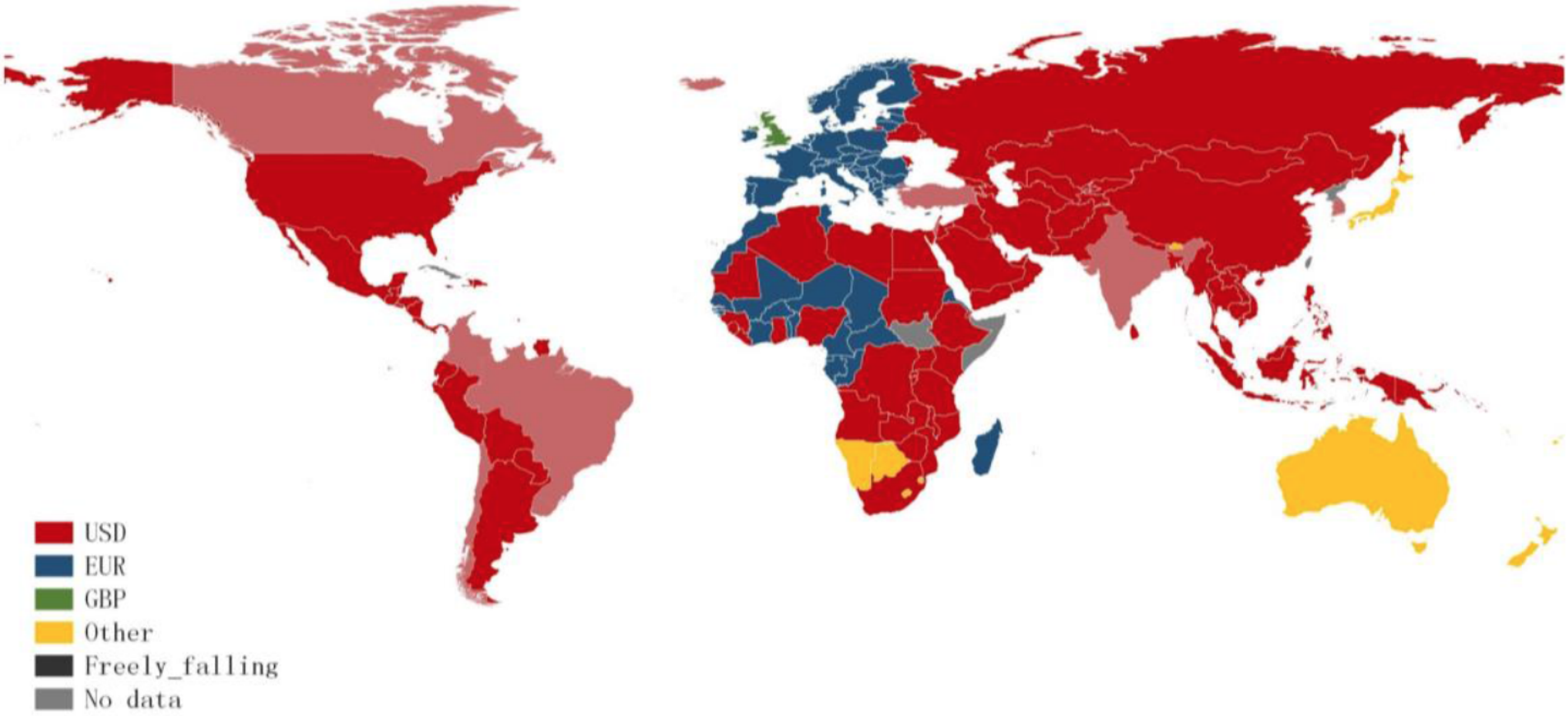
- **Corollary**: forming currency union can benefit its members

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

APPENDIX

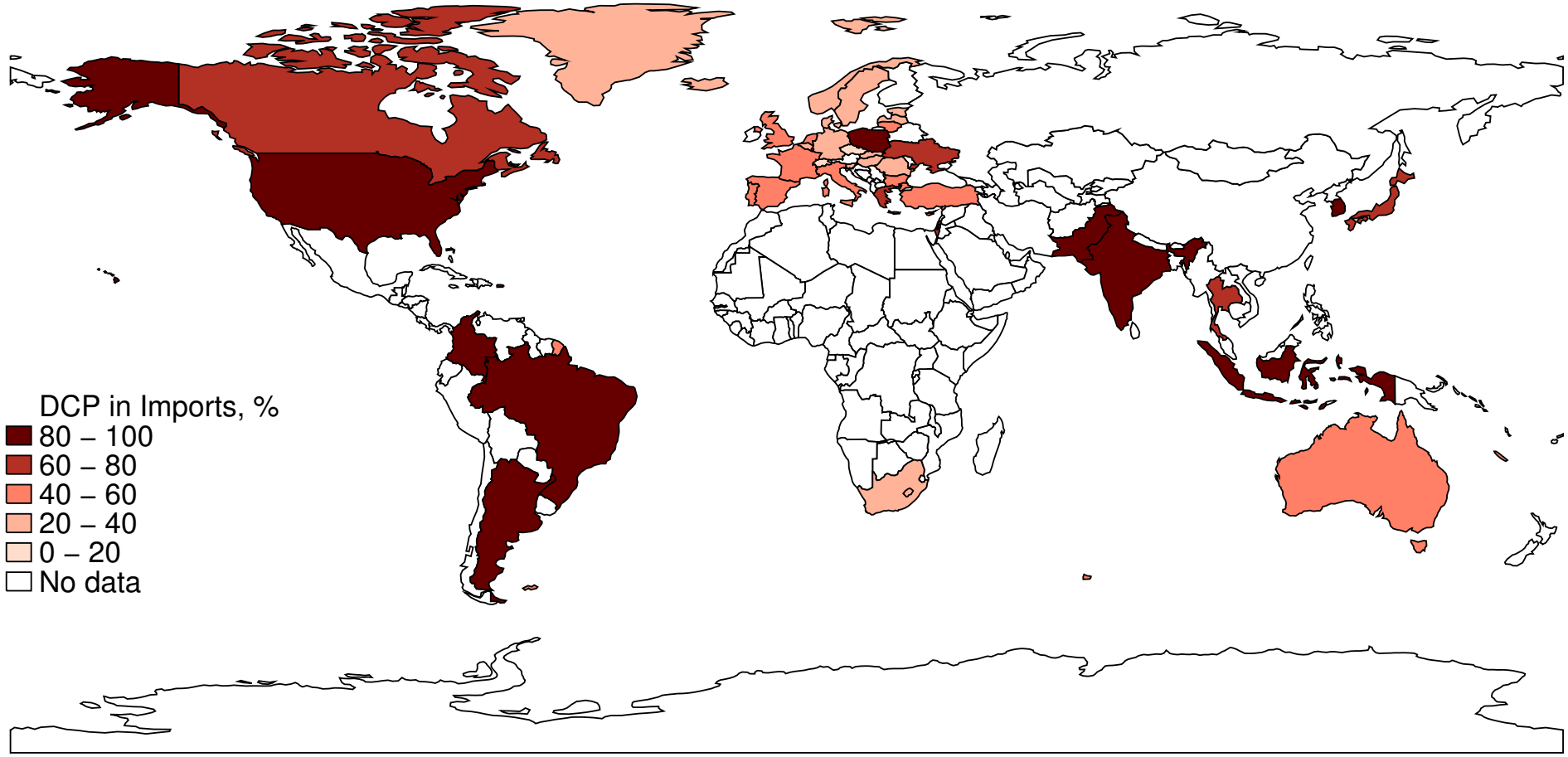
Dollar as an Anchor Currency



Source: Ilzetzki, Reinhart and Rogoff (2017)

Motivation GMC

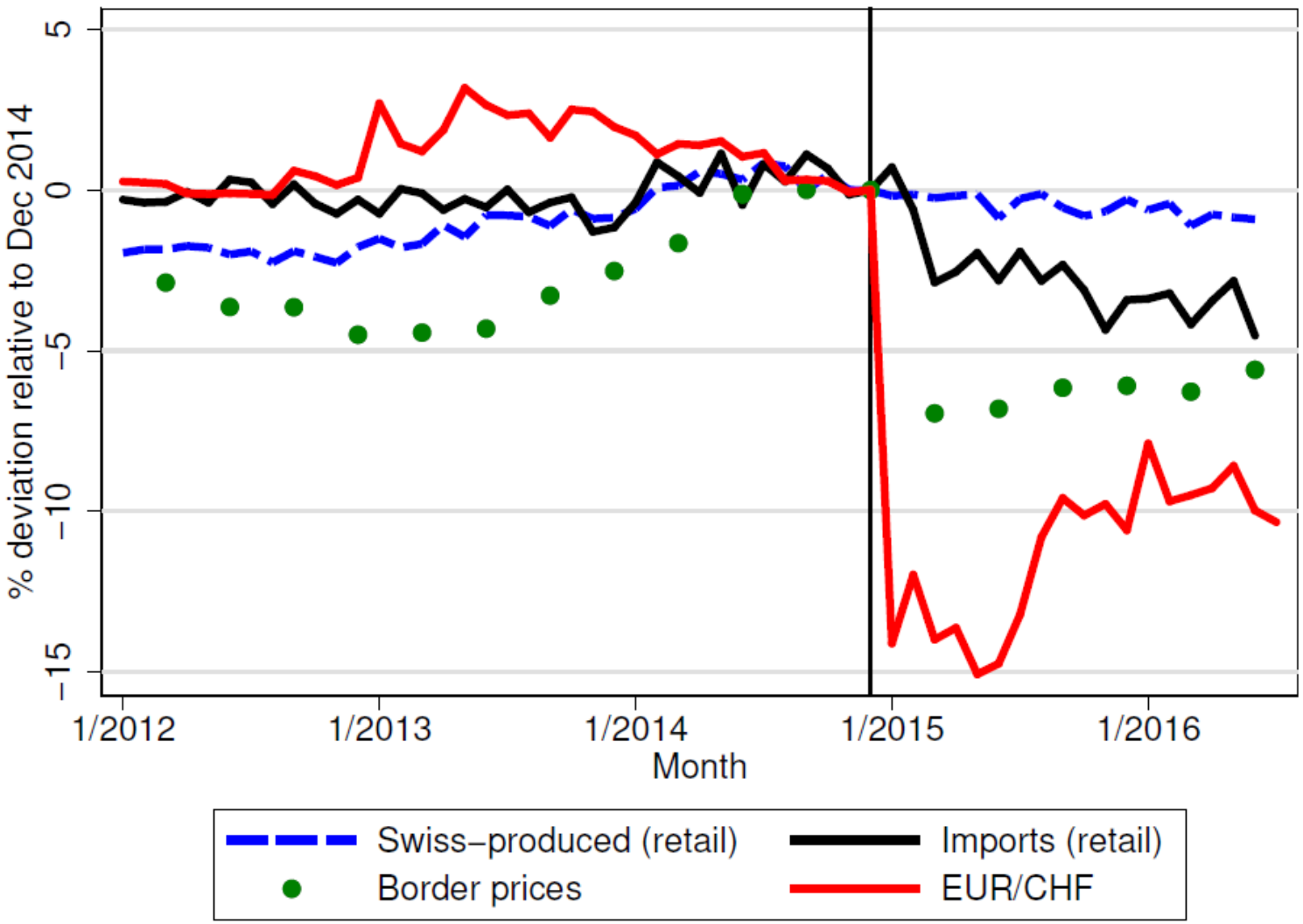
DCP in Imports



Source: Gopinath (2016)

back

Pass-Through into Border and Retail Prices



Source: Auer, Burstein, and Lein (2018)

back

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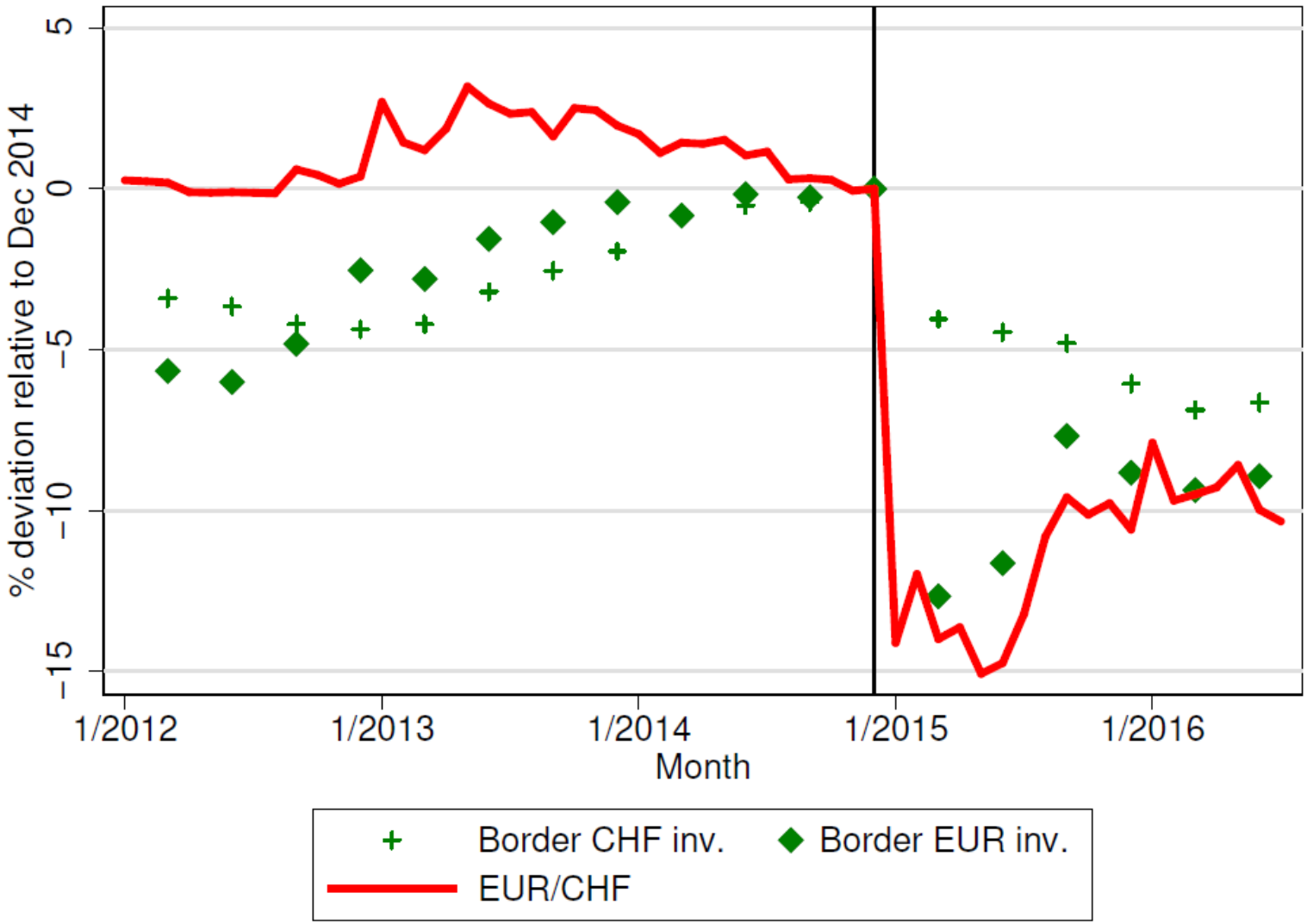

Source: Auer, Burstein, and Lein (2018)

back

Households

- Preferences:

$$\mathbb{E}\sum_{t=0}^{\infty}\beta^t U\left(C_{it}, N_{it}, \xi_{it}\right)$$

- Consumption aggregator:

$$C_{it} = \left[(1-\gamma)^{\frac{1}{\theta}} C_{iit}^{\frac{\theta-1}{\theta}} + \gamma^{\frac{1}{\theta}} C_{it}^{*\,\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}, \quad C_{it}^{*} = \left(\int C_{jit}(\omega)^{\frac{\varepsilon-1}{\varepsilon}} \mathrm{d}\omega \mathrm{d}j\right)^{\frac{\varepsilon}{\varepsilon-1}}$$

  — macro elasticity θ vs. micro elasticity $\varepsilon > 1$

- Budget constraint:

$$P_{it}C_{it} + \mathcal{E}_{it}\sum_{h\in H_t}\mathcal{Q}_t^h B_{it+1}^h + \frac{\mathcal{B}_{it+1}^i}{R_{it}} = W_{it}N_{it} + \Pi_{it} + \mathcal{E}_{it}\sum_{h\in H_{t-1}}(\mathcal{Q}_t^h + D_t^h)B_{it}^h + \mathcal{B}_{it}^i + \psi_{it}$$

  — $\mathcal{E}_{it}$ is the nominal exchange rate against the dollar
  — $\mathcal{B}_{it}^i$ is domestic nominal bond
  — arbitrary set H_t of internationally traded assets
  — wealth/ToT/commodity/financial shock ψ_{it}

back

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:

$$\max_{\{P_t\}} \mathbb{E} \sum_{t=0}^{\infty} \Theta_{it} \left[(P_t - \tau_i MC_{it}) \left(\frac{P_t}{P_{iit}} \right)^{-\varepsilon} Y_{iit} - (1-\gamma) \frac{\varphi}{2} \left(\frac{P_t}{P_{t-1}} - 1 \right)^2 W_{it} \right]$$

  2. **Dollars** in foreign markets:

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

  — $\Theta_{it} \equiv \beta^t \frac{U_{Cit}}{P_{it}}$ is the nominal SDF

  — $Y_{iit} \equiv C_{iit} + X_{iit}$ and $Y_{it}^* \equiv \int (C_{ijt} + X_{ijt}) \mathrm{d}j$ are demand shifters

  — τ_i and τ_i^* are time-invariant subsidies to domestic firms and exporters

back

Market Clearing

- Goods market:

$$A_{it}F(L_{it},X_{it}) = (1-\gamma)\left(\frac{P_{iit}}{P_{it}}\right)^{-\theta}(C_{it}+X_{it})+\gamma\left(\frac{P^*_{it}}{P^*_t}\right)^{-\varepsilon}\int\left(\frac{\mathcal{E}_{jt}P^*_t}{P_{jt}}\right)^{-\theta}(C_{jt}+X_{jt})\,\mathrm{d}j$$

- Labor market:

$$N_{it} = L_{it} + \frac{\varphi}{2}(1-\gamma)\pi^2_{iit} + \frac{\varphi}{2}\gamma\pi^{*2}_{it}$$

- Asset markets:

$$\int B^h_{it+1}\mathrm{d}i = 0, \quad \forall h \in H_t, \qquad \mathcal{B}^i_{it} = 0$$

- Country's budget constraint:

$$\sum_{h\in H_t}\mathcal{Q}^h_t B^h_{it+1} - \sum_{h\in H_{t-1}}(\mathcal{Q}^h_t + D^h_t)B^h_{it}$$

$$= \gamma\left[P^*_{it}\left(\frac{P^*_{it}}{P^*_t}\right)^{-\varepsilon}\int\left(\frac{\mathcal{E}_{jt}P^*_t}{P_{jt}}\right)^{-\theta}(C_{jt}+X_{jt})\,\mathrm{d}j - P^*_t\left(\frac{\mathcal{E}_{it}P^*_t}{P_{it}}\right)^{-\theta}(C_{it}+X_{it})\right] + \psi_{it}.$$

back

Equilibrium

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

back

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- **Definition**: *solve for a SPNE of the following game*
  - *countries choose domestic inflation* π_{iit}
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  - *full commitment*

back

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  - — *full commitment* $\rightarrow$ binds only for the U.S.
- **Lemma 1**: the same equilibrium in a large set of games

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  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_t^h are independent from monetary policies
  $\Rightarrow$ *monetary policy does not aim to complete asset markets*

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  A2: payoffs of assets D^h_t are independent from monetary policies
  $\Rightarrow$ *monetary policy does not aim to complete asset markets*
- **Lemma 2**: the flexible-price equilibrium $\varphi = 0$
  (a) is efficient from the perspective of individual country,
  (b) can be implemented under PCP by targeting $\pi_{iit} = 0$.

back

Intuition

1. Fully sticky prices:
   - Corsetti-Pesenti'2007, Devereux et al.'2007, Goldberg-Tille'2009
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   - Casas-Diez-Gopinath-Gourinchas'2018
   - ToT are time-varying, but still exogenous to monetary policy

$$\frac{MC_{it}}{\mathcal{E}_{it}} = \frac{W_{it}}{A_{it}\mathcal{E}_{it}} = \frac{P_{it}C_{it}}{A_{it}\frac{P_{it}C_{it}}{P_{0t}C_{0t}}} = \frac{P_{0t}C_{0t}}{A_{it}}$$

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

back

Domestic Dollarization

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

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1. Optimal monetary target:
   — currency of invoicing $\gg$ country of origin
2. Capital controls:
   — AD externality
   — subsidize assets that pay in states with $\mathcal{E}_{it} P^*_{iit} > P_{iit}$
3. Export tariffs:
   — AD externality
   — boost exports in states with $\mathcal{E}_{it} P^*_{iit} > P_{iit}$

back

Endogenous Currency Choice

- Extend the baseline model:
  1. heterogeneous import share $\gamma_c, \gamma_d, \gamma_e$
  2. heterogeneous use of intermediates ϕ_d, ϕ_e
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If price linkages across exporters α_e and $\phi_e \gamma_e$ are strong enough, then

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(b) *the optimal policy targets $\pi_{iit} = 0$.*

— policy targets $\pi_{iit} = 0$ $\Rightarrow$ local firms choose PCP

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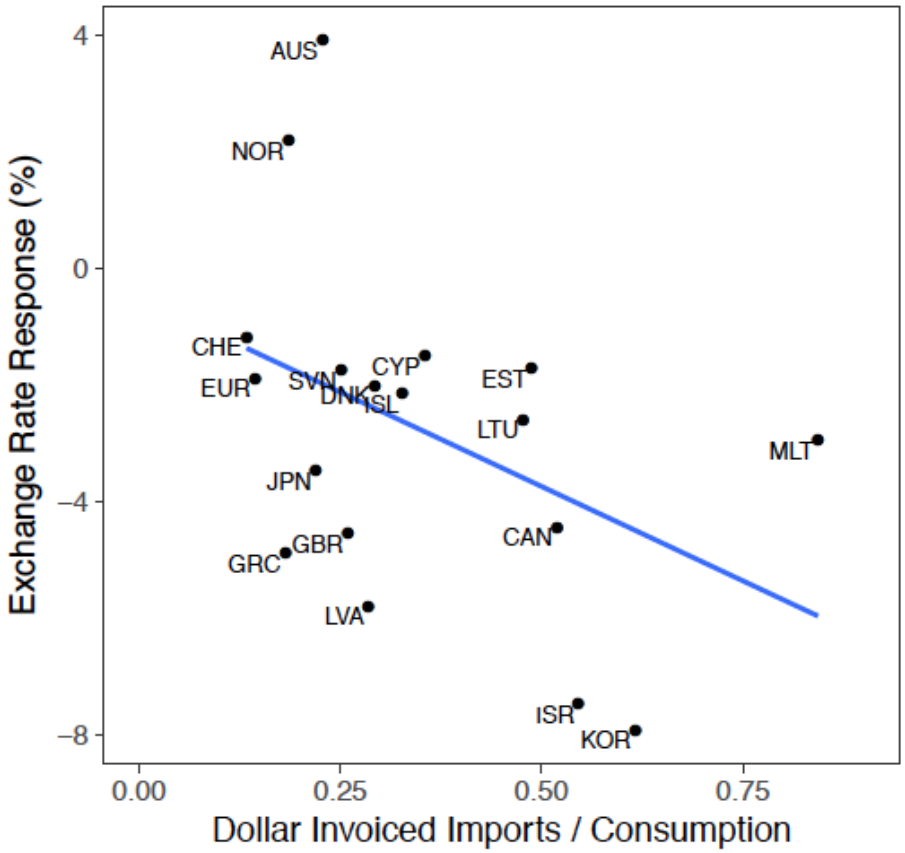
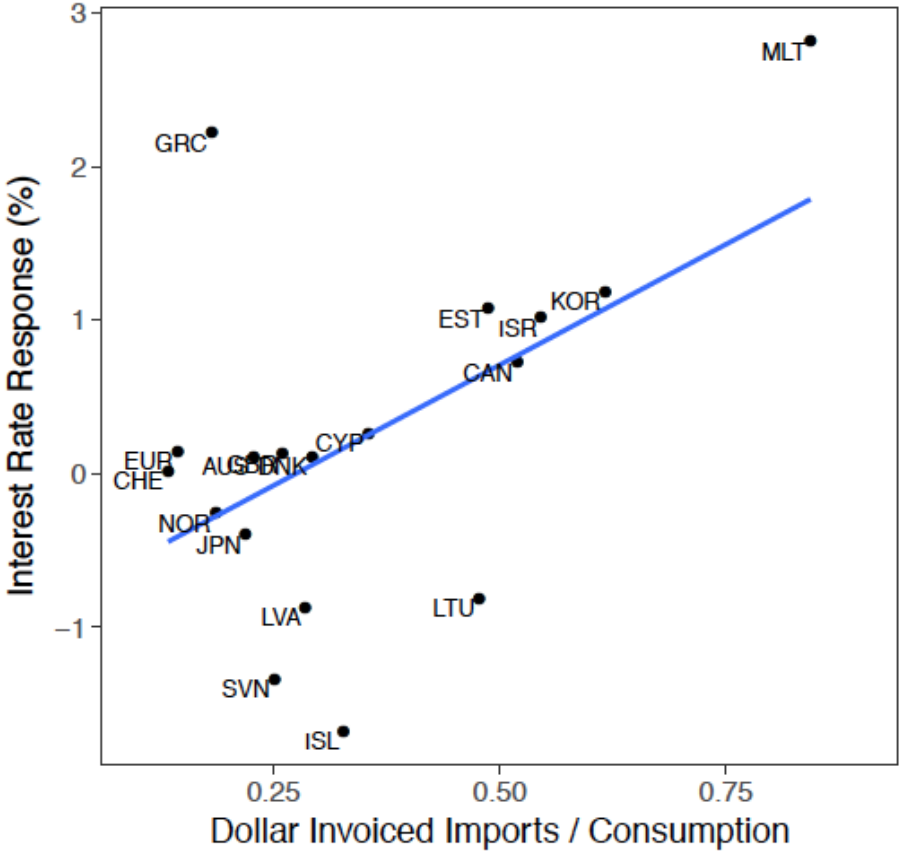
— currency choice is efficient $\Rightarrow$ policy targets $\pi_{iit} = 0$

back

DCP vs. Response to Fed's Shocks





Source: Zhang (2018) ▸ GMC

Comparison to the Literature

	DSX	CP	GT	CDGG	EM
Environment:					
# of countries	two		three	SOE	continuum
preferences	log-linear				general
intermediates	no				yes
asset markets	complete				arbitrary
prices	fully sticky			Calvo	Rtmberg/Calvo
terms-of-trade	exogenous to MP				endogenous
currency choice	rationalized	exogenous			endogenous
Non-U.S. policy:					
optimal target	price stabilization				
allocation	inefficient				
implementation	inward-looking				outward-looking
exchange rates	floating				partial peg
capital contols	—				inefficient
trade policy	—				efficient
U.S. policy motives:					
import prices	yes			—	yes
dynamic ToT	no			—	yes
welfare effects	negative	—	ambiguous	—	ambiguous
cooperative policy	yes			—	yes

Papers: Devereux, Shi & Xu (2007), Corsetti & Pesenti (2007), Goldberg & Tille (2009), Casas, Diez, Gopinath & Gourinchas (2018), Egorov & Mukhin (2019) back

Non-U.S. Planner's Problem

$$\max_{\{\mathcal{E}_{it}, B^h_{it}, C_{it}, L_{it}, \pi_{iit}, \pi^*_{it}\}} \mathbb{E} \sum_{t=0}^{\infty} \beta^t U\left(C_{it}, L_{it} + \frac{\varphi}{2}(1-\gamma)\pi^2_{iit} + \frac{\varphi}{2}\gamma\pi^{*2}_{it}, \xi_{it}\right)$$

(RS) $$\mathbb{E}_t \Theta_{it,t+1} \frac{\mathcal{E}_{it+1}}{\mathcal{E}_{it}} \frac{\mathcal{Q}^h_{t+1} + D^h_{t+1}}{\mathcal{Q}^h_t} = 1$$

(BC) $$\sum_{h \in H_t} \mathcal{Q}^h_t B^h_{it+1} - \sum_{h \in H_{t-1}} (\mathcal{Q}^h_t + D^h_t) B^h_{it}$$

$$= \gamma \left[P^*_{it} \left(\frac{P^*_{it}}{P^*_t}\right)^{-\varepsilon} \int \left(\frac{\mathcal{E}_{jt} P^*_t}{P_{jt}}\right)^{-\theta} (C_{jt} + X_{jt})\, \mathrm{d}j - P^*_t \left(\frac{\mathcal{E}_{it} P^*_t}{P_{it}}\right)^{-\theta} (C_{it} + X_{it}) \right] + \psi_{it}$$

(MC) $$A_{it} F(L_{it}, X_{it}) = (1-\gamma) \left(\frac{P_{iit}}{P_{it}}\right)^{-\theta} (C_{it} + X_{it}) + \gamma \left(\frac{P^*_{it}}{P^*_t}\right)^{-\varepsilon} \int \left(\frac{\mathcal{E}_{jt} P^*_t}{P_{jt}}\right)^{-\theta} (C_{jt} + X_{jt})\, \mathrm{d}j$$

(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) $$\pi^*_{it} (\pi^*_{it} + 1) W_{it} = -\kappa \left(\mathcal{E}_{it} P^*_{it} - \frac{\varepsilon \tau^*_i}{\varepsilon - 1} MC_{it}\right) \frac{Y^*_{it}}{\gamma} + \beta \mathbb{E}_t \Theta_{it,t+1} \pi^*_{it+1} (\pi^*_{it+1} + 1) W_{it+1}$$

where $\frac{X_{it}}{L_{it}} = g\left(\frac{-U_{Nit}}{U_{Cit}}\right)$, $\Theta_{it,t+\tau} = \beta^\tau \frac{U_{Cit+\tau} P_{it}}{U_{Cit} P_{it+\tau}}$, $\frac{MC_{it}}{P_{it}} = \frac{h\left(\frac{-U_{Nit}}{U_{Cit}}\right)}{A_{it}}$, $Y^*_{it} \equiv \int (C_{ijt} + X_{ijt}) \mathrm{d}j$

back

Planner's Problem w/ Capital Controls

$$\max_{\{\mathcal{E}_{it},\tau^h_{it+1},B^h_{it},C_{it},L_{it},\pi_{iit},\pi^*_{it}\}} \mathbb{E}\sum_{t=0}^{\infty}\beta^t U\big(C_{it}, L_{it}+\frac{\varphi}{2}(1-\gamma)\pi^2_{iit}+\frac{\varphi}{2}\gamma\pi^{*2}_{it}, \xi_{it}\big)$$

(RS) $$\mathbb{E}_t\Theta_{it,t+1}\frac{\mathcal{E}_{it+1}}{\mathcal{E}_{it}}\frac{\mathcal{Q}^h_{t+1}+D^h_{t+1}}{(1-\tau^h_{it+1})\mathcal{Q}^h_t}=1$$

(BC) $$\sum_{h\in H_t}\mathcal{Q}^h_t B^h_{it+1}-\sum_{h\in H_{t-1}}(\mathcal{Q}^h_t+D^h_t)B^h_{it}$$
$$=\gamma\left[P^*_{it}\left(\frac{P^*_{it}}{P^*_t}\right)^{-\varepsilon}\int\left(\frac{\mathcal{E}_{jt}P^*_t}{P_{jt}}\right)^{-\theta}(C_{jt}+X_{jt})\,\mathrm{d}j-P^*_t\left(\frac{\mathcal{E}_{it}P^*_t}{P_{it}}\right)^{-\theta}(C_{it}+X_{it})\right]+\psi_{it}$$

(MC) $$A_{it}F(L_{it},X_{it})=(1-\gamma)\left(\frac{P_{iit}}{P_{it}}\right)^{-\theta}(C_{it}+X_{it})+\gamma\left(\frac{P^*_{it}}{P^*_t}\right)^{-\varepsilon}\int\left(\frac{\mathcal{E}_{jt}P^*_t}{P_{jt}}\right)^{-\theta}(C_{jt}+X_{jt})\,\mathrm{d}j$$

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back