# Global Networks, Monetary Policy and Trade

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AEA P&P Paper: Global Trade, Tariff Uncertainty, and the U.S. Dollar

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# Tariffs and the Macroeconomy

**How do tariffs affect the macroeconomy in the presence of global I-O networks?**

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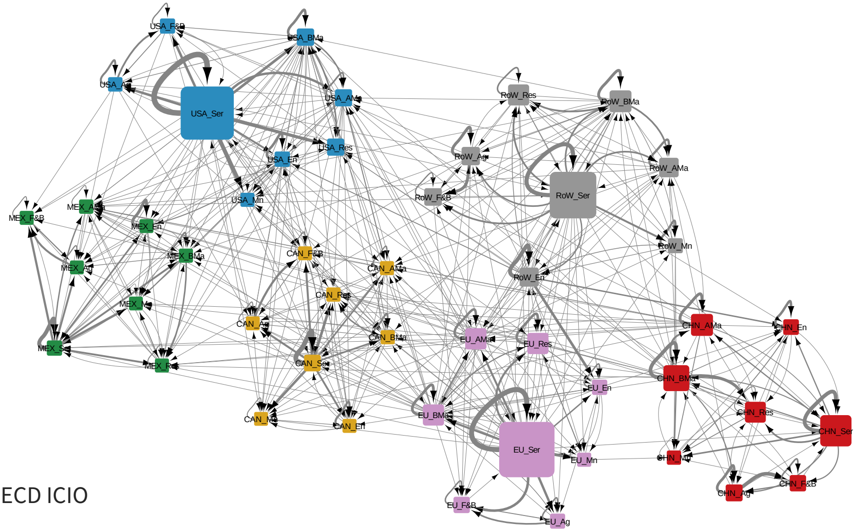
Two related questions:

- Why do networks matter for macro impact of tariffs?
- Can global networks be re-shaped under large country import tariffs?

# Global trade and production network—Complicated, hard to change




Source: OECD ICIO

# Reserach Agenda

Develop tractable $N$-country, $J$-sector New Keynesian Open Economy (NKOE) framework:

- Full input-output (I-O) linkages across countries and sectors,
- Unbalanced trade and incomplete markets,
- Nominal rigidity, combining PCP&DCP.

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Results:

- Derive the *NKOE Leontief inverse*, which governs propagation across *time*
- Network can make inflation more persistent and decline in output bigger
- 2018 road test: match 7% appreciation of the dollar
- 2025 tariffs: most models deliver appreciation of the dollar.

- 2025 Reality: depreciation

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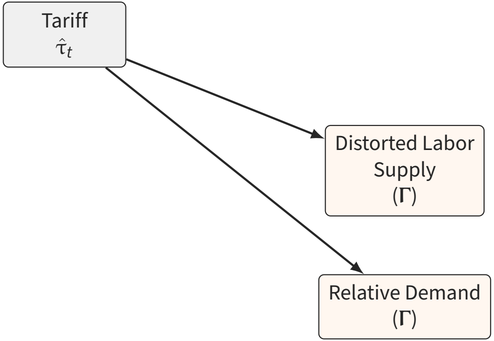
Today's Paper: Additional Shock—Tariff Threats (trade uncertainty)

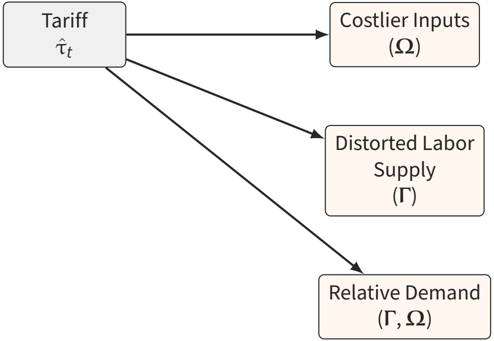
# Primitives

Consumption shares **Γ**: ToT gains vs. distorted labor supply



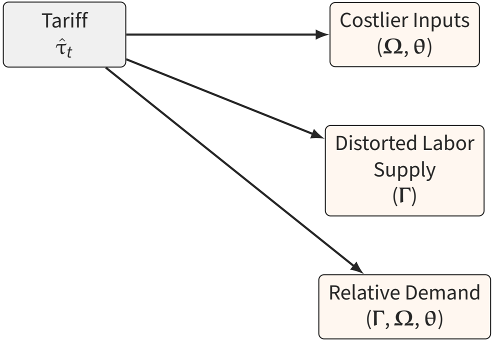
# Primitives

I-O matrix $\mathbf{\Omega}$: ToT gains vs. higher marginal cost propagated by network



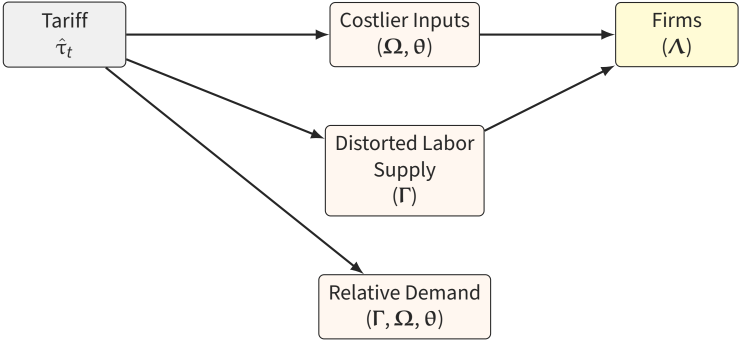
# Primitives

EoS $\theta$: high $\theta \Rightarrow$ easy to substitute $\Rightarrow \hat{Y}_t \uparrow$ or low $\theta \Rightarrow$ complements & bottlenecks, $\rightarrow \hat{Y}_t \downarrow$



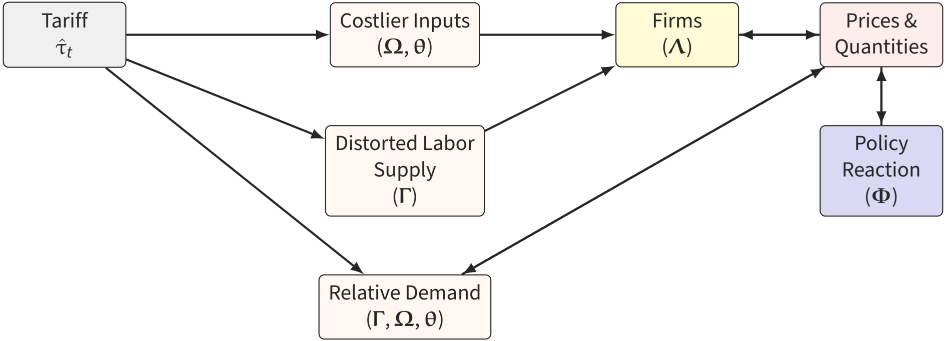
# Primitives

Stickiness $\boldsymbol{\Lambda}$: Combines PCP&DCP. Low $\Lambda \Rightarrow$ flatter NKPC or high $\Lambda \Rightarrow$ steeper NKPC



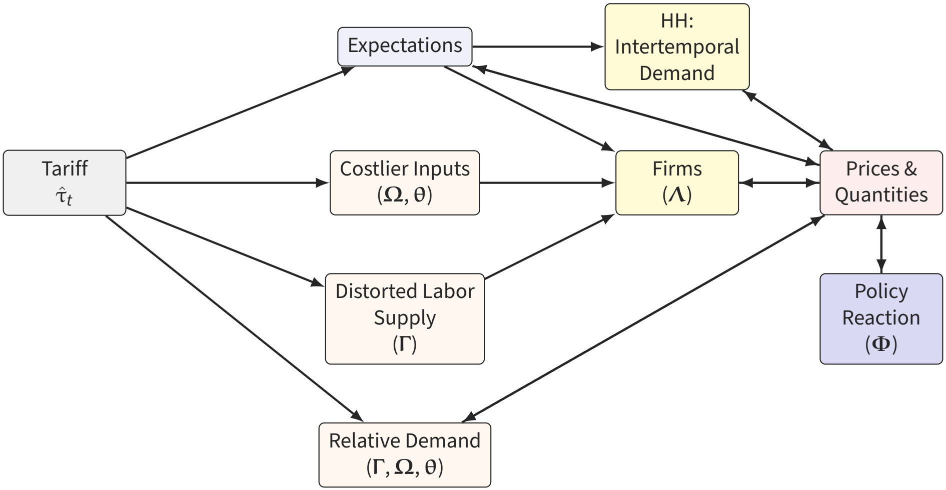
# Primitives

Policy $\boldsymbol{\Phi}$: response to $\pi_t^P \Rightarrow$ tariffs contract demand



# Primitives

Tariffs lead to intertemporal tradeoffs $\Leftrightarrow$ via expectations



# 5-Equation Global New Keynesian Representation

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**NKIS+TR:**

$$\sigma(\mathbb{E}_t \hat{\mathbf{c}}_{t+1} - \hat{\mathbf{c}}_t) = \underbrace{\Phi \Gamma \pi_t^P}_{\hat{\mathbf{i}}_t} - \mathbb{E}_t \pi_{t+1}^C$$

# 5-Equation Global New Keynesian Representation

**Expectations**

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# 5-Equation Global New Keynesian Representation

**Policy** → $\Phi\Gamma\pi_t^P$

**Expectations** → $\mathbb{E}_t\pi_{t+1}^C$

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**Costlier Inputs**

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**BoP:** $\beta\underbrace{\hat{V}_t}_{\text{Debt}} = \underbrace{\hat{V}_{t-1}}_{\text{Debt Dynamics}} + \underbrace{\Xi_2\hat{\boldsymbol{C}}_t + \Xi_3\hat{\boldsymbol{P}}^P_t + \Xi_4\hat{\mathcal{E}}_t + \Xi_5\hat{\tau}_t}_{\text{NX Response to AD \& ToT}}$

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**Relative Demand**

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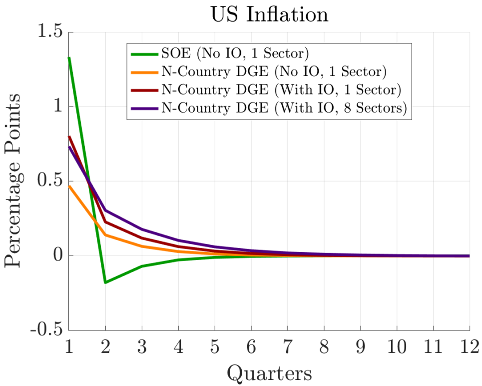
+ inflation definition

# Inflation-Output Tradeoff with Global Production Networks

## Example: Near-permanent tariff and w/o MP Response



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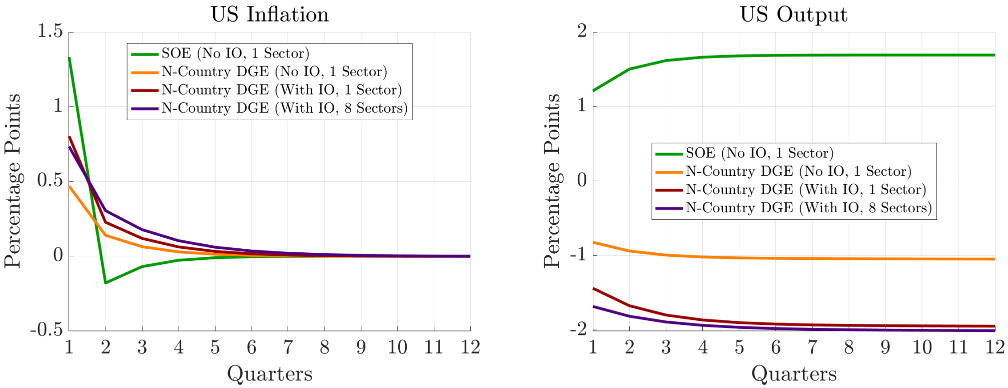
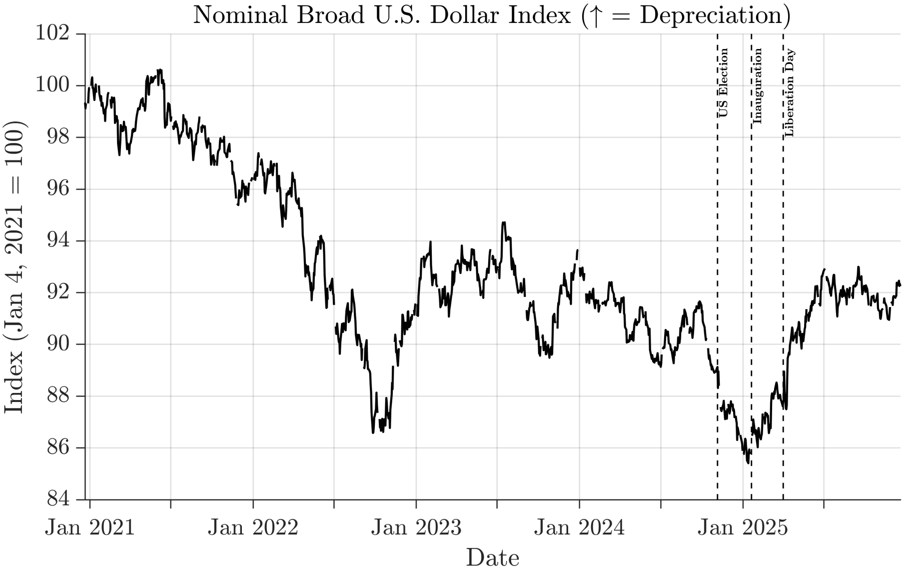
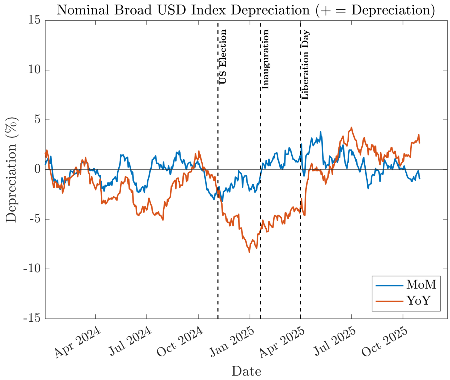



**U.S. exchange rate appreciates between 5 to 10%**

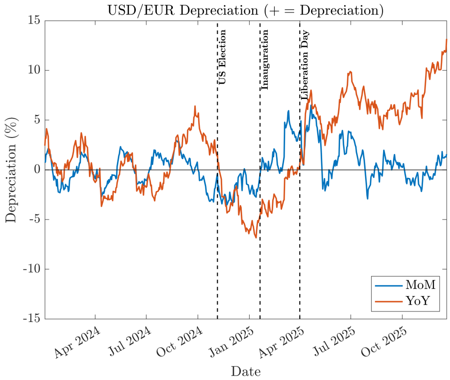
# Reality: The Dollar Depreciated after Liberation Day



# Dollar Depreciation: Broad Dollar vs Euro

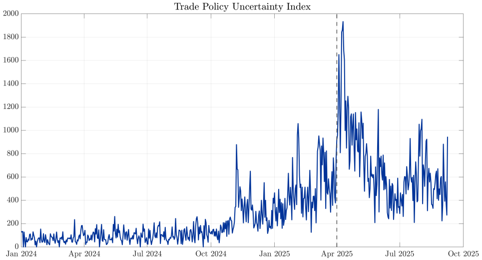



(a) Broad US Dollar Index

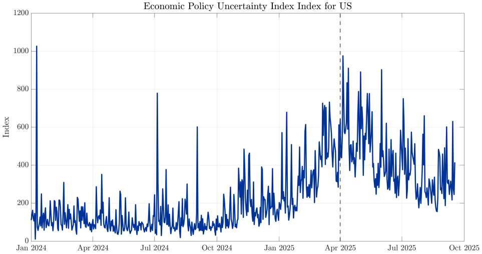



(b) USD–EUR Exchange Rate

# Simultaneous Increase in Policy Uncertainty




(a) Trade Policy Uncertainty




(b) U.S. Economic Policy Uncertainty

# AEA P&P Paper: Global Trade, Tariff Uncertainty, and the U.S. Dollar

# 5-Equation Global Representation—Simple Case (2 country, 1 good, flex-P)

**Euler (H):** $$(\mathbb{E}_t \hat{C}_{H,t+1} - \hat{C}_{H,t}) = \hat{i}_{H,t} + \underbrace{\frac{1}{2}\text{Var}_t(\hat{C}_{H,t+1})}_{\eta\,\sigma_t^2}$$

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# 5-Equation Global Representation Under Flex Price and No Networks

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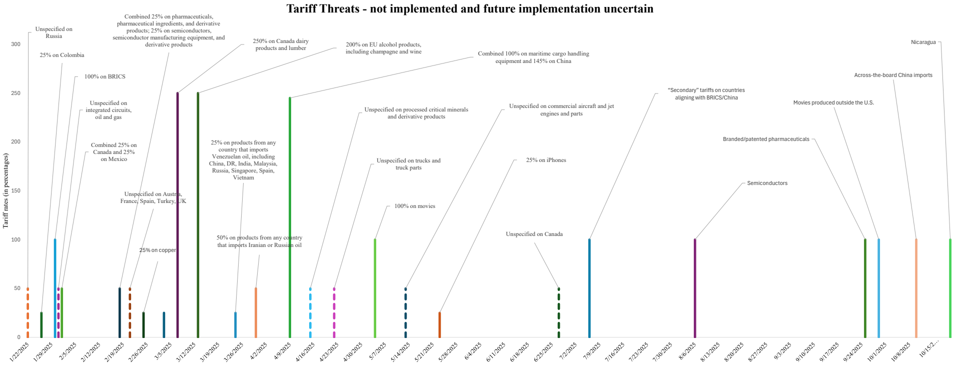
# Tariff vs Tariff Volatility Impact on Exchange Rate

$$\hat{\mathcal{E}}_t = \underbrace{\left(\left(R_H^{-1} - \frac{1}{2}\right)(1-2\gamma)^2 - \frac{1}{2}\right)}_{<0} \hat{\tau}_t + \underbrace{R_H^{-1}(1-2\gamma)^2(\eta + \kappa)}_{>0} \sigma_t^2 + \underbrace{\frac{(1-R_H^{-1})(1-2\gamma)^2}{\gamma}}_{>0} \hat{V}_{H,t-1}$$

- Both HH and financial inter-mediation are sensitive to risk.
- Higher uncertainty means precautionary saving, lower demand for goods/dollar, higher expected excess returns to dollars.

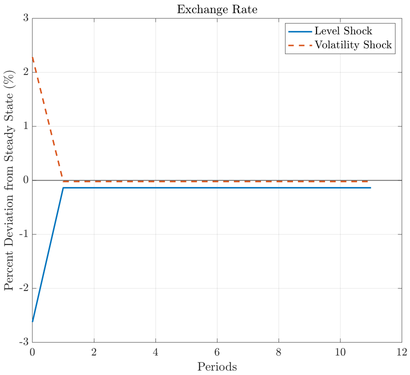
# Tariff Threats - Not implemented and future implementation uncertain



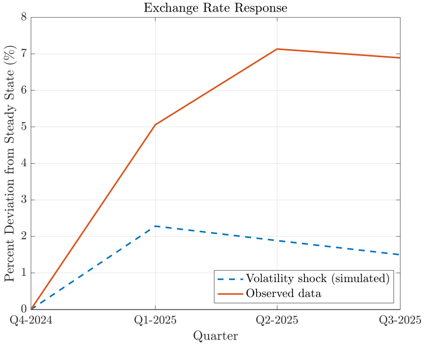

SOURCE: Trade Compliance Resource Hub Trump 2.0 Tariff Tracker.

**Our volatility measure:** For each day *t*, we compute the standard deviation of all announced and threatened tariff rates observed up to (and including) day *t*. (mean: 43%; 72, 60, 49 during 2025)

# Exchange Rate Responses to Tariff Level and Volatility Shocks: Agents Expectations and Volatility Shock Persistence Matter




(a) Exchange Rate Model Responses to Level and Volatility Shocks: 18% level, 72% volatility




(b) Comparing Model IRFs to Data with A Series of One-Time Volatility Shocks

# Takeaways

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1. With global trade and production networks, macro impact of tariffs is different than canonical models: $\pi_t$ can be more persistent and decline in *RGDP* can be bigger

2. Why? Tariffs work as 3 separate shocks:

   - Consumption tax, distorting intertemporal consumption and labor supply choice
   - Cost push shock, all sectors' marginal costs are linked
   - Risk sharing shock: wealth transfer from F to H under unilateral tariffs

# Takeaways

1. With global trade and production networks, macro impact of tariffs is different than canonical models: $\pi_t$ can be more persistent and decline in *RGDP* can be bigger

2. Why? Tariffs work as 3 separate shocks:

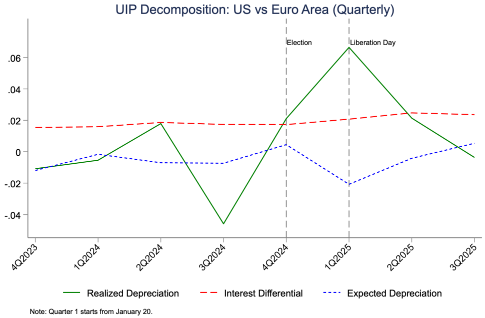
   - Consumption tax, distorting intertemporal consumption and labor supply choice
   - Cost push shock, all sectors' marginal costs are linked
   - Risk sharing shock: wealth transfer from F to H under unilateral tariffs

3. Tariffs lead to home currency appreciation unless accompanied by tariff uncertainty $\Rightarrow$ depreciation

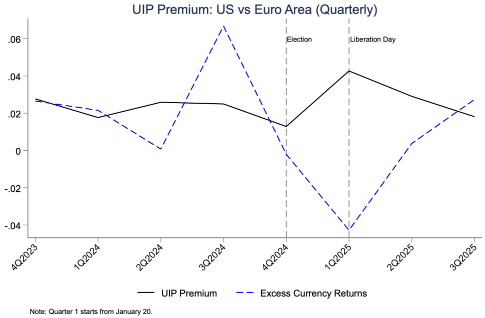
   - Via higher UIP premia and households' precautionary savings
   - **Rogoff (2025):** Currency dominance/reserve currency status erosion $\Rightarrow$ (tariff volatility subsides but safe country/currency came under suspicion; possible acceleration of erosion of confidence.)

# Appendix: Model

# Decomposing the UIP Condition and Excess Currency Returns



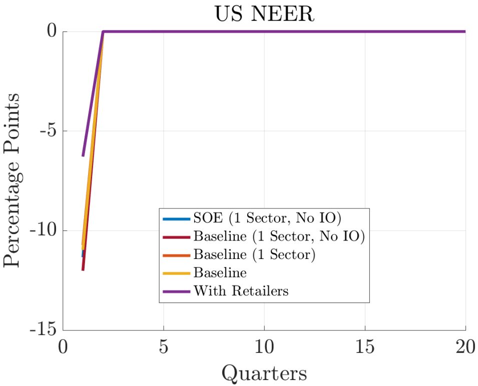

(a) Interest Differential and Depreciation



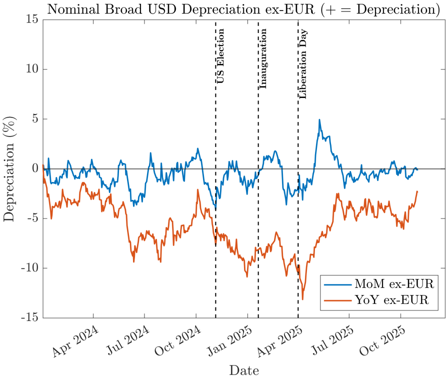

(b) UIP and Excess Currency Returns

# Exchange Response

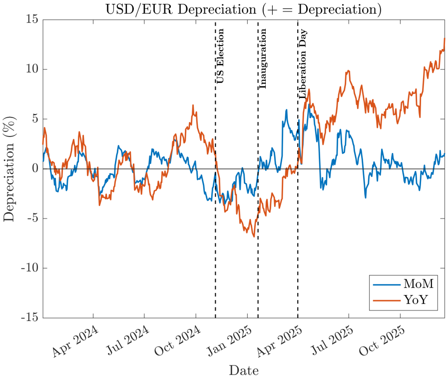
## Example: Near-permanent tariff and w/o MP Response



# Dollar Depreciation: Broad Dollar Without Euro vs Euro



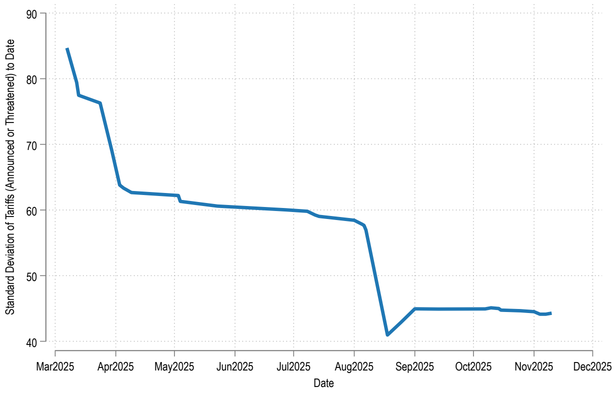

(a) Broad US Dollar Index Without USD-EUR




(b) USD–EUR Exchange Rate

NOTE: Positive values indicate depreciation of the US dollar and negative values indicate appreciation.

# Tariff Volatility Measure




SOURCE: Trade Compliance Resource Hub Trump 2.0 Tariff Tracker.

**Our volatility measure:** For each day $t$, we compute the standard deviation of all announced and threatened tariff rates observed up to (and including) day $t$.

# Network Model Overview: NK Block

1. Rotemberg costs, producer pricing and dollar pricing

2. Firm $f$ in country-sector $mj$ pricing for importer in country $n$:

$$P^f_{n,mj,t} = \arg\max_{P^P_{n,mj,t}} \mathbb{E}_t \left[ \sum_{T=t}^{\infty} \text{SDF}_{t,T} \left[ Y^f_{n,mj,T}(P^f_{n,mj,T}) \left( P^f_{n,mj,T} - MC_{mj,T} \right) \right.\right.$$
$$\left.\left. - \frac{\delta_{mj}}{2} \left[ (1 - \vartheta_{n,mj}) \left( \frac{P^f_{n,mj,T}}{P^f_{n,mj,T-1}} - 1 \right)^2 + \vartheta_{n,mj} \left( \frac{\mathcal{E}^{US}_{n,T-1} P^f_{n,mj,T}}{\mathcal{E}^{US}_{n,T} P^f_{n,mj,T-1}} - 1 \right)^2 \right] Y_{n,mj,T} P^P_{n,mj,T} \right]\right]$$

3. Producer price has nominal rigidity, combining PCP & DCP with $\vartheta_{ni} \in [0,1] \rightarrow$ share of prices rigid in dominant currency.

4. Endogenous markups due to monopolistic competition+nominal rigidity

# Network Model Overview: Open Econ Block

1. The household in country $n$ maximizes the present value of lifetime utility:

$$\max_{\{C_{n,t},L_{n,t},B^{US}_{n,t}\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t \left[ \frac{C_{n,t}^{1-\sigma}}{1-\sigma} - \chi \frac{L_{n,t}^{1+\eta}}{1+\eta} \right] s.t.$$

$$P^C_{n,t} C_{n,t} + T_{n,t} - B_{n,t} - \mathcal{E}^{US}_{n,t} B^{US}_{n,t} + \mathcal{E}^{US}_{n,t} P^{US}_{n,t} \psi(B^{US}_{n,t}/P^{US}_{n,t}) \leq$$

$$W_{n,t} L_{n,t} + \sum_i \Pi_{ni,t} - (1+i_{n,t-1}) B_{n,t-1} - \mathcal{E}^{US}_{n,t} (1+i^{US}_{n,t-1}) B^{US}_{n,t-1}$$

2. Evolution of each country $n$'s net international position:

$$\sum_{m \in \mathcal{N}} \sum_{j \in \mathcal{J}} \left( \frac{P_{n,mj,t}}{1+\tau_{n,mi,t}} C_{n,mj,t} \right) + \sum_{m \in \mathcal{N}} \sum_{i \in \mathcal{J}} \sum_{j \in \mathcal{J}} \left( \frac{P_{n,mj,t}}{1+\tau_{n,mi,t}} X_{ni,mj,t} \right) + \mathcal{E}_{n,t} (1+i^{US}_{n,t-1}) B^{US}_{n,t-1}$$

$$+ \mathcal{E}_{n,t} P^{US}_{n,t} \psi(B^{US}_{n,t}/P^{US}_{n,t}) = \sum_{i \in \mathcal{J}} P_{ni,t} Y_{ni,t} + \mathcal{E}_{n,t} B^{US}_{n,t} \quad \forall n \in N-1$$

to account for tariffs lump-sum rebate, we divide $P_{n,mj,t}$ by $1+\tau_{n,mi,t}$.

# Tariffs and Prices

- German cars+American cars+ Japanese cars $\rightarrow C_t^{cars}$; $C_t^{cars} + C_t^{food} \rightarrow C_t$
- German steel+Canadian steel $\rightarrow$ American car production
- $n$: Importing country, $m$: Exporting country, $j$: Exporting Industry.
  - $P^C_{n,i,t}$: Local currency consumer price of bundle $i$ in country $n$ (e.g., car bundle for American consumers)
  - $P^X_{ni,j,t}$: Price of intermediate ($X$) bundle $j$ in for country $n$ in industry $i$ (e.g., car bundle for American services industry).
- The price of $mj$ in country $n$ can be written as:

$$\underbrace{P_{n,mj,t}}_{\text{Price of German cars in US}} = \underbrace{P_{mj,t}}_{\text{Producer Price}} \underbrace{\mathcal{E}_{n,m,t}}_{\text{Exchange Rate}} \underbrace{(1+\tau_{n,mj,t})}_{\text{Tariff on German cars by US}}$$

- Recall: Producer price has nominal rigidity, combining PCP & DCP with $\vartheta_{ni} \in [0,1] \rightarrow$ share of prices rigid in dominant currency.

# Analytical Solution: Decomposing the Impact on Inflation

## Theoretical Example: U.S. 10% Tariffs on RoW

*Based on the analytical solution:*

$$\frac{\partial \pi_t^C}{\partial \hat{\tau}_t} = \underbrace{\boldsymbol{L}_\tau^C}_{\text{Direct CPI Effect}} + \underbrace{\Gamma \boldsymbol{L}_\tau^P}_{\text{Direct PPI Effect}} + \underbrace{\Gamma \alpha \boldsymbol{L}_\tau^C}_{\text{Direct Effect on Real Wages}} + \underbrace{\Gamma \alpha \sigma \boldsymbol{c}_\tau}_{\text{Demand Channel}}$$

$$+ \underbrace{\left(\Gamma(\alpha \boldsymbol{L}_\varepsilon^C + \boldsymbol{L}_\varepsilon^P) + \boldsymbol{L}_\varepsilon^C\right) e_\tau}_{\text{ER Channel}} + \underbrace{\beta \Gamma \Lambda^{-1} \boldsymbol{p}_v v_\tau}_{\text{Debt Channel}}$$

$$+ \underbrace{\Gamma\left(\left[\tilde{\Psi}_\Lambda^{-1} - \beta(\rho \boldsymbol{I} + \Psi^{\text{NKOE}})\right]^{-1} \Lambda - \boldsymbol{I}\right) \boldsymbol{H}}_{\text{Propagation via Network \& Stickiness}}$$

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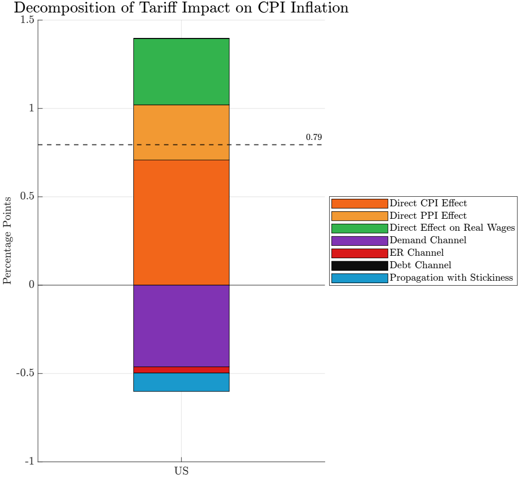
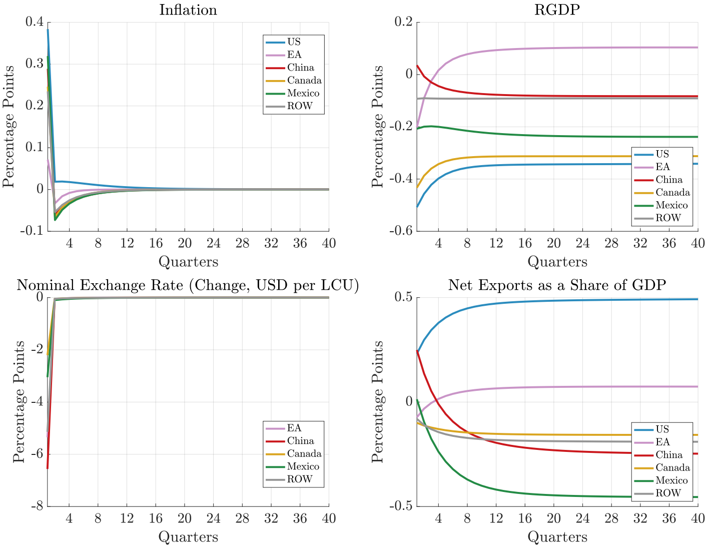


# Baseline: 2025 Tariffs

- Implemented tariffs (mostly unilateral), country-sector as of October 23, 2025.
- Near-permanent shock.

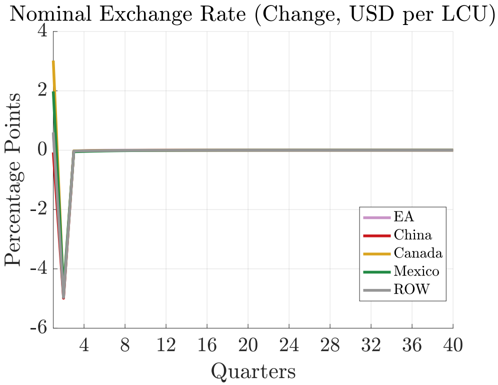


# Scaling One-Time Tariff Volatility Shock: Observed UIP Risk Premia

- Uncertainty can widen the UIP premium $\epsilon_t^{\psi} \uparrow$

$$\hat{i}_{n,t} - \hat{i}_{m,t} = \mathbb{E}_t \hat{\mathcal{E}}_{n,m,t+1} - \hat{\mathcal{E}}_{n,m,t} + \epsilon_t^{\psi}$$

- Following Kalemli-Özcan and Varela (2021), we use Consensus survey data:
  - UIP premium widened by 2-5pp around 2025 tariff announcements
- In Kalemli-Özcan et al. (2025) we feed in a one-time volatility shock scaled to match the size of the UIP wedge in 1Q2025 (2.98%)
  - In Kalemli-Özcan et al. (2026), we feed in a series of unexpected one-time volatility shocks in consecutive periods



# Appendix: Risk Sharing Wedge in Networks

# The Risk Sharing Wedge

- Defining the real exchange rate as $\hat{Q}_t = \hat{P}_t^F + \hat{\mathcal{E}}_t - \hat{P}_t^C$, the Backus -Smith condition in expectation ($\sigma(\mathbb{E}_t \Delta \hat{C}_{H,t+1} - \Delta \hat{C}_{F,t+1}) = \mathbb{E}_t \Delta \hat{Q}_{t+1}$) is a martingale:

$$\hat{w}_t \equiv \hat{Q}_t - \sigma(\hat{C}_{H,t} - \hat{C}_{F,t}), \qquad \hat{w}_t = \mathbb{E}_t \hat{w}_{t+1}$$

- 3 cases for the risk sharing wedge, $\hat{w}_t$:
    1. Complete markets: $\hat{w}_t = 0$
    2. Incomplete markets: $0 < \hat{w}_t < \infty$
    3. Financial autarky limit $\rightarrow$ large PAC $\rightarrow$ larger wedge

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  1. Complete markets: $\hat{w}_t = 0$
  2. Incomplete markets: $0 < \hat{w}_t < \infty$
  3. Financial autarky limit $\rightarrow$ large PAC $\rightarrow$ larger wedge
- For a given shock $\hat{\tau}_0$ and persistence $\rho$, the wedge is time-invariant

$$\hat{w}_t = L_\tau^Q \hat{\tau}_0, \qquad \forall t \geq 0,$$

  - $L_\tau^Q$ captures valuation/ToT gains as it is a function of $\hat{V}_t$ and $\boldsymbol{P}_t^P$

# 3 Aspects of Tariff Shocks

The risk sharing wedge yields a three-equation representation:

**NKIS+TR:**

$$\sigma(\mathbb{E}_t\hat{\boldsymbol{C}}_{t+1} - \hat{\boldsymbol{C}}_t) = \underbrace{\Phi\Gamma\pi_t^P}_{\hat{\boldsymbol{i}}_t} - \underbrace{(\Gamma(\mathbb{E}_t\pi_{t+1}^P) + \boldsymbol{L}_{\mathcal{E}}^C(\mathbb{E}_t\hat{\mathcal{E}}_{t+1} - \hat{\mathcal{E}}_t) + (\rho - 1)\boldsymbol{L}_{\tau}^C\hat{\tau}_t)}_{\mathbb{E}_t\pi_{t+1}^C}$$

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**NKPC:**

$$\pi^P_t = \Lambda \underbrace{\left[(\Omega - \boldsymbol{I})\,\hat{\boldsymbol{P}}^P_t + \alpha \underbrace{\left(\Gamma\hat{\boldsymbol{P}}^P_t + \boldsymbol{L}^C_{\mathcal{E}}\hat{\mathcal{E}}_t + \boldsymbol{L}^C_{\tau}\hat{\tau}_t + \sigma\hat{\boldsymbol{C}}_t\right)}_{\text{Nominal Wage}} + \boldsymbol{L}^P_{\mathcal{E}}\,\hat{\mathcal{E}}_t + \boldsymbol{L}^P_{\tau}\,\hat{\tau}_t\right]}_{\text{Real Marginal Cost}} + \beta\mathbb{E}_t\,\pi^P_{t+1}$$

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**NKPC:**

$$\pi_t^P = \Lambda \underbrace{\left[ (\Omega - \boldsymbol{I}) \hat{\boldsymbol{P}}_t^P + \alpha \underbrace{\left( \Gamma \hat{\boldsymbol{P}}_t^P + \boldsymbol{L}_{\mathcal{E}}^C \hat{\mathcal{E}}_t + \boldsymbol{L}_{\tau}^C \hat{\tau}_t + \sigma \hat{\boldsymbol{C}}_t \right)}_{\text{Nominal Wage}} + \boldsymbol{L}_{\mathcal{E}}^P \hat{\mathcal{E}}_t + \boldsymbol{L}_{\tau}^P \hat{\tau}_t \right]}_{\text{Real Marginal Cost}} + \beta \mathbb{E}_t \pi_{t+1}^P$$

**Risk Sharing**

$$-\boldsymbol{Z} \underbrace{(\Gamma \hat{\boldsymbol{P}}_t^P + \boldsymbol{L}_{\mathcal{E}}^C \hat{\mathcal{E}}_t + \boldsymbol{L}_{\tau}^C \hat{\tau}_t)} + \hat{\mathcal{E}}_t = \sigma \boldsymbol{Z} \hat{\boldsymbol{C}}_t + L_{\tau}^Q \hat{\tau}_0$$

# Risk Sharing Wedge Under Incomplete Markets

## Flexible-Price One Good Example

- Closed-form responses of consumption and exchange rate:

$$\hat{C}_{H,t} = -\underbrace{\frac{\Omega(1-\gamma)+\gamma}{1+\Omega}}_{>0}\left(\frac{1}{1-\Omega}\hat{\tau}_t + \hat{w}_t\right)$$

$$\hat{\mathcal{E}}_t = -\underbrace{\frac{(\Omega(1-\gamma)+\gamma)}{1+\Omega}}_{>0}\hat{\tau}_t + \underbrace{\frac{(1-\Omega)(1-2\gamma)}{1+\Omega}}_{>0}\hat{w}_t$$

- Tariffs generate persistent deviations from perfect risk-sharing. Wedge response:

$$\frac{\partial \hat{w}_{t+j}}{\partial \hat{\tau}_t} = -\frac{(1-\beta)}{1-\beta\rho^{\tau}}\,\frac{\gamma(1-\Omega)(\theta-1)^2-\theta}{(1+\Omega-2\theta)\big(\Omega(2(1-\gamma)+1)-(1-2\gamma)\big)}(1+\Omega)$$

- Sign and magnitude depends on $(\gamma, \Omega, \theta)$:
  - $\hat{w}_t < 0$: wealth transfer to home country $\Rightarrow$ appreciation, consumption gain.
  - More persistent tariffs $\Rightarrow$ larger wedge $\Rightarrow$ larger wealth transfer.