

Pass-through Beyond the Border: Oligopoly, Networks, and Tariffs

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 - ▶ **Industry level**: pass-through $\gg 1$
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- ▶ **This paper:**
 - ▶ models joint effects to **costs of production**, **the prices of foreign rivals**, and **the domestic production network**
 - ▶ structured as consistent with how price data are constructed → test with industry-level data

Main results

- ▶ Input costs, oligopoly, and networks are all needed to match observed producer prices
 - ▶ Micro studies interpretable as *controlling for* network and competition effects
 - ▶ Observed relative movements in PPI / model's prediction:
own cost only **2.95** → + network **2.31** → + foreign competition **1.17**

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 - ▶ Observed relative movements in PPI / model's prediction:
own cost only 2.95 → + **network 2.31** → + **foreign competition 1.17**
- ▶ Prices moved one-for-one with the model's prediction of 2025 tariff effects
- ▶ 2025 tariffs added 0.91 pp to headline PCE (Feb–Oct)
Over half through **final imports**; the rest through **imported inputs** and **foreign competition**

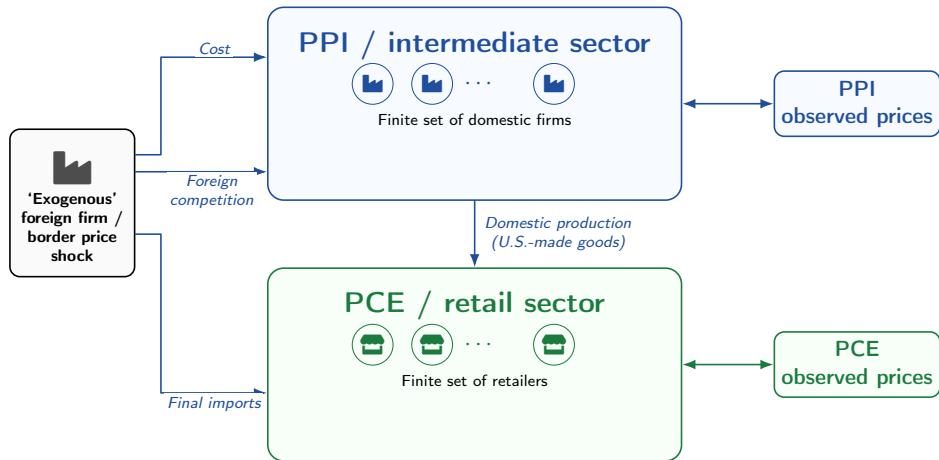
Roadmap

① Model

② Evidence

③ Contribution to headline PCE

A unified framework tracing border shocks through the US price system



- ▶ **'Exogenous' means:** a border price change orthogonal to whatever else moves domestic prices, with all other shocks held fixed — first order, partial equilibrium

Model ingredients: oligopolistic competition with a foreign rival

- ▶ Finite set of firms f in industry i (Bertrand), facing shift-invariant demand:

$$dp_{fi} = \rho_{fi} \underbrace{dmc_{fi}}_{\text{own costs}} + (1 - \rho_{fi}) \underbrace{dp_{-f,i}}_{\text{rival's prices}}$$

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$$d \log p_i^d = \tilde{\rho}_i \Upsilon_i d \log mc_i + (1 - \tilde{\rho}_i) d \log p_i^*$$

$$\tilde{\rho}_i = \frac{\bar{\rho}}{\bar{\rho} + (1 - \bar{\rho}) s_{Fi}}: \text{weight on own cost. Falls with the foreign sales share } s_{Fi}.$$

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- ▶ **Foreign rival's price.** Domestic firms also track the price of the competing imported variety

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Model ingredients: amplification through the production network

- ▶ Marginal costs depend on domestic *and* imported input prices (CRTS, first order):

$$d \log mc_i = \sum_j \Omega_{ij}^d d \log p_j^d + \sum_j \Omega_{ij}^* d \log p_j^*$$

MAPPABLE DATA OBJECTS

p_i^d
PPI price

Ω^d
domestic input shares

Ω^*
imported input shares

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- ▶ Substitute into the industry pricing equation from before and vectorize:

$$\underbrace{(I - \tilde{\rho} \Upsilon \Omega^d)}_{\text{Network Amplification}} d \log \mathbf{p}^d = [\tilde{\rho} \Upsilon \Omega^* + (I - \tilde{\rho})] d \log \mathbf{p}^*$$

MAPPABLE DATA OBJECTS

p_i^d	Ω^d	Ω^*	Υ
PPI price	domestic input shares	imported input shares	variable cost / sales

Putting the pieces together

$$\mathrm{d} \log \mathbf{p}^d = \underbrace{\left[I - \tilde{\rho} \Upsilon \Omega^d \right]^{-1}}_{\text{network}} \left[\underbrace{\tilde{\rho} \Upsilon \Omega^*}_{\text{own cost}} + \underbrace{(I - \tilde{\rho})}_{\text{foreign rivals}} \right] \mathrm{d} \log \mathbf{p}^*$$

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- 2 **The margins interact**
 - ▶ Neglecting any margin may result in omitted variable bias
 - ▶ Network 'spread' exposure: a SUTVA violation

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- 3 **Linear expression in border prices**
 - ▶ Can decompose by source country or industry, and map the effect to each category
 - ▶ Aggregates with expenditure weights

Roadmap

① Model

② Evidence

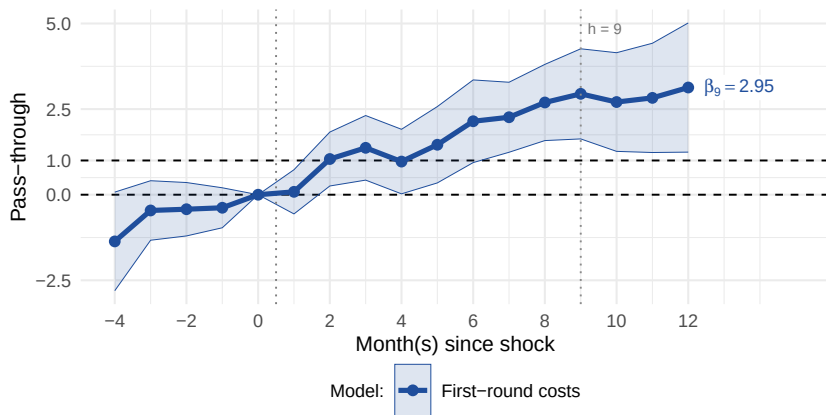
③ Contribution to headline PCE

Local projection diff-in-diff on PPI price responses

$$\Delta_h \log p_{i,t-1} = \beta_h \Delta \log p_i^d \left(\overbrace{\bar{\rho}}^{\text{Oligopoly}}, \overbrace{\boldsymbol{\Omega}^d}^{\text{Network}}, \overbrace{(\mathbf{1} + \hat{\boldsymbol{\tau}}_t)}^{\text{Instrumented tariffs}} \right) + \alpha_i + \delta_t + \text{controls} + \varepsilon_{i,t+h}$$

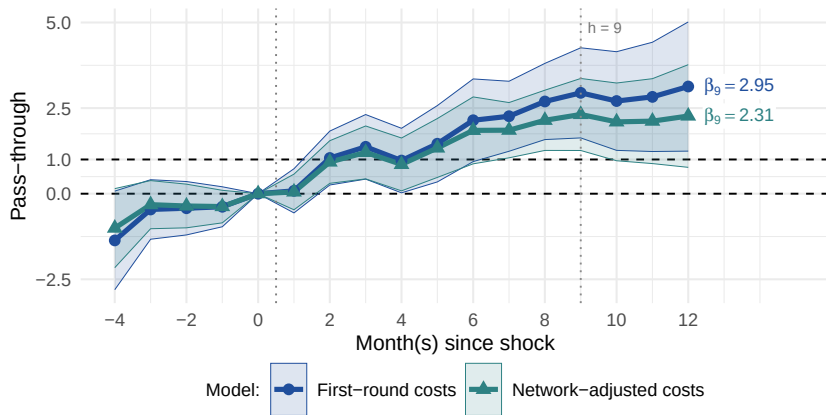
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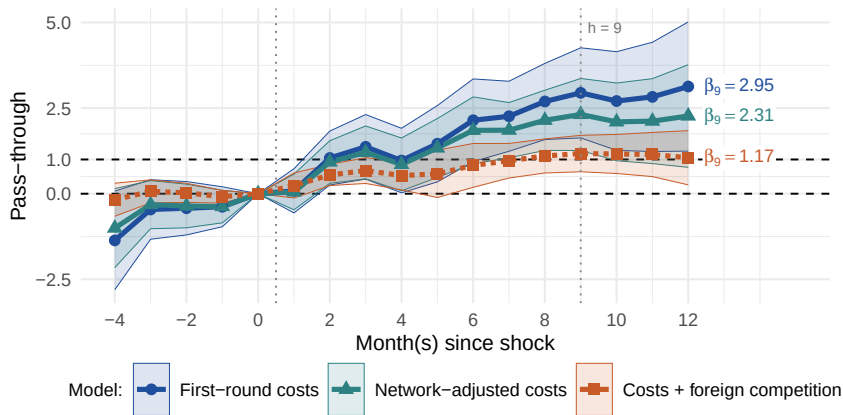
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How much weight do producers put on their rivals' prices?

$\bar{\rho}$ (unobserved) is the weight on producer's **marginal cost**, $1 - \bar{\rho}$ the weight on **its rival's prices**.

① Outside evidence

- ▶ Amiti, Itskhoki & Konings (2019) estimate a weight of about **0.6** on **own cost**

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② Estimated in sample, from the 2025 tariff response

- ▶ Evaluate the model residual at the reference horizon $h = 9$ (local projection identifies long-term impact)
- ▶ Apply **GMM** on residuals
- ▶ $\hat{\rho} = \mathbf{0.655}$, 95% set $[0.433, 0.886]$; monopolistic competition ($\bar{\rho} = 1$) is rejected
- ▶ Applying the same framework to the 2018–19 episode returns a similar **0.697**

From producer prices to consumer prices

- ▶ Retailers buy domestic goods (whose PPI already embeds **cost**, **network**, and **competition**) and imported final goods:

$$d \log \mathbf{p}^{\text{PCE}}(\hat{\rho}) = \Upsilon^r \left[\underbrace{\Theta^d d \log \mathbf{p}^d(\hat{\rho}, \mathbf{p}^*)}_{\text{domestic production}} + \underbrace{\Theta^* d \log \mathbf{p}^*}_{\text{final imports}} \right]$$

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Υ^r	Θ^d	Θ^*
retail variable cost / sales	domestic sourcing shares	imported final-good shares

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- ▶ Θ^d , Θ^* map products (domestic vs. foreign) to expenditure categories
- ▶ Υ^r maps distribution margins
- ▶ All retailers are domestic and homogeneous within expenditure category: no new competition parameter to estimate

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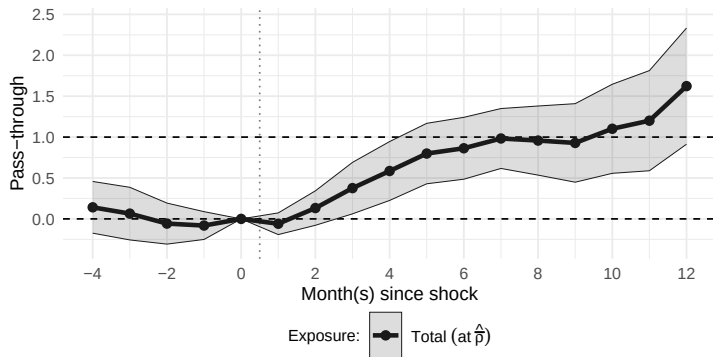
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Local projection diff-in-diff on PCE price categories

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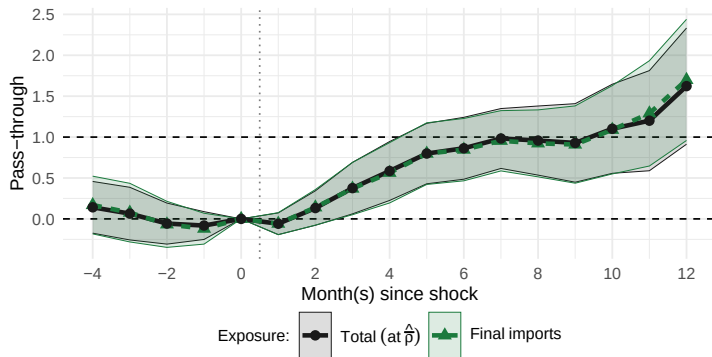
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- $\beta_9 = 0.93$ at $\hat{\rho}$ — indistinguishable from full pass-through

Local projection diff-in-diff on PCE price categories

$$\Delta_h \log p_{e,t+h} = \beta_h v_e^r \theta_e^* \Delta \log(1 + \tau_t) + \alpha_e + \delta_t + \text{controls} + \varepsilon_{e,t+h}$$



- ▶ $\beta_9 = 0.93$ at $\hat{p}$ — indistinguishable from full pass-through
- ▶ Mostly identified by **final imports**: the domestic channels are compressed by the network, aggregation, and margins. PPI is where those channels are identified.

Competition parameter $\bar{\rho}$

- ▶ **Pass-through in logs:** $\hat{\rho} = 0.679$.
Levels and logs cannot be told apart at industry precision
- ▶ **Within-industry covariance** (are exposed firms the high-pass-through ones?): estimated jointly, $\hat{\rho} = 0.719$, and $\bar{\rho} = 1$ is still rejected
- ▶ **ρ varying with concentration (HHI):** median 0.652
- ▶ **2018–19 episode:** $\hat{\rho} = 0.697$, but too noisy to reject $\bar{\rho} = 1$ (pre-trends, wider SEs)

Pass-through estimates β_h

- ▶ **Instrument:** legally enacted schedule instead of statutory observed rates
- ▶ **Treatment:** duty-inclusive border unit value instead of the tariff
- ▶ **Sign-split controls:** tariff increases vs. decreases are not statistically different
- ▶ **Goods-only PCE:** faster and higher, but not significantly different
- ▶ **2018–19 PPI:** same ladder, $\beta_9 = 1.25$ with competition

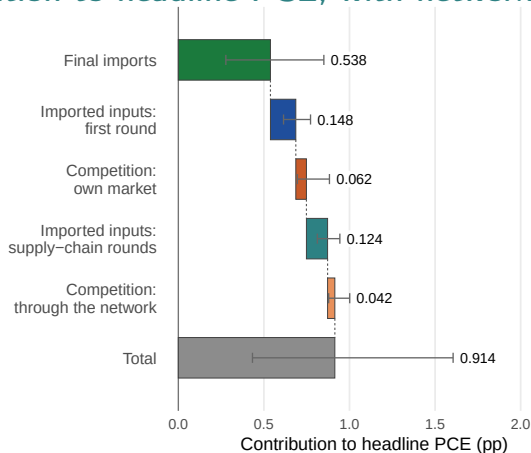
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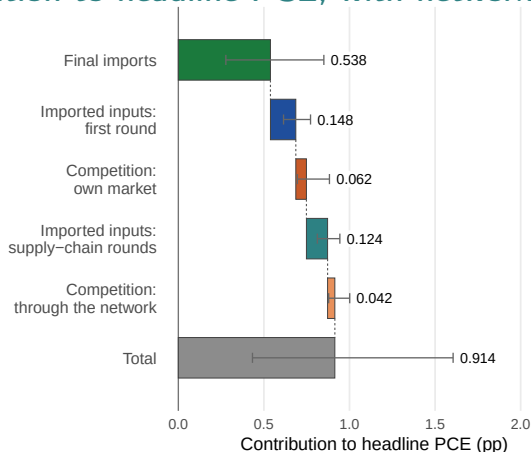
③ Contribution to headline PCE

First-order contribution to headline PCE, with network and oligopoly



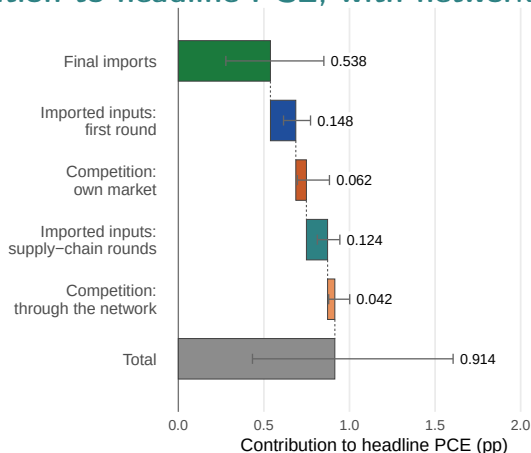
► Feb–Oct 2025 tariff increases, pass-through in levels, first order: **0.91 pp**

First-order contribution to headline PCE, with network and oligopoly



- ▶ Feb–Oct 2025 tariff increases, pass-through in levels, first order: **0.91 pp**
- ▶ **Final imports** over half; **imported inputs** plus **supply-chain rounds** about a third; **competition 0.10 pp** and its **network amplification**

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- ▶ **Final imports** over half; **imported inputs** plus **supply-chain rounds** about a third; **competition 0.10 pp and its network amplification**
- ▶ About a quarter arrives in services and small categories reached *only* through **the network**

Appendix

Where this sits: pass-through × networks × imperfect competition

- ① **Tariff pass-through.** Amiti, Redding & Weinstein (2019); Fajgelbaum et al. (2020); Cavallo, Gopinath, Neiman & Tang (2021); Flaaen & Pierce (2024); Minton & Somale (2025); Amiti, Heise & Weinstein (2026)
 - ▶ We clarify *which* downstream object each design is identifying
- ② **Production networks & inflation.** Baqaee & Farhi (2019); La'O & Tahbaz-Salehi (2022); Baqaee & Rubbo (2023); Silva (2024)
 - ▶ We map border shocks through the IO network while keeping oligopolistic pricing
- ③ **Markups & imperfect competition.** Atkeson & Burstein (2008); Amiti, Itskhoki & Konings (2019); Sangani (2026)
 - ▶ We embed pass-through *in levels* and competition with foreign rivals in an IO + retail model, and estimate them jointly

From firm pricing to industry PPI

Domestic firms $f \in \mathcal{D}_i$ compete with each other and with one foreign firm F . Logit variety shares π_{fi} , Bertrand pricing $p_{fi} = mc_{fi} + \sigma_i / (1 - \pi_{fi})$.

1. Firm price (levels).

$$dp_{fi} = (1 - \pi_{fi}) dmc_{fi} + \pi_{fi} dp_{-f,i}$$

2. Domestic PPI. Aggregate over $f \in \mathcal{D}_i$ and solve the within-industry fixed point:

$$d \log p_i^d = \frac{v_i^d \sum_f \tilde{\delta}_{fi} \rho_{fi} d \log mc_{fi} + \frac{(1 - \pi_{Fi}) \sum_f \tilde{\pi}_{fi} (1 - \rho_{fi})}{1 - s_{Fi}} s_{Fi} d \log p_{Fi}}{1 - (1 - \pi_{Fi}) \sum_f \tilde{\pi}_{fi} (1 - \rho_{fi})}, \quad \rho_{fi} = \frac{(1 - \pi_{fi})^2}{1 - \pi_{fi} + \pi_{fi}^2}$$

3. Common $\bar{\rho}$, $\pi = s$. The expression collapses to a weighted average:

$$d \log p_i^d = \tilde{\rho}_i v_i^d d \log mc_i + (1 - \tilde{\rho}_i) d \log p_{Fi}, \quad \tilde{\rho}_i = \frac{\bar{\rho}}{\bar{\rho} + (1 - \bar{\rho}) s_{Fi}}$$

In the data: $d \log p_{Fi} = d \log p_i^* = d \log(1 + \tau_i)$ (full border pass-through).

Pass-through in levels vs. logs

- ▶ **Standard (pass-through in logs).** Markup is a *percentage* of marginal cost

$$p_i = \bar{\mu}_i \cdot mc_i \implies d \log p_i = d \log mc_i$$

1% cost shock $\rightarrow$ 1% price increase

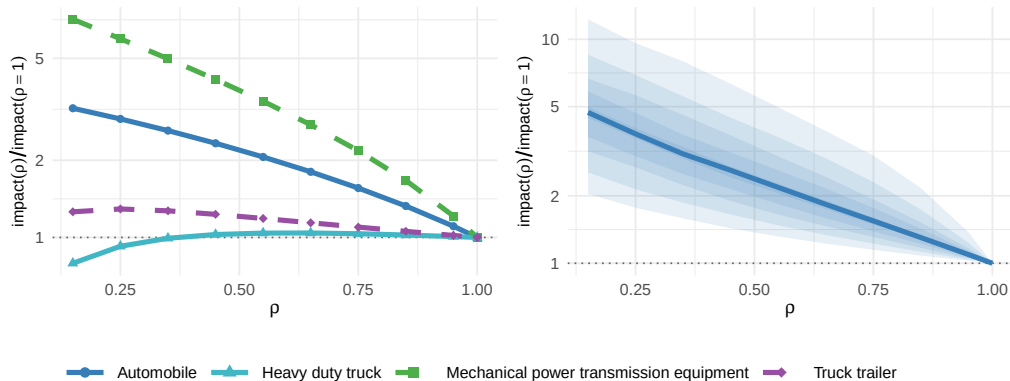
- ▶ **Pass-through in levels** (*à la* Sangani 2026). Markup is a *dollar* amount

$$p_i = \bar{\mu}_i + mc_i \implies dp_i = dmc_i \xrightarrow{\text{CRTS}} d \log p_i = \overbrace{\frac{\Upsilon_i}{\text{Costs}_i}}^{\text{Costs}_i} \frac{\text{Costs}_i}{\text{Sales}_i} d \log mc_i$$

1% cost shock $\rightarrow$ *cost-share* % price increase

- ▶ **The episode cannot tell them apart.** Re-estimating in logs gives $\hat{\rho} = 0.679$ against 0.655 in levels; the contribution to headline PCE rises by ≈ 0.2 pp

Competition amplifies when rivals are tariffed: autos vs. heavy trucks



- ▶ Same NAICS-4 industry and the same steel- and aluminum-heavy inputs. Section 232 hit finished autos and carved out heavy trucks
- ▶ Autos: the rival's price rises by 13.4 pp, so lowering ρ raises the predicted impact. Trucks: 1.6 pp, so it lowers it. Trucks are the only manufacturing commodity where the impact falls