Dominant Currency Paradigm

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Lecture II

Road Map

1. Facts: International prices and quantities
2. Keynesian macro redux
3. Endogenous currency choice

Open Economy Keynesian Macro Redux

- Dollar Pricing: Corsetti and Pesenti (2005), Goldberg and Tille (2008, 2009), Devereux, Shi, Xu (2007), Canzoneri et al (2013).
  - Mostly static, one-period ahead price stickiness.
- Dominant currency paradigm: Casas, Diez, Gopinath, Gourinchas (2016)
  - Dominant currency pricing
  - Strategic complementarity in pricing
  - Imported inputs

Households

- Utility:

$$U(C_{j,t}, N_{j,t}) = \frac{1}{1-\sigma_c} C_{j,t}^{1-\sigma_c} - \frac{\kappa}{1+\varphi} N_{j,t}^{1+\varphi}$$

- Budget constraint

$$\begin{aligned} P_{j,t}C_{j,t} + \mathcal{E}_{\$j,t}(1+i_{\$,t-1})B_{\$j,t} + B_{j,t} &= W_{j,t}(h)N_{j,t}(h) + \Pi_{j,t} \\ &\quad + \mathcal{E}_{\$j,t}B_{\$j,t+1} + \sum_{s' \in \mathcal{S}} Q_{j,t}(s')B_{j,t+1}(s'). \end{aligned}$$

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- Consumption Aggregator: Kimball

$$\sum_i \frac{1}{|\Omega_i|} \int_{\omega \in \Omega_i} \gamma_{ij} \Upsilon \left(\frac{|\Omega_i| C_{ij,t}(\omega)}{\gamma_{ij} C_{j,t}} \right) d\omega = 1.$$

- Strategic complementarities/Variable mark-ups

Households

- Demand

$$C_{ij,t}(\omega) = \gamma_i \left(1 + \epsilon \ln \frac{\sigma - 1}{\sigma} - \epsilon \ln Z_{ij,t}(\omega)\right)^{\sigma/\epsilon} C_{j,t}$$

where $Z_{ij,t}(\omega) \approx \frac{P_{ij,t}(\omega)}{P_{j,t}}$

$$\sigma_{ij,t}(\omega) = \frac{\sigma}{\left(1 + \epsilon \ln \frac{\sigma-1}{\sigma} - \epsilon \ln Z_{ij,t}(\omega)\right)}$$

$$\Gamma_{ij,t}(\omega) = \frac{\epsilon}{\left(\sigma - 1 - \epsilon \ln \frac{\sigma-1}{\sigma} + \epsilon \ln Z_{ij,t}(\omega)\right)}.$$

Households

- Portfolio

$$C_{j,t}^{-\sigma_c} = \beta(1 + i_{\$,t})\mathbb{E}_t \left[C_{j,t+1}^{-\sigma_c} \frac{P_{j,t}}{P_{j,t+1}} \frac{\mathcal{E}_{\$j,t+1}}{\mathcal{E}_{\$j,t}} \right] \tag{1}$$

$$C_{j,t}^{-\sigma_c} = \beta(1 + i_{j,t})\mathbb{E}_t \left[C_{j,t+1}^{-\sigma_c} \frac{P_{j,t}}{P_{j,t+1}} \right] \tag{2}$$

- Wage setting (Calvo)

$$\mathbb{E}_t \sum_{s=t}^{\infty} \delta_w^{s-t} \Theta_{j,t,s} N_{j,s} W_{j,s}^{\vartheta(1+\varphi)} \left[\frac{\vartheta}{\vartheta - 1} \kappa P_{j,s} C_{j,s}^{\sigma} N_{j,s}^{\varphi} - \frac{\bar{W}_{j,t}(h)^{1+\vartheta\varphi}}{W_{j,s}^{\vartheta\varphi}} \right] = 0,$$

$$\Theta_{j,t,s} = \beta^{s-t} \frac{C_{j,s}^{-\sigma_c}}{C_{j,t}^{-\sigma_c}} \frac{P_{j,t}}{P_{j,s}}$$

Producers

- Production Function: $Y_{j,t} = e^{a_{jt}} L_{jt}^{1-\alpha} X_{jt}^{\alpha}$

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- Profits

$$\Pi_{j,t}(\omega) = \sum_{i,k} \mathcal{E}_{kj,t} P^k_{ji,t}(\omega) Y^k_{ji,t}(\omega) - \mathcal{MC}_{j,t}\, Y_{j,t}(\omega)$$

Producers

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- Labor Aggregator: Standard CES
- Intermediate input aggregator X: Same as C
- Profits

$$\Pi_{j,t}(\omega) = \sum_{i,k} \mathcal{E}_{kj,t} P_{ji,t}^{k}(\omega) Y_{ji,t}^{k}(\omega) - \mathcal{MC}_{j,t}\, Y_{j,t}(\omega)$$

- Roundabout production: $Y_{ji,t}^{k}(\omega) = C_{ji,t}^{k}(\omega) + X_{ji,t}^{k}(\omega)$

$$\mathcal{MC}_{j,t} = \frac{1}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} \cdot \frac{W_{j,t}^{1-\alpha} P_{j,t}^{\alpha}}{e^{a_{j,t}}}. \tag{3}$$

- Price Stickiness: Calvo
  - Nest producer, local, dominant currency
  - Domestic prices and wages in H currency

Flexible Prices: Exchange Rate Pass-through

- $p_{ij} = \mu_i + mc_{ij}$

  $\mu_{ij} = \mu_{in}(p_{ij} - p_n),\ mc_{ij} = mc_{ij}(q_{ij}, w_i, e_{ij})$

- Log-differentiating:

$$\Delta p_{ij} = -\Gamma_{ij}\left(\Delta p_{ij} - \Delta p_j\right) + mc_q \Delta q_{ij} + \Delta w_i + \alpha_{ij} \Delta e_{ij} \ ,$$

$$\Delta q_{ij} = -\varepsilon_{ij}\left(\Delta p_{ij} - \Delta p_j\right) + \Delta q_j$$

- $\Gamma_{ij} \equiv -\frac{\partial \mu_{in}(.)}{\partial \left(p_{ij} - p_j\right)}$: elasticity of the mark-up with respect to the relative price
- $mc_q \equiv \frac{\partial mc_{ij}(.,.,.)}{\partial q}$: elasticity of marginal cost with respect to output
- $\alpha_{ij} \equiv \frac{\partial mc_{ij}(.,.,.)}{\partial e_{ij}}$: partial-elasticity of the marginal cost (expressed in the destination country's currency) to the exchange rate.

Flexible Prices: Exchange Rate Pass-through

- **Direct ERPT** $(\Delta w_i = \Delta p_j = \Delta q_j = 0)$

$$\frac{\Delta p_{ij}}{\Delta e_{ij}} = \frac{\alpha_{ij}}{1 + \Gamma_{ij} + \Phi_{ij}}$$

where $\alpha_{ij} = \frac{\partial mc_{ij}(.,.,.)}{\partial e_{ij}}$, $\Gamma_{ij} = -\frac{\partial \mu_{in}(.)}{\partial (p_{ij} - p_j)}$, $\Phi_{ij} = mc_q \varepsilon_{ij}$

- **Direct + Indirect ERPT**

$$\frac{\Delta p_{ij}}{\Delta e_{ij}} = \frac{\alpha_{ij}}{1 + \Gamma_{ij} + \Phi_{ij}} + \frac{\Gamma_{ij} + \Phi_{ij}}{1 + \Gamma_{ij} + \Phi_{ij}} \frac{\Delta p_j}{\Delta e_{ij}} + \frac{mc_q}{1 + \Gamma_{ij} + \Phi_{ij}} \frac{\Delta q_j}{\Delta e_{ij}}$$

  - Regressions effectively estimating overall ERPT if no accurate controls
  - Scope of shock: ERPT higher using trade-weighted ER

Price Stickiness: Calvo

- $\theta^{i}_{i,j}$: fraction prices in producer currency
- $\theta^{j}_{i,j}$: fraction prices in local/destination currency
- $\theta^{u}_{i,j}$: fraction prices in dominant currency
- Domestic prices and wages in H currency
- Reset price

$$\mathbb{E}_t \sum_{s=t}^{\infty} \delta_p^{s-t} \Theta_{j,t,s} Y^k_{ji,s|t}(\omega)(\sigma^k_{ji,s}(\omega)-1)\left(\mathcal{E}_{kj,s}\bar{P}^k_{ji,t}(\omega) - \frac{\sigma^k_{ji,s}(\omega)}{\sigma^k_{ji,s}(\omega)-1}\mathcal{MC}_{j,s}\right) = 0.$$

Closing the Model

- Domestic interest rates

$$i_{i,t} - i^* = \rho_m(i_{i,t-1} - i^*) + (1 - \rho_m)\left(\phi_M \pi_{i,t} + \phi_Y \tilde{y}_{i,t}\right) + \varepsilon_{i,t}.$$

$$\varepsilon_{i,t} = \rho_\varepsilon \varepsilon_{i,t-1} + \varepsilon^m_{i,t}$$

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- Dollar interest rate

$$^{U}_{i,t} = i_{U,t} + \psi(e^{(B^U_{i,t+1}/P_{Ut}) - \bar{B}^U_i} - 1) + \epsilon^U_{i,t}$$

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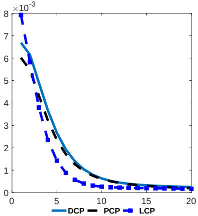
- Market clearing: $Y_{i,t}(\omega) = \sum_j \left(C_{ij,t}(\omega) + X_{ij,t}(\omega)\right)$ and $N_{i,t} = L_{i,t}, B^k_{i,t} = 0 \forall k \notin U$ LOE: $\sum_j B^U_{j,t} = 0$

H Monetary policy shock

$\Gamma = 1, \alpha = 0.66, \gamma_H = 0.6, \eta = 1$



(a) ER

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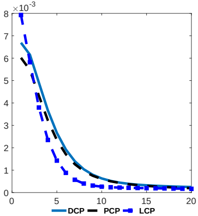

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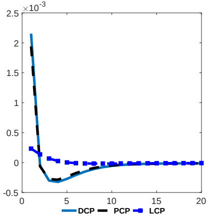

(b) π

H Monetary policy shock

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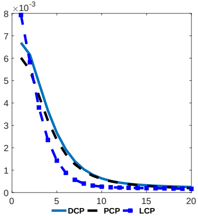
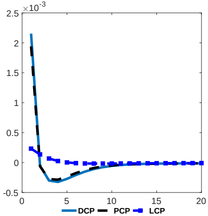
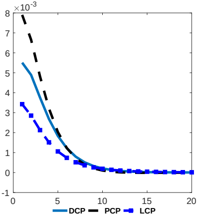


(a) *ER*



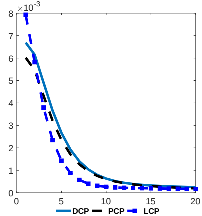
(b) π



(c) *Output*

H Monetary policy shock

$\Gamma = 1, \alpha = 0.66, \gamma_H = 0.6, \eta = 1$



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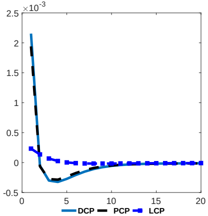
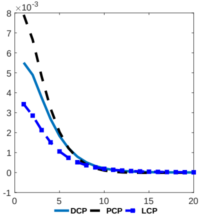
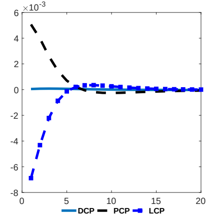


(b) π



(c) *Output*



(d) *TOT*

Monetary policy shock

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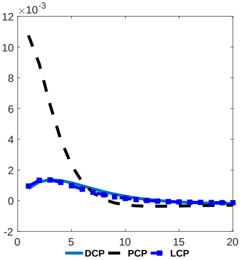
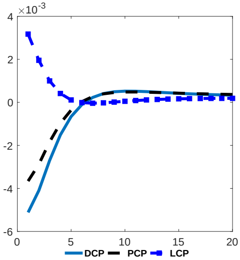


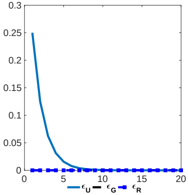
(a) *Exports*



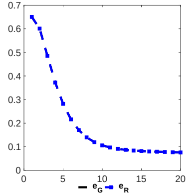
(b) *Imports*

Large open economy

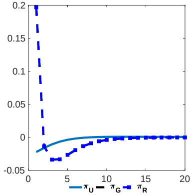
Impulse responses to a 25 basis point monetary tightening in U



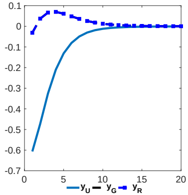
(c) MP shock



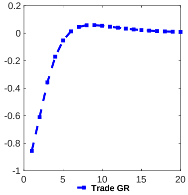
(d) ER vs. U



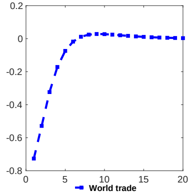
(e) Inflation



(f) Output



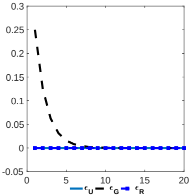
(g) ROW trade



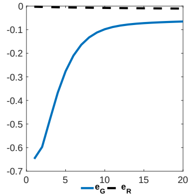
(h) World trade

Large open economy

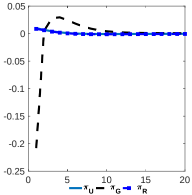
Impulse responses to a 25 basis point monetary tightening in G



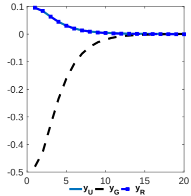
(i) MP shock



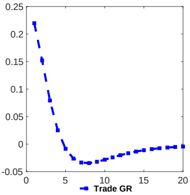
(j) ER vs. U



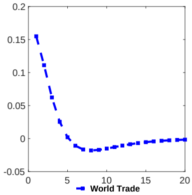
(k) Inflation



(l) Output



(m) ROW trade



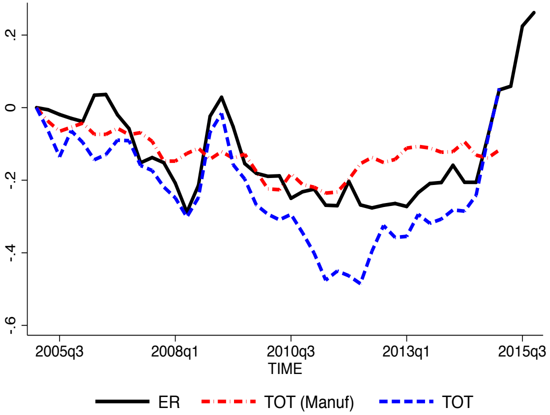
(n) World trade

Figure: Impulse responses to a 25 basis point monetary tightening in U. Rest-of-world trade is defined as the sum of quantities traded between G and

Colombia

2005-2014

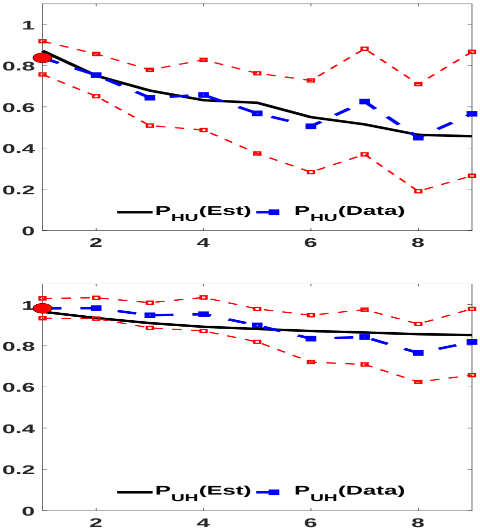
- Commodity Currency, free float since September 1999
- Currency composition of exports: USD: 98.4%
- Weighted (by income) average imported input share: 38% for manufacturers, 44% for manuf exporters



- $\beta_{TOT,ER} = 1.15$, $\beta_{MTOT,ER} = 0.33$

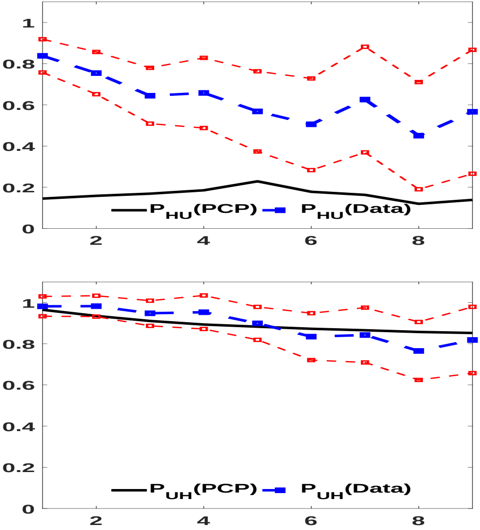
Dollar Pass-through, Dollar Destinations/Origins

Data Vs. DCP



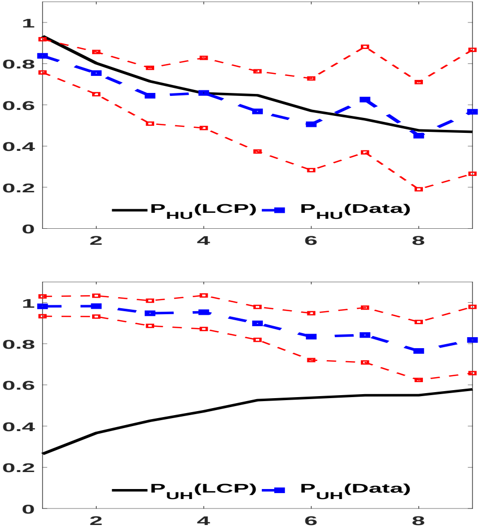
Dollar Pass-through, Dollar Destinations/Origins

Data Vs. PCP



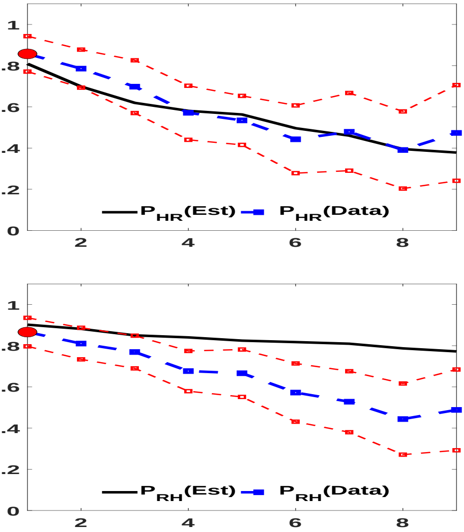
Dollar Pass-through, Dollar Destinations/Origins

Data Vs. LCP



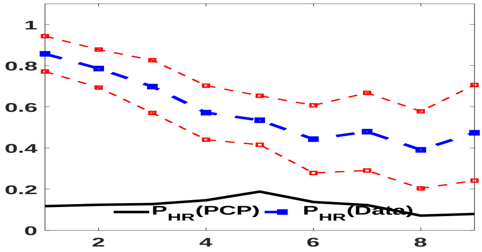
Dollar Pass-through, Non-Dollar Destinations/Origins

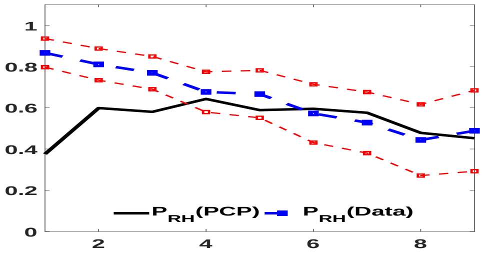
Data Vs. DCP



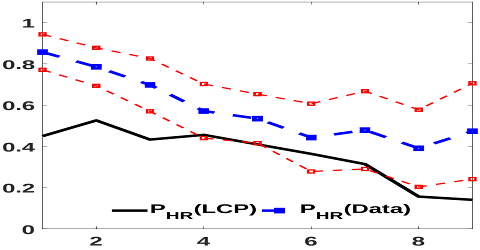
Dollar Pass-through, Non-Dollar Destinations/Origins

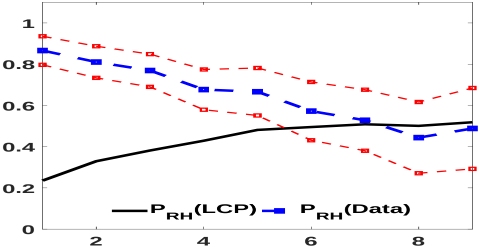
Data Vs. PCP



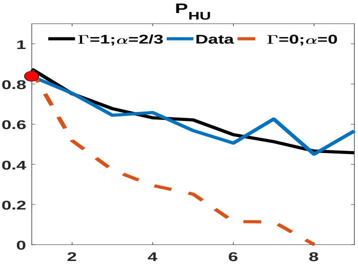


LCP


1
0.8
0.6
0.4
0.2
0
2
4
6
8
P_{HR}(LCP)
P_{HR}(Data)


1
0.8
0.6
0.4
0.2
0
2
4
6
8
P_{RH}(LCP)
P_{RH}(Data)

Role of Variable mark-ups ($\Gamma > 0$) and imported intermediates ($\alpha > 0$)



Non-Dominant Vs. Dominant Currency

Table: ERPT (Non-Dollarized Economies, R)

	(1) Δp_{HR}	(2) Δp_{HR}	(3) Δp_{RH}	(4) Δp_{RH}
		Data		
Δe_R	0.697***	0.0896*	0.742***	0.301***
	(0.115)	(0.0464)	(0.126)	(0.0791)
Δe_U		0.660***		0.540***
		(0.0473)		(0.0662)
		DCP		
Δe_R	0.72	0.28	0.68	0.22
Δe_U		0.66		0.70
		PCP		
Δe_R	0.49	0.26	0.92	0.88
Δe_U		0.36		0.06
		LCP		
Δe_R	0.98	0.93	0.44	0.19
Δe_U		0.08		0.39

Optimal Monetary Policy

When $\varepsilon = \alpha = \varphi = 0$, $\sigma_c = 1$, and international asset markets are complete,

$$\pi_{HH,t} = \frac{\lambda_p}{\gamma}\left[\tilde{y}_t - (1-\gamma)\tilde{s}_t\right] + \beta \mathbb{E}_t \pi_{HH,t+1}$$

$$\tilde{y}_t = \mathbb{E}_t \tilde{y}_{t+1} - (i_t - \mathbb{E}_t \pi_{HH,t+1} - r_t^n) + (1-\gamma)\mathbb{E}_t(\Delta \tilde{m}_{t+1})$$

$$\tilde{m}_t = \frac{1}{\gamma}(\tilde{y}_t - \tilde{s}_t)$$

- $\tilde{m}_t = \tilde{e}_{U,t} + \tilde{p}^U_{HU,t} - \tilde{p}_{HH,t} = \tilde{e}_{U,t} + \tilde{p}^U_{HR,t} - \tilde{p}_{HH,t}$
- $r_t^n = \log \beta + \mathbb{E}_t \Delta a_{t+1}$ is the natural real rate,
- γ measures home-bias; $\lambda_p = (1-\delta_p)(1-\beta\delta_p)/\delta_p$.

Optimal Monetary Policy

When $\varepsilon = \alpha = \varphi = 0$, $\sigma_c = 1$, and international asset markets are complete,

- Welfare loss function

$$\mathbb{W}^{DCP} \approx \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{1}{2} \tilde{y}_t^2 + \gamma \frac{\sigma}{2\lambda_p} \pi_{HH,t}^2 + \frac{\gamma(1-\gamma)}{2} \tilde{m}_t^2 \right] + t.i.p$$

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where $\tilde{m}_t = \tilde{e}_{U,t} + p_{HU,t}^U - \tilde{p}_{HH,t} = e_{U,t} + p_{HR,t}^U - \tilde{p}_{HH,t}$

- Implementation constraints

$$\begin{aligned} \pi_{HH,t} &= \frac{\lambda_p}{\gamma} \left[\tilde{y}_t - (1-\gamma)\tilde{s}_t \right] + \beta \mathbb{E}_t \pi_{HH,t+1} \\ \tilde{m}_t &= \frac{1}{\gamma} \left(\tilde{y}_t - \tilde{s}_t \right) \end{aligned}$$

- Terms-of-trade evolves independently of monetary policy.

Optimal Monetary Policy

- Optimal discretionary policy:

$$\tilde{y}_t + (1-\gamma)\tilde{m}_t = -\sigma\pi_{HH,t}$$

Optimal Monetary Policy

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- No “divine coincidence.”
- Without cost-push shocks, no gains to commitment

The Macroeconomics of Border Taxes

Omar Barbiero
Harvard

Emmanuel Farhi
Harvard

Gita Gopinath
Harvard

Oleg Itskhoki
Princeton

Prepared for the NBER Macroeconomics Annual 2018

Border Adjustment Taxes

Border Adjustment: tax imports and exempt exports

- Corporate Border Adjustment Tax(C-BAT)/ Ryan-Brady proposal (DBCFT)

  > *"While we have debated the pro-growth benefits of border adjustability, we appreciate that there are many unknowns associated with it..."*
  >
  > Joint statement on tax reform, July 2017

- Value Added Tax (VAT)

Border Adjustment and Protectionism

- Border adjustment often perceived as protectionist
- Ironically, border adjustment *undoes* protectionism
- Consequence of Lerner symmetry (1936)
- VAT without export rebate = export tax = import tariff (inelastic labor)
- C-BAT= corporate tax $\Longrightarrow$ C-BAT introduction is neutral

Conditions for Lerner Symmetry

1. Flexible prices
2. Trade balance

- Skepticism about underlying price changes in GE
- Conditions violated in practice

- More general conditions for neutrality (no real effects)?
- Effects when neutrality violated?

Conditions for Neutrality in Open-Economy NK Model

- Conditions for neutrality of C-BAT:
  1. Symmetric pass-through for taxes and exchange rates
  2. All international assets in foreign currency
  3. Monetary policy targets inflation + output gap, *not* exchange rates
  4. Applies uniformly to all imports and exports.
  5. One-time unanticipated
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Conditions for C-BAT neutrality

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	USA$^{\$}$	Border$^{\$}$	World*
Imports			
Exports			

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Exports			

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Imports		$\mathcal{E}\overline{\mathbf{P}^*_{\mathbf{m}}}$	$\longleftarrow$	$\overline{\mathbf{P}^*_{\mathbf{m}}}$
Exports				

$\downarrow\mathcal{E}$ means \$ appreciation. Starred prices are expressed in foreign currency

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Imports	$\frac{\mathcal{E}\overline{\mathbf{P}^*_{\mathbf{m}}}}{1-\tau}$	$\longleftarrow$	$\mathcal{E}\overline{\mathbf{P}^*_{\mathbf{m}}}$	$\longleftarrow$	$\overline{\mathbf{P}^*_{\mathbf{m}}}$
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Exports	$\overline{\mathbf{P}^{\$}_{\mathbf{x}}}$				

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Exports	$\overline{\mathbf{P}^{\$}_{\mathbf{x}}}$	$\longrightarrow$	$(1-\tau)\overline{\mathbf{P}^{\$}_{\mathbf{x}}}$		

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Exports	$\overline{\mathbf{P}^{\$}_{\mathbf{x}}}$	$\longrightarrow$	$(1-\tau)\overline{\mathbf{P}^{\$}_{\mathbf{x}}}$	$\longrightarrow$	$\frac{(1-\tau)\overline{\mathbf{P}^{\$}_{\mathbf{x}}}}{\mathcal{E}}$

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	USA$^{\$}$		Border$^{\$}$		World*
Imports	$\frac{\mathcal{E}\overline{\mathbf{P}^*_{\mathbf{m}}}}{1-\tau}$	$\longleftarrow$	$\mathcal{E}\overline{\mathbf{P}^*_{\mathbf{m}}}$	$\longleftarrow$	$\overline{\mathbf{P}^*_{\mathbf{m}}}$
Exports	$\overline{\mathbf{P}^{\$}_{\mathbf{x}}}$	$\longrightarrow$	$(1-\tau)\overline{\mathbf{P}^{\$}_{\mathbf{x}}}$	$\longrightarrow$	$\frac{(1-\tau)\overline{\mathbf{P}^{\$}_{\mathbf{x}}}}{\mathcal{E}}$

Complete appreciation: $\mathcal{E} = (1-\tau)\mathcal{E}_0 \implies$ consumer prices unchanged

Conditions for C-BAT neutrality

1. Prices respond identically to border taxes and exchange rates

Dominant Currency Pricing (DCP)

	USA$^{\$}$	Border$^{\$}$	World*
Imports		$\overline{\mathbf{P}_{\mathbf{m}}^{\$}}$	
Exports		$\overline{\mathbf{P}_{\mathbf{x}}^{\$}}$	

Policy/DRAFT/loc

- 97% of US exports and 93% of US imports priced in dollars

Conditions for C-BAT neutrality

1. Prices respond identically to border taxes and exchange rates

Dominant Currency Pricing (DCP)

	USA$^{\$}$		Border$^{\$}$		World*
Imports	$\frac{\overline{\mathbf{P}_m^{\$}}}{1-\tau}$	$\longleftarrow$	$\overline{\mathbf{P}_m^{\$}}$	$\longleftarrow$	$\frac{\overline{\mathbf{P}_m^{\$}}}{\mathcal{E}}$
Exports	$\frac{\overline{\mathbf{P}_x^{\$}}}{1-\tau}$	$\longrightarrow$	$\overline{\mathbf{P}_x^{\$}}$	$\longrightarrow$	$\frac{\overline{\mathbf{P}_x^{\$}}}{\mathcal{E}}$

Policy/DRAFT/lo

- 97% of US exports and 93% of US imports priced in dollars

Conditions for C-BAT neutrality

2. All international assets and liabilities in foreign-currency bonds

$$B^*_{t+1} - (1 + i^*_t)B^*_t = \frac{(1-\tau)}{\mathcal{E}_t} P_{x,t} X_t - P^*_{m,t} M_t$$

B^*: Foreign denominated debt. $\mathcal{E}$: Dollars per foreign currency. X: exports. M: imports

Conditions for C-BAT neutrality

2. All international assets and liabilities in foreign-currency bonds

$$\frac{B_{t+1}}{\mathcal{E}_t} - \frac{(1+i_t)B_t}{\mathcal{E}_t} + B^*_{t+1} - (1+i^*_t)B^*_t = \frac{(1-\tau)}{\mathcal{E}_t} P_{x,t}X_t - P^*_{m,t}M_t$$

- 82% of US liabilities are in dollars
- 32% of US assets are in dollars

Wealth Loss: $\frac{B_0}{GDP}\frac{\Delta\mathcal{E}}{\mathcal{E}}\% = -1.09 \cdot \frac{\Delta\mathcal{E}}{\mathcal{E}}\%$

B^*: Foreign denominated debt. $\mathcal{E}$: Dollars per foreign currency. X: exports. M: imports

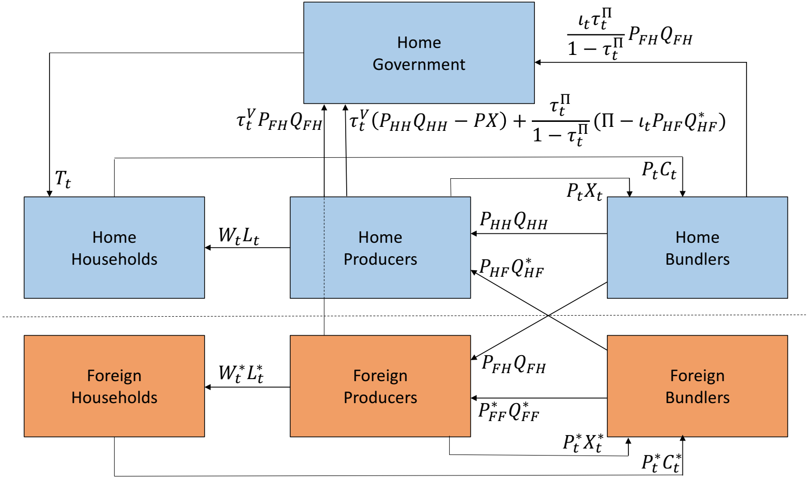
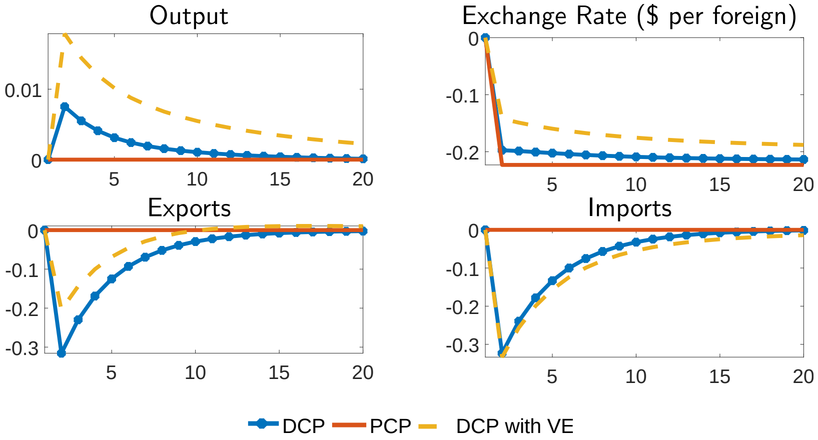


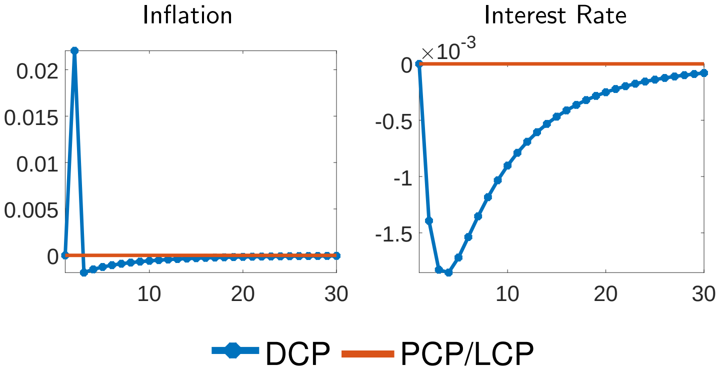
Figure: Value flows

Note: Transaction value flows between agents in the economy. All flows with Home are in home currency. Flows within Foreign are in foreign currency. For brevity we suppress government consumption flow $P_t G_t$, as well as time subscript t on certain flows. The direction of arrows indicates the direction of payments; the goods/factors flow in the reverse direction. τ_t^V is the VAT and τ_t^{Π} is the profit tax with $\iota_t = 1$ if it includes the BAT.

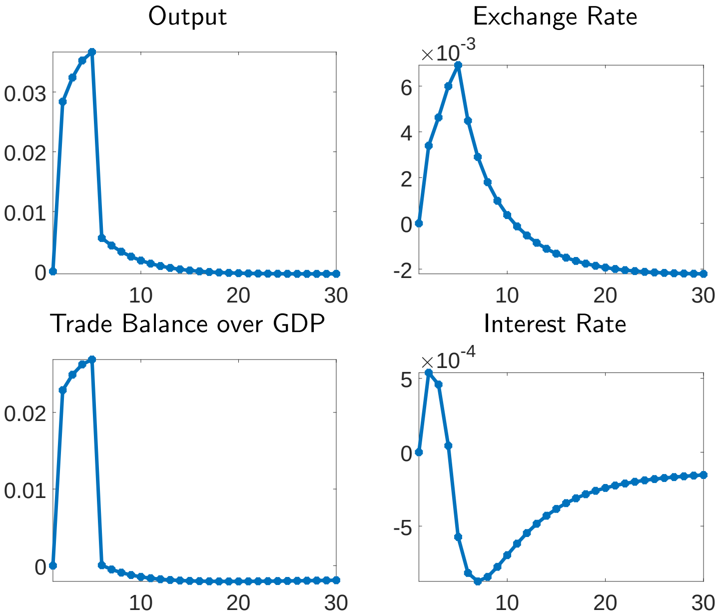
Quantitative Effects of C-BAT



Quantitative Effects of C-BAT



Border Adjustment Retaliation



Wealth and Revenues

Valuation Effect

- 16% of GDP wealth transfer from US to world ($1.09 \cdot 0.15$)

Fiscal Revenues

- Proportional to trade balance path
- Short-run: $+0.4$ p.p. of GDP
- Net Present Value: -15p.p. of GDP

Conditions for VAT neutrality

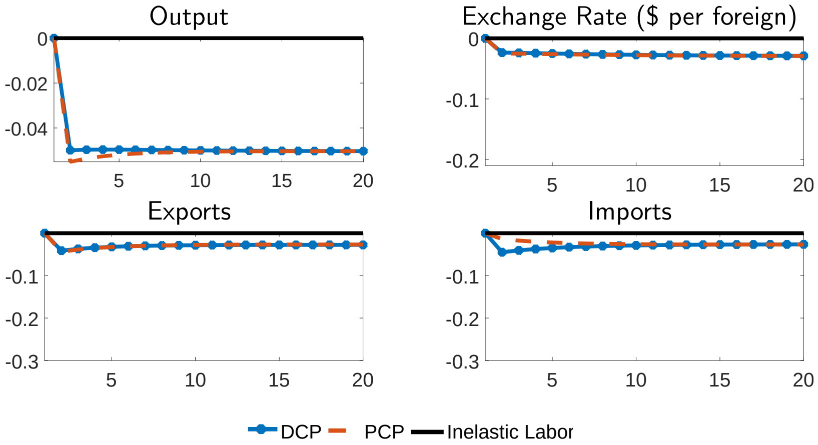
1. Complete pass-through of VAT into prices in the short-run

   Import vs. Domestic Price: $\frac{P_{m,0}/(1-\tau)}{P_0/(1-\tau)}$

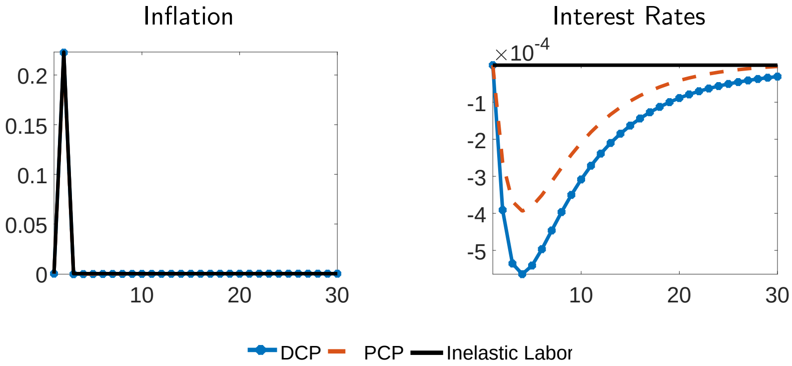
   Export vs. Foreign Price: $\frac{P_{x,0}}{\mathcal{E}_0 P_0^*}$

2. **Inelastic labor supply or fully rigid wages**
   — Otherwise distortion of labor-leisure condition

Quantitative Effects of VAT



Quantitative Effects of VAT



Conclusions

- **Neutrality** conditions for C-BAT and VAT **unrealistic**

First-quarter impact of 20% tax

	C-BAT	VAT
Trade Volume	-30%	-4%
Output	+2%	-5%
$ Appreciation	15%	2%

- **C-BAT**
  - **Valuation effect** to world: 16% GDP
  - **Fiscal revenues**: short term +0.4p.p. GDP; in NPV -15p.p. GDP