Payment Innovations and Currency Competition in Trade

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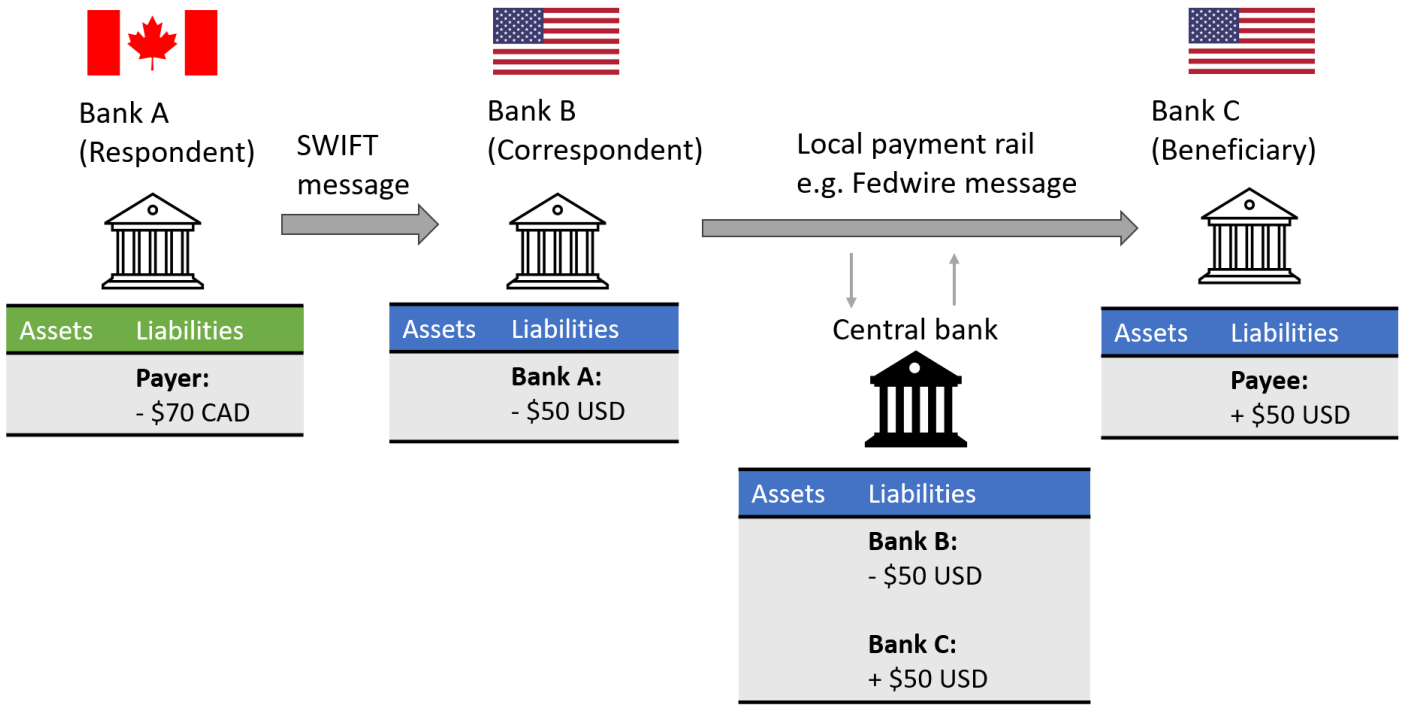
Preliminary and Incomplete
Please do not circulate

Background

Why is cross-border (XB) payment costly?

Cross-border payments mostly rely on correspondent banking arrangement:



$\Rightarrow$ Observed FX and fee margins reflect: markups + marginal cost (compliance costs, intermediary fees, nostro/vostro account management)

Introduction

- Cross-border payment infrastructure is evolving rapidly $\rightarrow$ potential reductions in payment costs for certain currencies, e.g.
  - Stablecoins: 24/7 tokenized payment rail, bypassing correspondent banking for the transfer leg $\rightarrow$ lower USD payment cost
  - Multi-CBDC platforms, interlinking fast payment systems $\rightarrow$ lower payment costs for participating countries' currencies
- Key question: How do payment innovations affect firms' currency choices and the global dominance of US dollar?

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- Existing models of currency choices focus on nominal rigidity
  - Exporters choose currencies to minimize deviations of preset prices from desired prices caused by exchange rate fluctuations

- **This paper**
  - Incorporates payment frictions into a multi-country GE model with endogenous currency choice building on Mukhin (2022)
  - Quantifies how lower payment costs affect currency competition globally

Key Model Mechanisms

Exporters choose their invoicing currency, taking into account:

1. **Nominal rigidity** (existing):
   - → With preset prices, exporters choose the currency that minimizes exchange-rate-induced deviations from desired prices.
2. **Destination price wedge** (new):
   - → If buyers' currency on hand differs from the invoicing currency, payment costs raise effective prices and lower demand.
   - → payment complementarity through downstream buyer network
3. **Imported input payment wedge** (new):
   - → If exporters' revenue currency differs from suppliers' invoicing currency, payment costs raise effective marginal costs.
   - → payment complementarity through upstream supplier network

Preview of Findings

Payment costs and currency choices

- Payment costs with currency mismatches matter for currency shares
- Equilibrium currency choice is a fixed point with network amplification
- Payment costs create complementarities and sustain vehicle currency dominance even without demand complementarities via Kimball
- Payment cost reductions can either entrench or unwind vehicle currency dominance
  - **USD-specific cost reduction** raises dollar's share by about **15 pp**, mostly at euro's expense
  - **Broad cost reduction across currencies** unwinds vehicle currency use: with all payment costs removed, the USD share falls by about **18 pp** and PCP rises by about **21 pp**

Related Literature (To be completed)

- **Vehicle currency and nominal rigidities**: Corsetti and Pesenti (2002); Goldberg and Tille (2008, 2016); Boz et al. (2022, 2025); Bacchetta and van Wincoop (2005); Engel (2006); Gopinath et al. (2010, 2020); and Mukhin (2022); Crowley, Han and Son (2024)

  $\Rightarrow$ Payment costs in the background

- **Settlement and financial frictions**: Krugman (1980); Devereux and Shi (2013), Chahrour and Valchev (2022), Perez-Saiz, Zhang, and Iyer (2023), and Rey (2025)

  $\Rightarrow$ Study transaction costs or payment flow, separate from nominal rigidities

Roadmap

- Simplified model to illustrate the key mechanism
- Full quantitative model: calibrated to match cross-border payment costs and country-level invoicing shares
- Counterfactual: quantifying impact of payment cost reductions on currency choices

Simplified Model

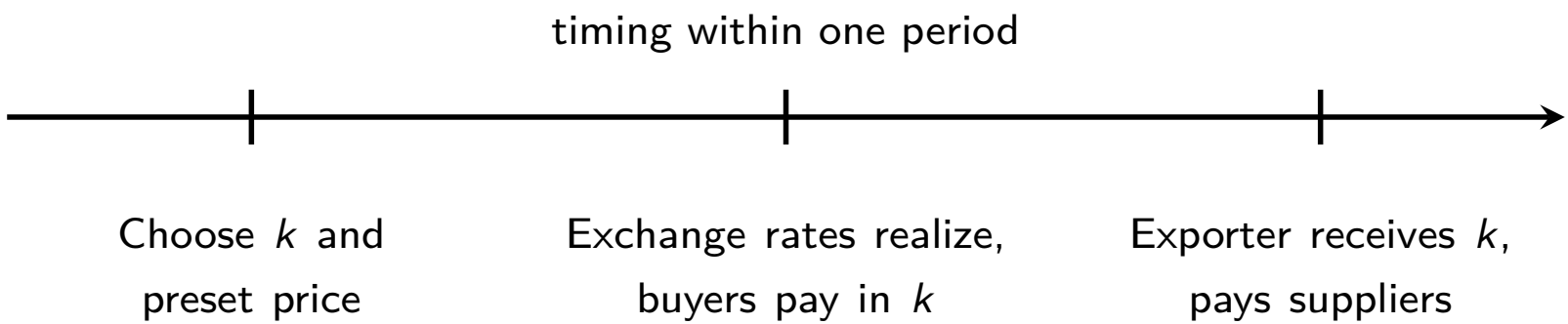
- N countries, one sector, two currency types (vehicle v and home j)
- **Nominal rigidities:** Fraction λ of exporters have to preset prices

$\downarrow$

- Exporter chooses a currency k for their preset prices

$\downarrow$

- Exporter receives revenue in currency k and uses those receipts to pay suppliers.



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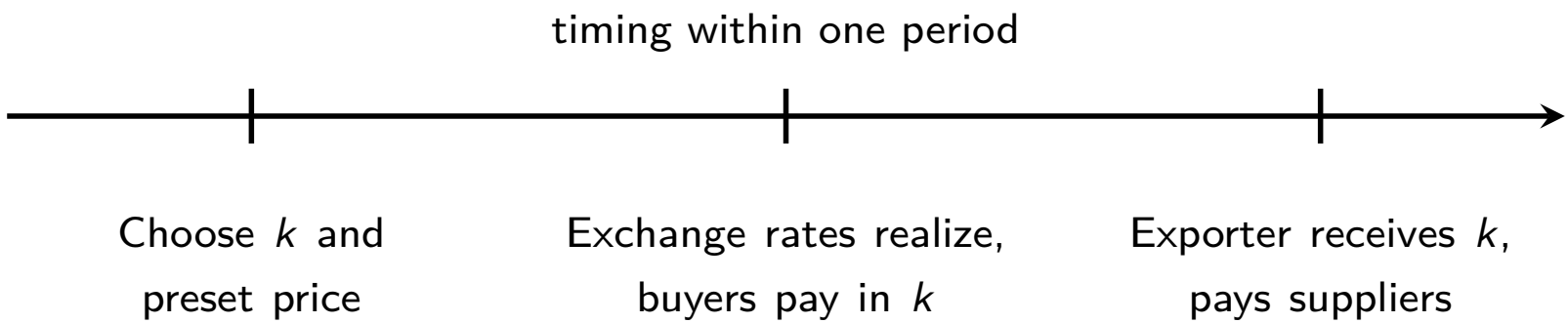


- For tractability, exporters use a **single** invoicing currency across destinations $\rightarrow$ this restriction is relaxed in the full model

Payment Costs and Frictions

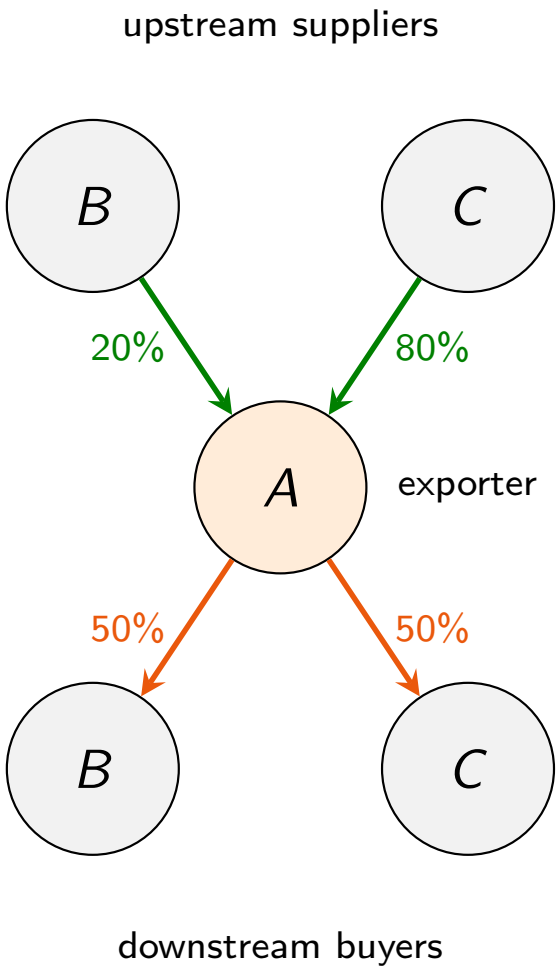
- Cost of paying in currency a when holding currency b on hand:

$$\Gamma(a,b) = \begin{cases} 0, & a = b, \\ \tau^{v}, & a = v \text{ or } b = v, \\ \tau^{nv}, & \text{otherwise.} \end{cases} \qquad \psi(a,b) \equiv \log[1 + \Gamma(a,b)]$$

- Payment frictions:
  - Buyers incur costs if holdings from their export receipts differ from k
  - Exporters incur costs if k differs from suppliers' invoicing currencies

Currency Mismatch: Buyer vs Supplier Networks

Numerical example of 3 countries (A, B, C)



- Continuum of exporters
- Let probabilities of choosing vehicle currencies be

$$\pi = (\pi_A, \pi_B, \pi_C) = (0.8, 0.1, 0.9)$$

- Vehicle currency held by A's buyers:

$$h_A^{\text{buy}} = 0.5\pi_B + 0.5\pi_C = 0.50$$

- Vehicle currency held by A's suppliers:

$$h_A^{\text{sup}} = 0.2\pi_B + 0.8\pi_C = 0.74$$

- Currency mismatch: $|h_A^{\text{buy}} - h_A^{\text{sup}}| = 0.24$.

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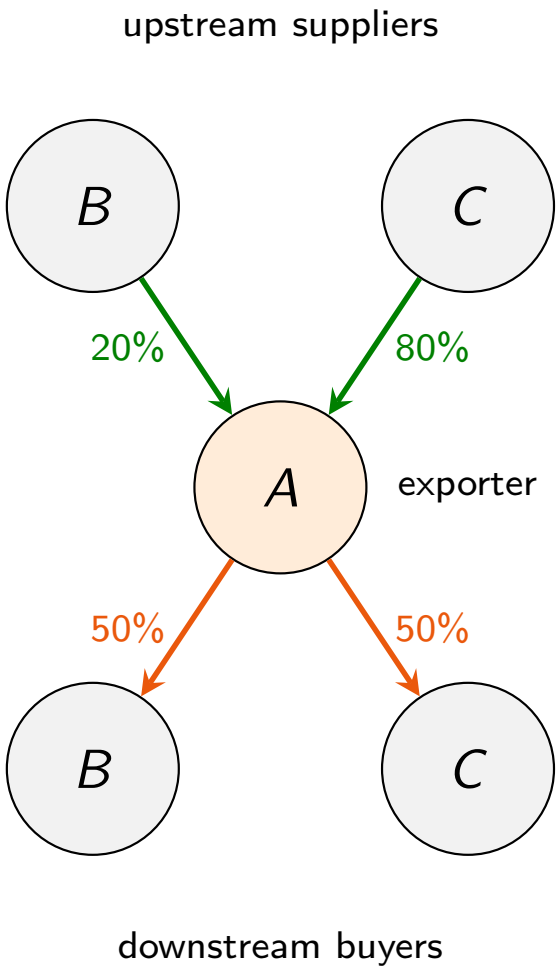

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$\Rightarrow \pi$ is the key endogenous variable that we will solve in equilibrium

Exporter Maximizes Expected Profit

Expected payoff from choosing currency k (given π):

$$V_{ji}(k;\pi) \equiv (1-\lambda)\mathbb{E}_s\left[\Pi_{ji}(k, \underbrace{P^*_{ji}(k;s,\pi)}_{\text{flexible price}}; s, \pi)\right] + \lambda\mathbb{E}_s\left[\Pi_{ji}(k, \underbrace{\bar{P}_{ji}(k;\pi)}_{\text{preset price}}; s, \pi)\right]$$

where profit function $\Pi_{ji}(k, P_{ji}; s, \pi)$ is

$$\Pi_{ji} \equiv \left[\mathcal{E}_{jk}(s)P_{ji} - MC_j(s)\underbrace{\exp\left(g_j^{\text{pay}}(k;\pi)\right)}_{\text{input-payment wedge}}\right]\left[\frac{\mathcal{E}_{ik}(s)P_{ji}\overbrace{\exp\left(g_{ji}^{\text{buy}}(k;\pi)\right)}^{\text{buyer-side wedge}}}{P_i(s)}\right]^{-\theta}$$

- P_{ji} is corridor price in currency k
- π is invoicing share vector
- s is state of the economy
- $\mathcal{E}_{jk}(s)$ is exchange rate between currency j and k
- $P_i(s)$ is price index in destination i
- θ is demand elasticity

Start with Nominal Rigidity Channel

Penalizes currencies that creates exchange rate risk in input costs

Optimal flexible price in currency k under CES:

$$\tilde{p}_{ji}(k; s, \pi) = \log P^*_{ji}(k; s, \pi) = \log \mu + \log MC_j(k; s, \pi) - \log \mathcal{E}_{jk}(s)$$

Optimal preset price:

$$\bar{p}_{ji}(k; \pi) = \mathbb{E}_s[\tilde{p}_{ji}(k; s, \pi)]$$

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$\Rightarrow$ **Nominal rigidity channel**: pricing in k creates relative exchange rate exposure in revenues and costs $\Omega_j(\pi)$

$$V^{\text{sticky}}(k;\pi) \approx -\frac{(\theta-1)\lambda\mathcal{R}}{2}\text{Var}\Big(e_{jk} - \phi\,\Omega_j(\pi)\Big)$$

- $\Omega_j(\pi) \equiv \sum_{m\neq j} W^M_{mj}\left[\pi_m e_{jv} + (1-\pi_m)e_{jm}\right]$ summarizes country j's exchange rate exposure to the currencies used by its input suppliers and $e_{jk} \equiv \log \mathcal{E}_{jk}$
- ϕ is intermediate input share in marginal cost and $\mathcal{R}$ is steady state revenue

Add Wedges and Decompose Exporter Profit

Payment frictions are first order, while the nominal rigidity channel is second order:

$$V(k;\pi) \approx \underbrace{-\mathcal{R}\, g_{ji}^{\text{buy}}(k;\pi)}_{\text{wedges in destination price}} - \underbrace{\kappa_\theta \mathcal{R}\, g_j^{\text{pay}}(k;\pi)}_{\text{wedges in input payment costs}} - \underbrace{\frac{(\theta-1)\lambda\mathcal{R}}{2}\,\text{Var}\Big(e_{jk} - \phi\,\Omega_j(\pi)\Big)}_{\text{nominal rigidity channel}}$$

where $\kappa_\theta = \frac{\theta-1}{\theta}$ is the variable-cost share of revenue and

$$g_{ji}^{\text{buy}}(k;\pi) = (1-\varphi)\underbrace{\psi(k,i)}_{\text{final consumers hold } i} + \varphi\underbrace{\Big[\pi_i\psi(k,v) + (1-\pi_i)\psi(k,i)\Big]}_{\text{firm buyers hold export receipts}}$$

$$g_j^{\text{pay}}(k;\pi) = \phi\left\{\underbrace{W_{jj}^M\psi(j,k)}_{\text{domestic input}} + \sum_{m\neq j}\underbrace{W_{mj}^M\Big[\pi_m\psi(v,k) + (1-\pi_m)\psi(m,k)\Big]}_{\text{input sourced from supplier } m}\right\}$$

where W_{mj}^M is j's input share sourced from supplier m.

From Corridors to Country-Level Payoffs

Vehicle-currency incentives combine direct and network terms

Payoff difference in using vehicle v vs home j currency:

$$\Delta_j \equiv \sum_i W_{ji}^X \Big[V_{ji}(v;\pi) - V_{ji}(j;\pi) \Big]$$

$$\approx \underbrace{a_j}_{\text{direct}} + \underbrace{\varphi\chi\mathcal{R} \sum_i W_{ji}^X \pi_i}_{\text{buyers}} + \underbrace{\kappa_\theta \phi\chi\mathcal{R} \sum_{m\neq j} W_{mj}^M \pi_m}_{\text{suppliers}} + \underbrace{(B^{\text{sticky}}\pi)_j}_{\text{sticky price}}$$

- $V_{ji}(k;\pi)$: exporter j's payoff from invoicing currency k in destination i
- W_{ji}^X and W_{ji}^M: export and import trade shares
- a_j: direct incentive, holding other countries' vehicle shares fixed
- $\chi \approx 2\tau^v - \tau^{nv}$: cost gap between vehicle-routed and direct conversion
- B^{sticky}: how suppliers' vehicle adoption changes country j's sticky-price incentive

Currency Choice is a Network Fixed Point

Buyer, supplier, and sticky-price feedback enter through one matrix

- With idiosyncratic preference shocks $\varepsilon_j \sim U[-\sigma/2, \sigma/2]$, currency shares are:

$$\pi_j = \Pr(\Delta_j + \varepsilon_j > 0) = \frac{1}{2} + \frac{1}{\sigma}\Delta_j$$

- Stack Δ_j and express in matrix form:

$$\Delta = a + \underbrace{\left(\varphi\chi\mathcal{R}W^X + \kappa_\theta\phi\chi\mathcal{R}\widetilde{W}^{M\top} + B^{\text{sticky}}\right)}_{B}\pi$$

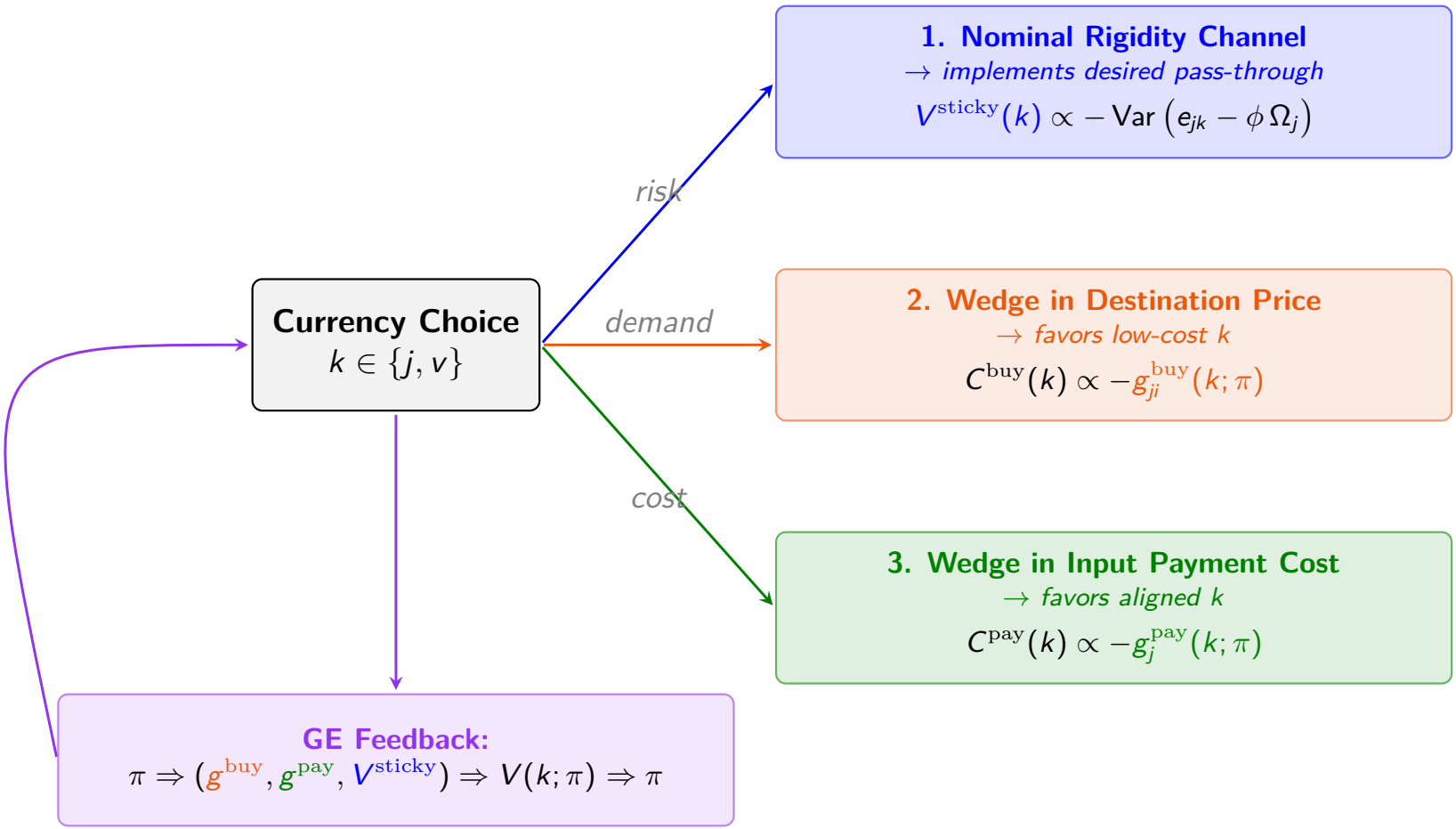
- The currency shares can be solved in closed form as

$$\pi = \underbrace{\left[I - \frac{1}{\sigma}B\right]^{-1}}_{\text{Currency-choice Leontief Inverse}} \left[\frac{1}{2}\mathbf{1} + \frac{1}{\sigma}a\right]$$

- All strategic feedback operates through "Currency-choice Leontief Inverse"

General Equilibrium Feedback

Payment costs shape currency shares, and currency shares feed back into payment costs



Full Quantitative Model

Differences from the Simple Model

- $N = 63$ countries, $S = 32$ sectors in the data; currency counterfactuals use the $S = 1$ baseline.
- Corridor-specific currency menu: $\mathcal{C}_{ji} = \{\text{USD},\ \text{EUR},\ \text{PCP},\ \text{LCP}\}$
- Kimball demand $\rightarrow$ variable markups
- Exporter and importer preferences for each currency (X^c, M^c)
- Currency choices modeled as probabilistic outcomes (logit error ϵ)

$$\pi_{ji}(k) = \frac{\exp\left(\left[V_{ji}(k;\pi) + \ln X_j^k + \ln M_i^k\right]/\sigma\right)}{\sum_{c\in\mathcal{C}_{ji}} \exp\left(\left[V_{ji}(c;\pi) + \ln X_j^c + \ln M_i^c\right]/\sigma\right)}$$

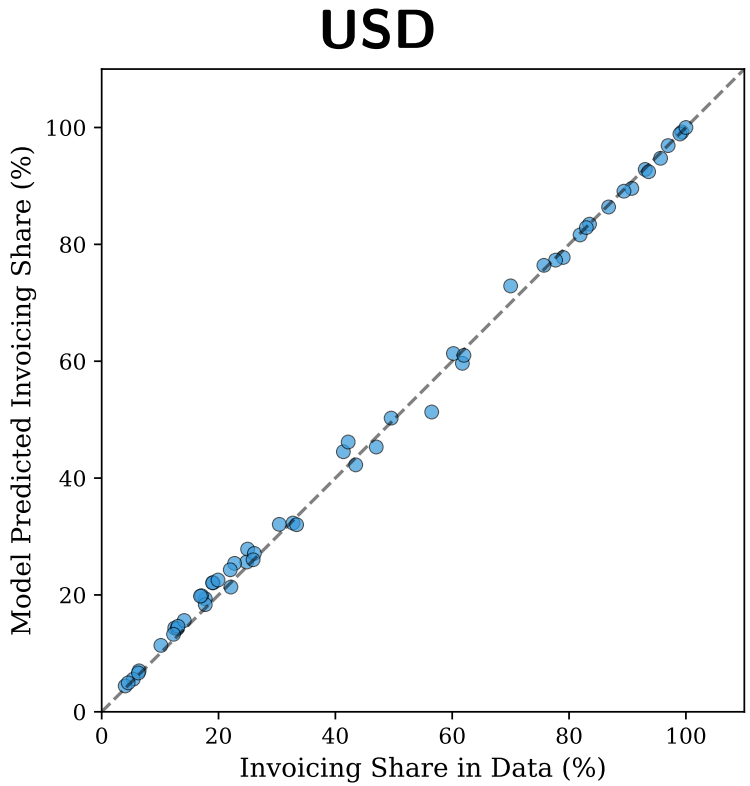
Data

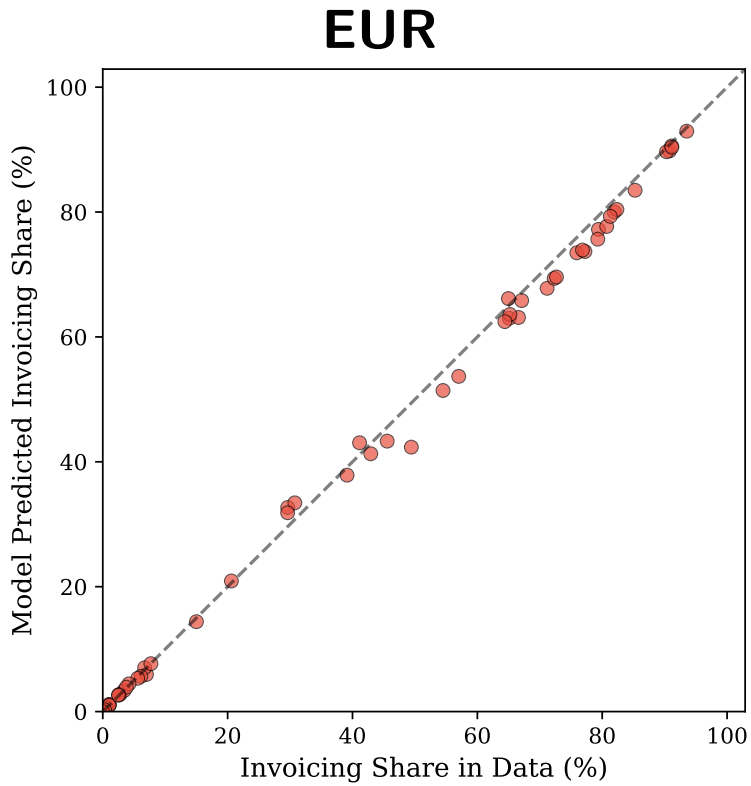
Data source	Calibration
IMF invoicing shares from Boz et al. (2022)	Estimate exporter and importer fixed effects X, M
OECD ICIO (2015)	Buyer share φ_i from intermediate imports $= 0.7$; sectoral ϕ, θ
Mukhin (2022)	Exchange-rate covariance matrix and sticky-price parameter λ; Kimball superelasticity α
FXC Intelligence	Payment costs: vehicle-leg $\tau^{v} = 0.024$; non-vehicle bilateral $\tau^{nv} = 0.03$

- The quantitative model uses 54 countries with IMF invoicing data to estimate exporter and importer fixed effects X and M.
- Logit scale σ is set to 0.05 (close to deterministic case in literature).

Model Fit

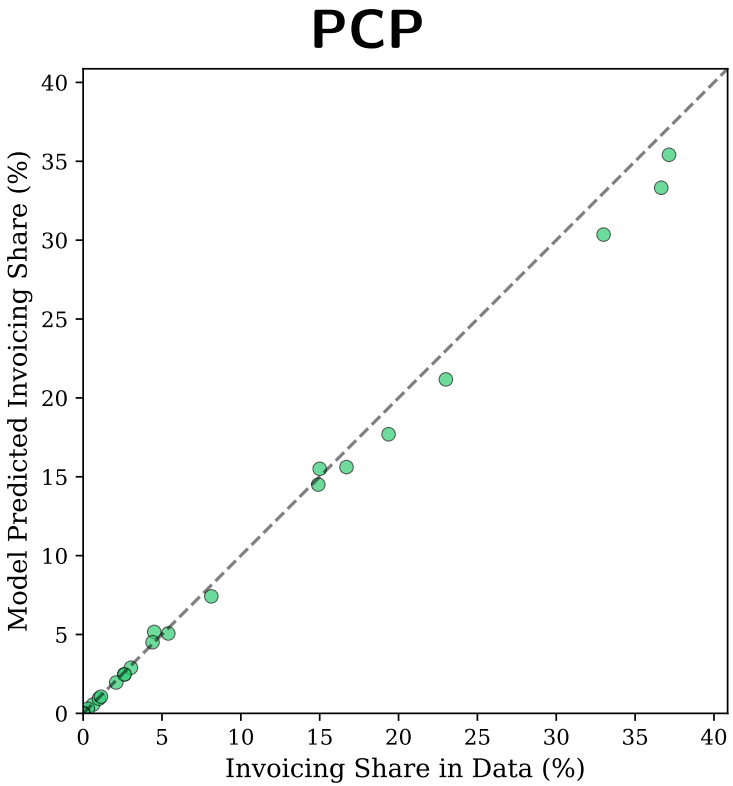
Predicted vs observed export invoicing shares: USD and EUR (each dot is a country)

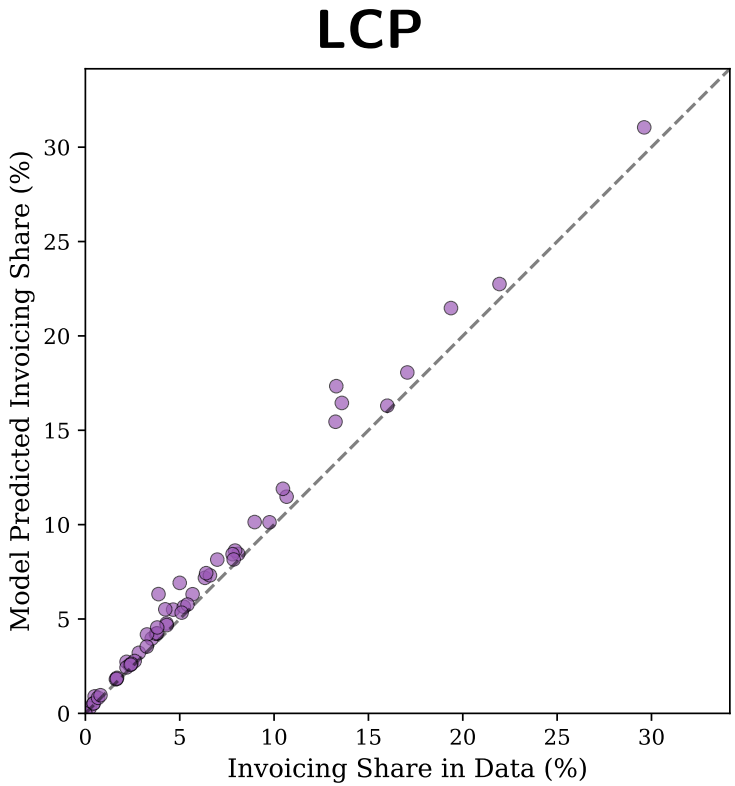




Model Fit

Predicted vs observed export invoicing shares: PCP and LCP (each dot is a country)



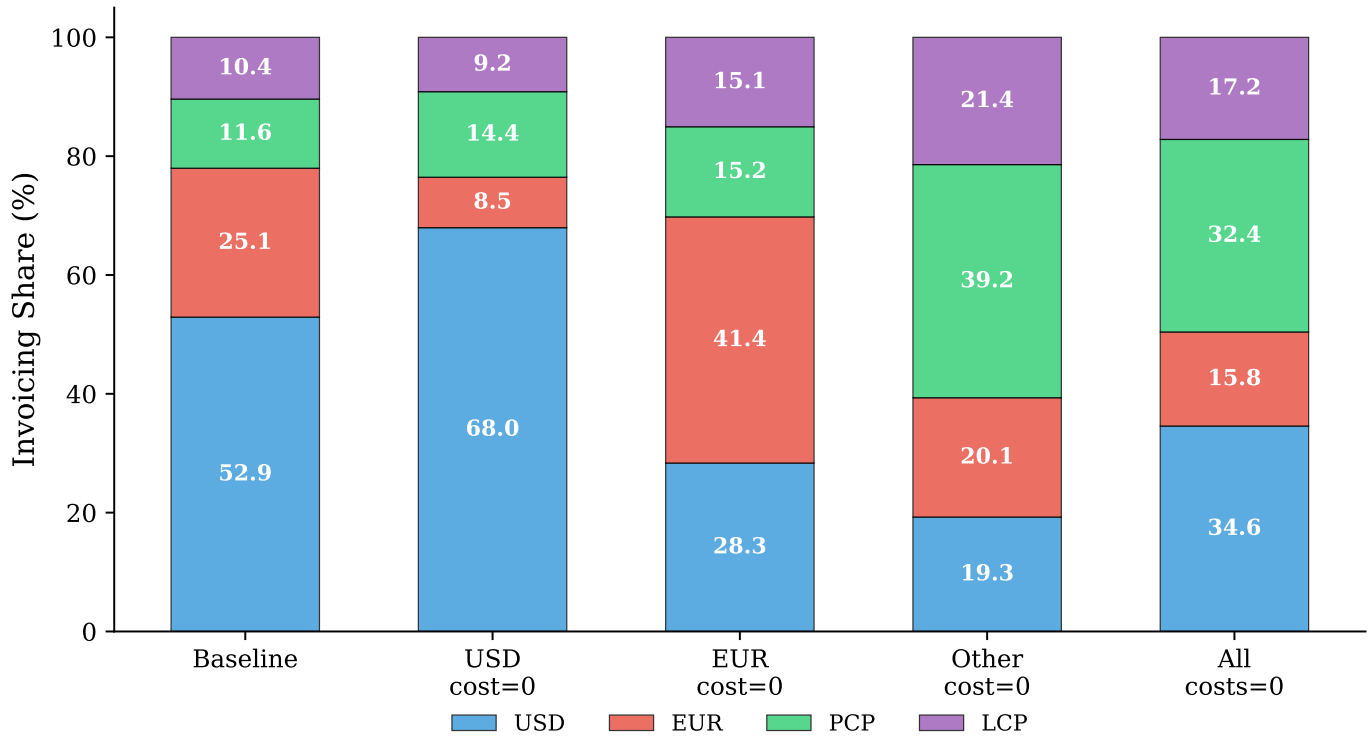


Counterfactual Design

Scenario	Interpretation
Baseline	Current conversion-cost matrix
USD cost $= 0$	Frictionless settlement involving USD
EUR cost $= 0$	Frictionless settlement involving EUR
Other cost $= 0$	Zero cost for non-USD/non-EUR currencies, USD-EUR leg unchanged
All costs $= 0$	Frictionless conversion across all currency pairs

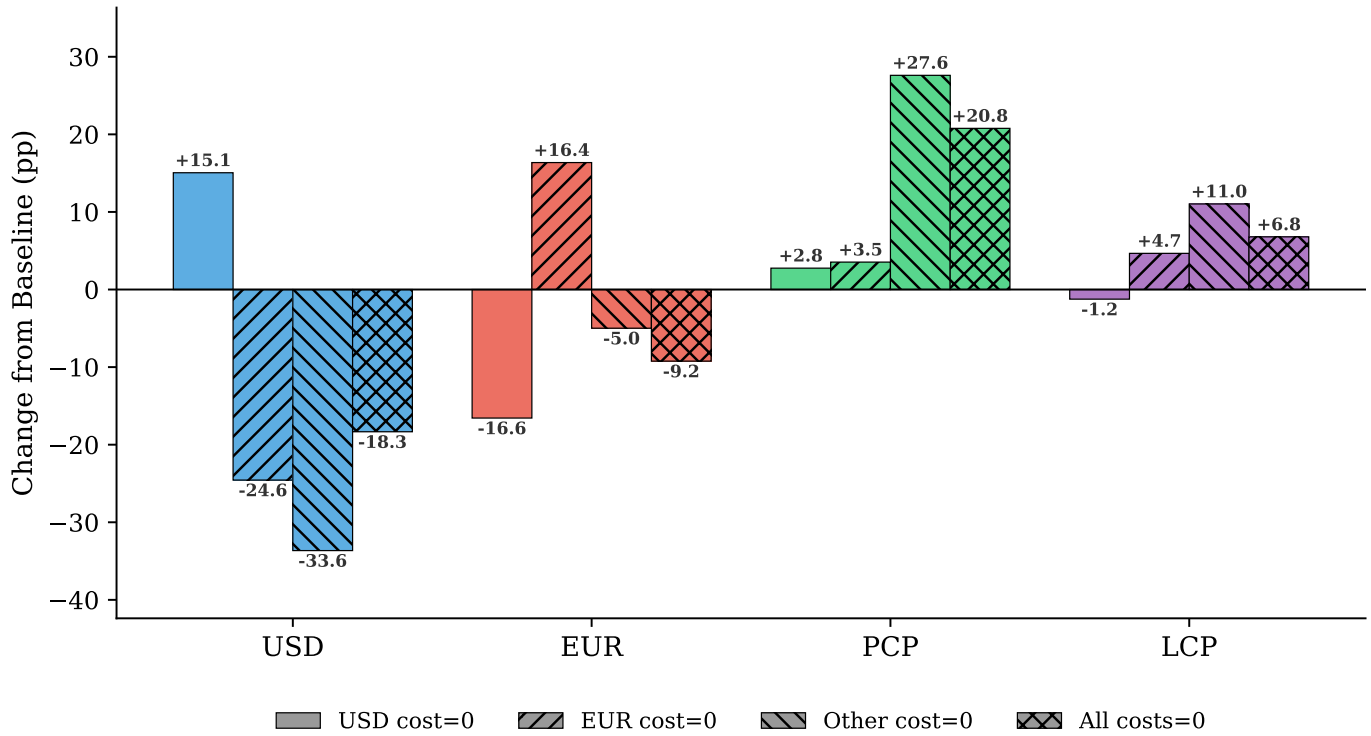
- **Currency-specific** cost reduction: e.g. USD-denominated stablecoins
- Broad cost reductions to **many currencies**: e.g. multilateral CBDC bridges, interlinked fast payment systems.

Aggregate Invoicing Shares: Levels



- Making one vehicle currency cheaper mostly reallocates share **between** vehicle currencies.
- Making many currencies cheaper reallocates share **away from** vehicle currencies and toward PCP/LCP.

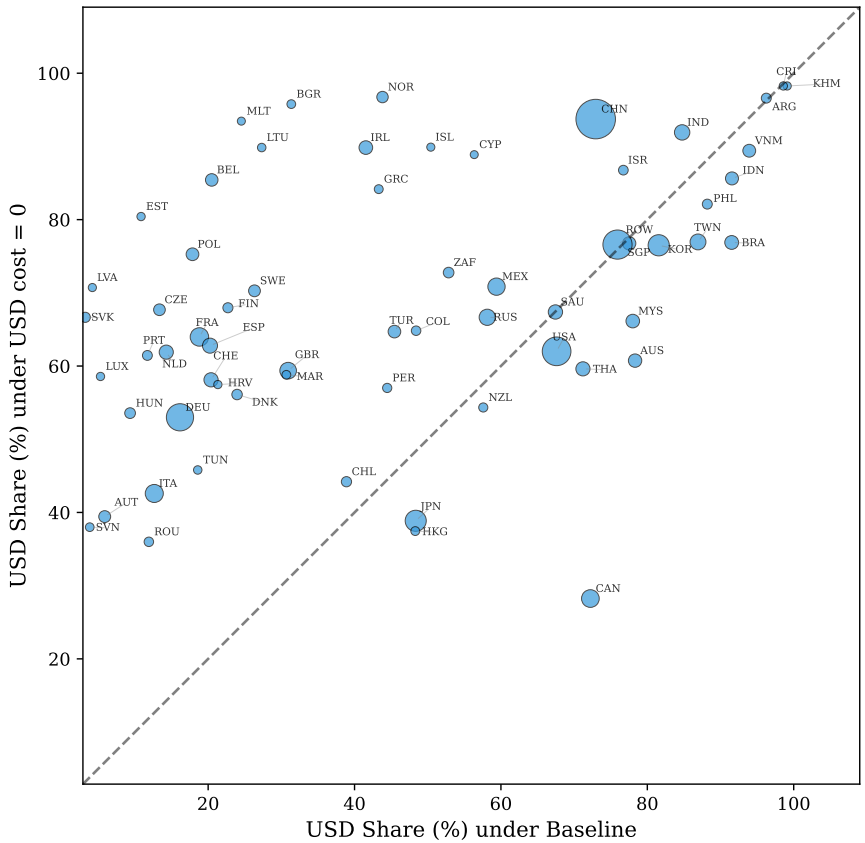
Aggregate Invoicing Shares: Changes from Baseline



- USD cost = 0: USD share rises by **15.1 pp**.
- Other cost = 0: USD share falls by **33.6 pp**, mostly shifting toward PCP
- All costs = 0: USD share falls by **18.3 pp**; PCP rises by **20.8 pp**

Country Heterogeneity: USD Cost Reduction

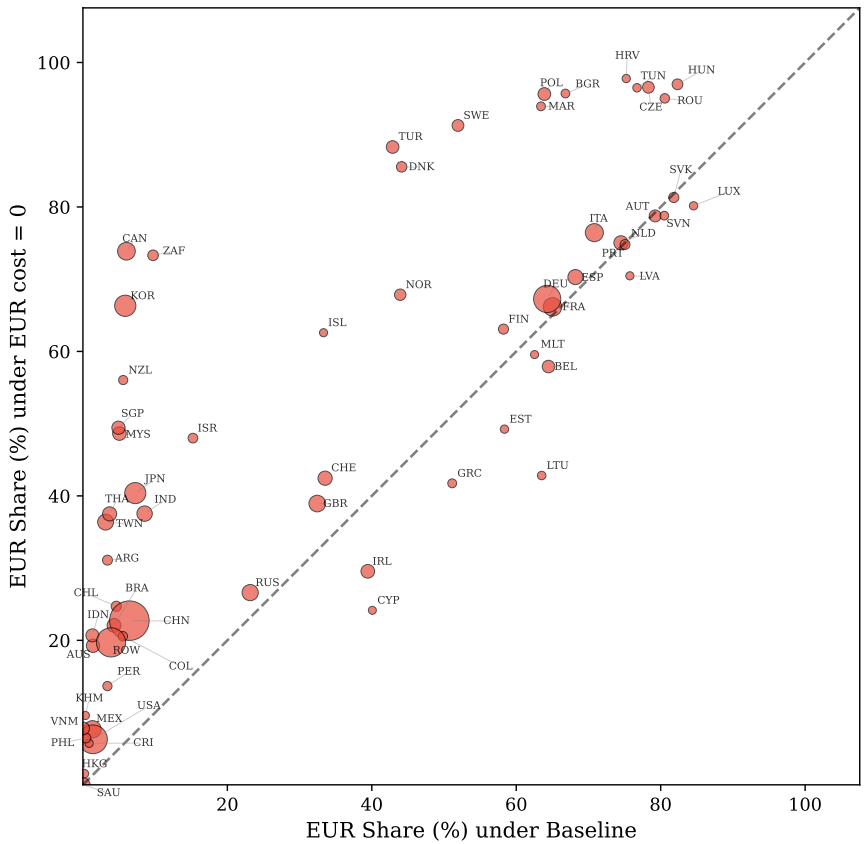
Most countries gain USD share when USD costs $\to 0$



- Canada is a notable exception: USD share $\downarrow$ and CAD share $\uparrow$
  - $\Rightarrow$ A frictionless USD lowers cost of using CAD in Canada-US trade
  - $\Rightarrow$ Firms using CAD no longer suffer demand and input payment wedges

Country Heterogeneity: EUR Cost Reduction

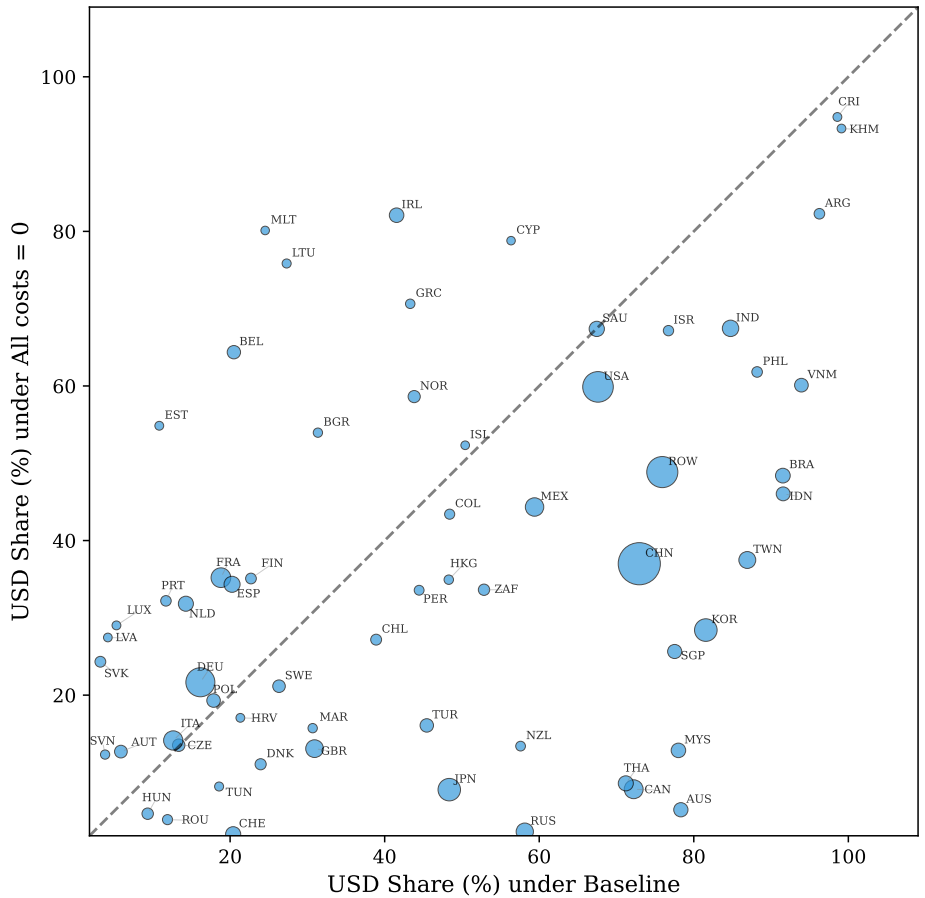
EUR invoicing gains are concentrated among non-euro European countries



- Euro-area countries barely change because EUR is already their PCP, and their 60–85% EUR shares are anchored by strong home-currency preferences.

Country Heterogeneity: Broad Cost Reduction

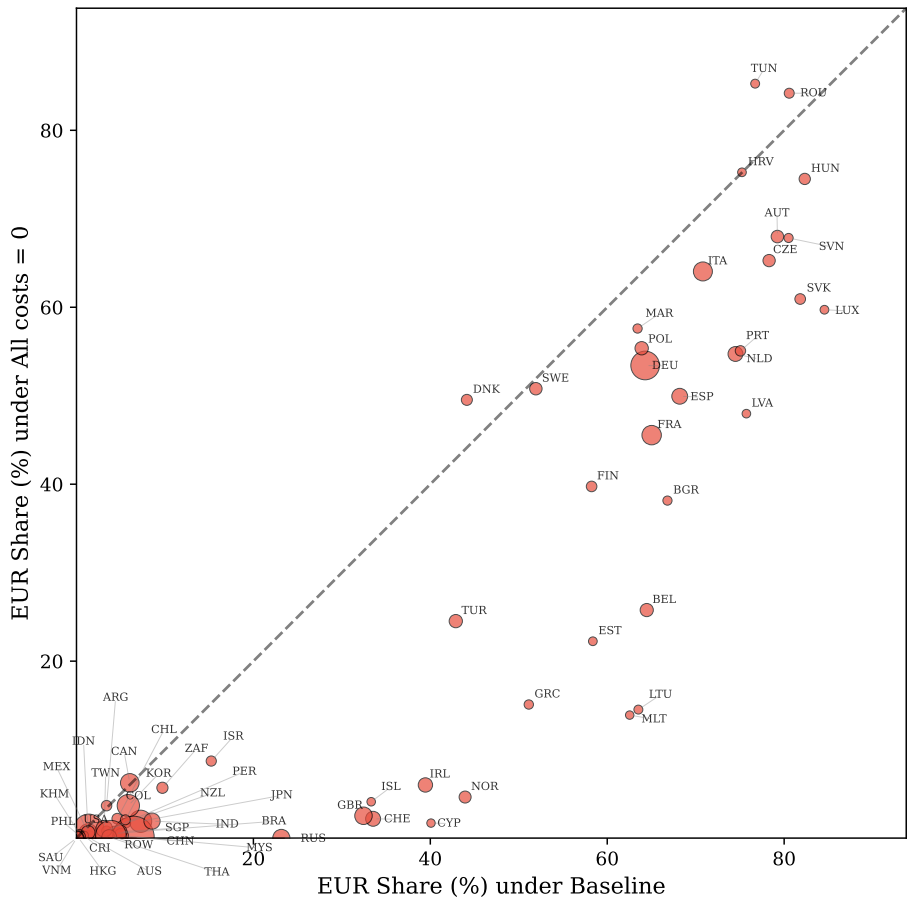
Largest USD drops among the high-USD economies in Asia and the Americas



- Despite the global decline in USD, euro-area countries gain USD shares.
- When all costs fall to zero, EUR loses its cost advantage in euro area and competes with USD on equal terms.

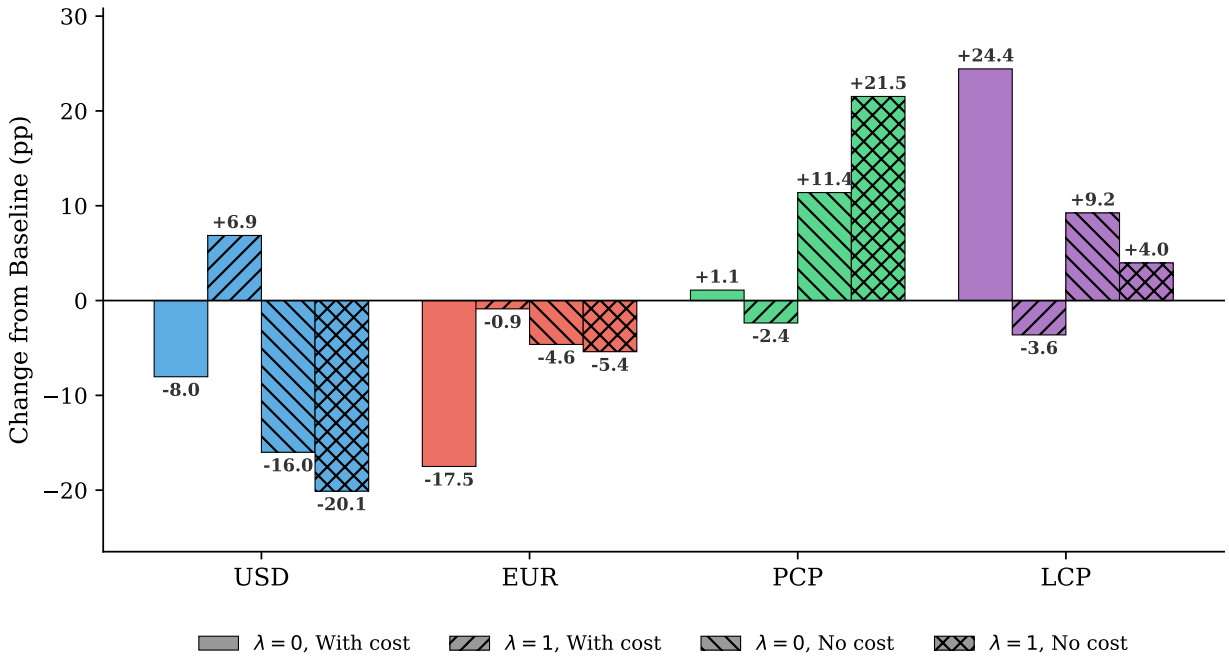
Country Heterogeneity: Broad Cost Reduction

EUR share under all costs $= 0$



- European economies also lose EUR share, while non-European countries, already at low EUR baseline, barely change.

Payment Frictions Interact with Nominal Rigidity

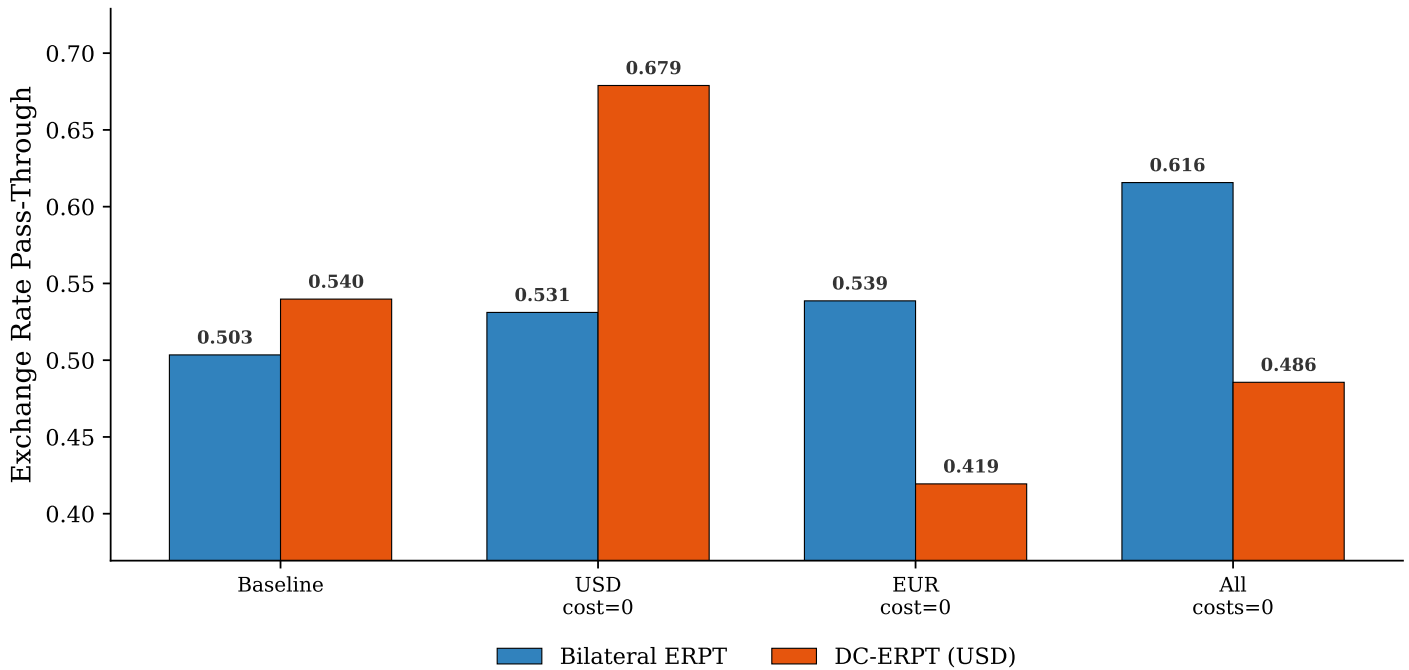


Payment cost advantages reinforce the pricing motives:

- With payment costs, raising price rigidity shifts share toward vehicle currencies: USD **+14.9 pp**, EUR **+16.6 pp**.
- Without payment costs, the same increase in rigidity favors PCP: PCP **+10.2 pp**, USD **-4.1 pp**.

Implications of Payment Frictions on Import Prices

Payment frictions → currency choices for preset prices → import prices respond to ex rate



- When USD settlement becomes frictionless, dollar movements matter more for import prices. A 1% stronger dollar raises non-US import prices by about 0.68%, instead of 0.54% in the baseline

Conclusion

Payment frictions matter for currency competition and pricing:

- Pricing and payment channels are amplified through production networks, summarized by a currency-choice Leontief inverse
- Scope of innovation matters: USD-only innovation raises USD invoicing by 15 pp; broad innovation lowers USD by 18 pp
- Currency reallocations reshape monetary transmission: frictionless USD settlement strengthens dollar pass-through

Appendix

Backup: Direct Incentive a_j

a_j collects the parts of the vehicle-minus-home payoff gap that do not depend on other countries' current vehicle shares π:

$$a_j = \underbrace{\mathcal{R}(L^{nv} - L^{v})}_{\text{buyer cost level}} + \underbrace{\kappa_\theta \mathcal{R}\phi\left[(1-d_j)L^{nv} - L^{v}\right]}_{\text{supplier cost level}}$$

$$- \underbrace{\frac{(\theta-1)\lambda\mathcal{R}}{2}\left(\text{Var}(e_{jv}) - 2\phi\sum_{m\neq j} W^{M}_{mj}\,\text{Cov}(e_{jv}, e_{jm})\right)}_{\text{nominal-rigidity level}}$$

Back

Backup: Why $\chi \approx 2\tau^{v} - \tau^{nv}$?

Let h be a non-vehicle currency: destination currency i for buyers, or supplier currency m for inputs. Define $L^{v} \equiv \log(1+\tau^{v})$ and $L^{nv} \equiv \log(1+\tau^{nv})$.

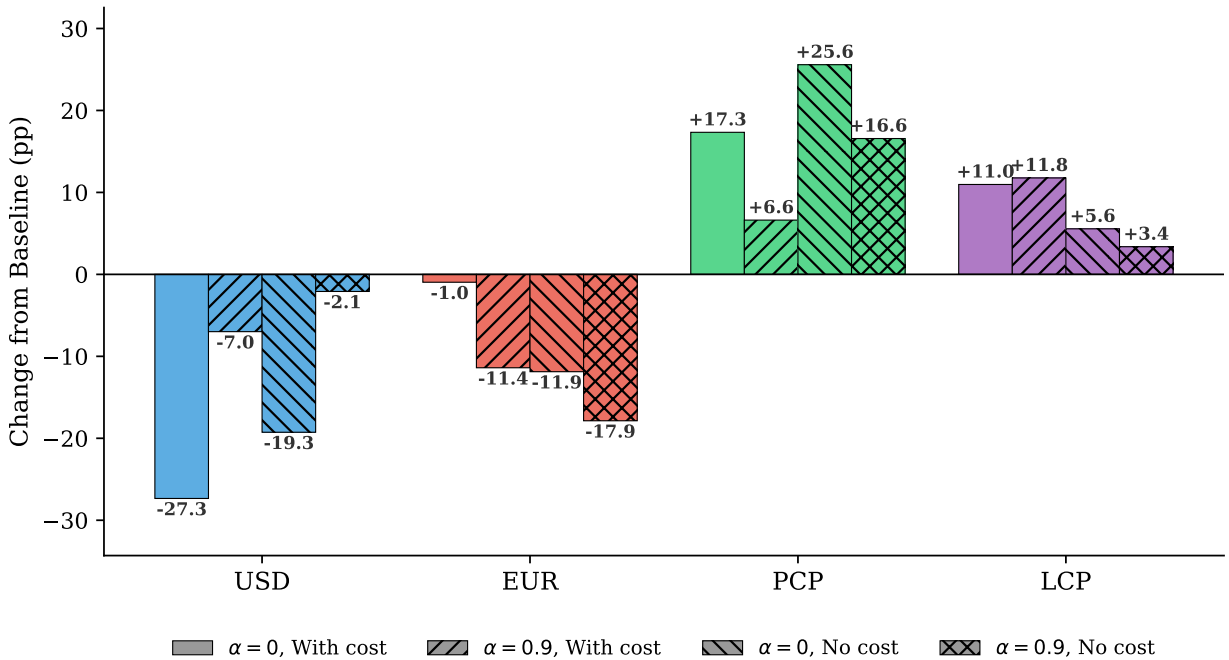
Counterparty currency	Home-j invoice	Vehicle-v invoice	Vehicle advantage
Holds/invoices in h	L^{nv}	L^{v}	$L^{nv} - L^{v}$
Holds/invoices in v	L^{v}	0	L^{v}

$$\underbrace{L^{v}}_{\text{vehicle advantage after adoption}} - \underbrace{(L^{nv} - L^{v})}_{\text{vehicle advantage before adoption}} = 2L^{v} - L^{nv} \equiv \chi \approx 2\tau^{v} - \tau^{nv}.$$

- χ measures the feedback from partners already using the vehicle currency.
- If $\chi > 0$, vehicle adoption makes vehicle invoicing more attractive for others.
- If $\chi < 0$, the vehicle was already valuable as a cheap bridge, so extra adoption adds less.

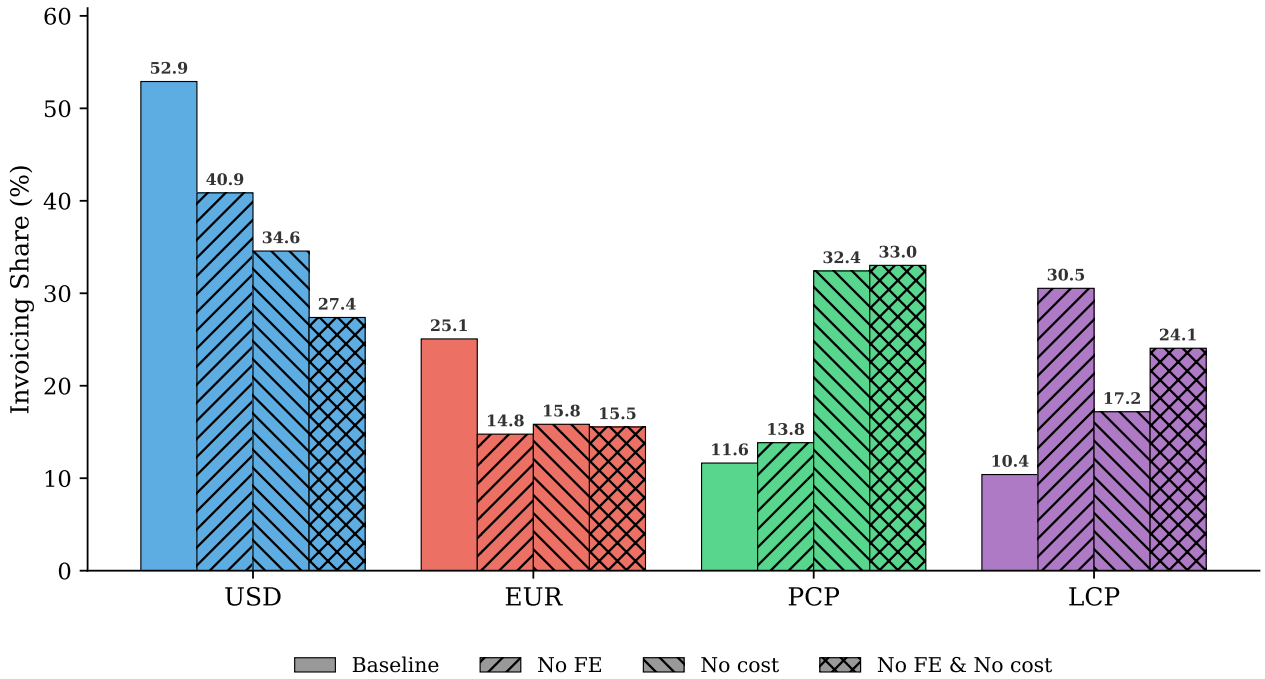
Back

Backup: Pricing Complementarity and Payment Costs



- Raising pricing complementary α from 0 to 0.53 increases the USD share by about **27.3 pp** with costs, but only **0.9 pp** without costs.

Backup: Structural Channels Without Fixed Effects



- "No FE" sets exporter and importer fixed effects to zero: $\ln X_j^k = \ln M_i^k = 0$.
- Even without fixed effects, the structural channels generate sizable vehicle-currency use: USD is **40.9%** and EUR is **14.8%**.
- Removing conversion costs shifts the no-FE model toward home currency: PCP rises from **13.8%** to **33.0%**, while USD falls to **27.4%**.
- Takeaway: fixed effects help match the high level of dollar dominance, but settlement-cost wedges have independent quantitative force.