

Dominant Currencies

How firms choose currency invoicing and why it matters

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PRELIMINARY AND INCOMPLETE

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Motivation

- Currency use in international trade is central for
 - ① international transmission of shocks
 - ② optimal monetary (exchange rate) policy
- Accumulated evidence in favor of endogenous currency choice
 - active firm-level decision
 - slow changes in the roles of individual currencies over time
- Dominant currencies: US dollar and Euro
 - welfare benefits?
 - macroeconomic consequences of a switch from dollar to euro
- Unique role of Belgian data:
 - detailed micro-level data suitable for firm-level analysis
 - substantial variation in currency use in the cross-section

Main Findings

- ① Little role for PCP in imports / DCP in exports (ex-EU trade)
- ② Instead, two **dominant currencies**:
 - **regional Euro**: dominates by count of (smaller) transactions
 - **global US dollar**: dominates by value of trade

Main Findings

- ① Little role for PCP in imports / DCP in exports (ex-EU trade)
- ② Instead, two **dominant currencies**:
 - **regional Euro**: dominates by count of (smaller) transactions
 - **global US dollar**: dominates by value of trade
- ③ Substantial variation in currency use within country \times sectors.
Firm-level characteristics key determinants of currency choice
 - import intensity, in particular in foreign currency
 - size of the firm
 - currency choice by competitors (strategic complementarities)
- ④ Currency choice feeds back into the dynamics of ERPT, and still matters at an annual horizon
- ⑤ This patterns are consistent with a sticky-price model of currency choice

Related Literature

- 1 Theory of currency choice and ERPT
 - Engel (2006)
 - Gopinath, Itskhoki and Rigobon (2010)
 - Mukhin (2018)
- 2 Firm-level analysis of exchange rate pass-through
 - Berman, Martin and Mayer (2012)
 - Amiti, Itskhoki and Konings (2014, 2018)
- 3 Empirical analysis of currency choice and dominant currencies
 - Goldberg and Tille (2008, 2016)
 - Gopinath and Rigobon (2008), Gopinath (2016)
 - Boz, Gopinath and Plagborg-Møller (2018)
 - Chung (2016), Chen, Chung and Novy (2018)

THEORETICAL FRAMEWORK

Model Environment

- Consider a problem of a Belgian exporter i serving a given industry s in foreign country k
- Denote with $e = e_k$ the log euro exchange rate with country k ; an increase in e corresponds to a depreciation of the euro
- The **desired export price** of the firm in foreign currency is:

$$\tilde{p}_i^* = \arg \max \Pi_i(p_i^* | \Omega)$$

- $\Pi_i(\cdot)$ is profit (surplus) function
 - state vector Ω includes exogenous states (e.g., productivity), endogenous shocks (e.g., exchange rate) and competitor prices
- Desired price can be converted to euro or any currency ℓ :

$$\tilde{p}_i = \tilde{p}_i^* + e,$$

$$\tilde{p}_i^\ell = \tilde{p}_i^* + e - e_\ell$$

Desired Pass-through

- Desired markup:

$$\tilde{p}_i = \tilde{\mu}_i + mc_i$$

- Price change decomposition (following AIK 2018):

$$d\tilde{p}_i = \frac{1}{1 + \Gamma_i} dmc_i + \frac{\Gamma_i}{1 + \Gamma_i} (dz_k^* + de) + \varepsilon_i$$

- z_k^* is the competitor price index in destination market k
- $\Gamma_i \equiv -\partial\tilde{\mu}_i/\partial p_i$ is the elasticity of the desired markup, increasing in the firm's market share, $\Gamma_i = \Gamma(S_i)$
+

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- Desired exchange rate pass-through (ERPT):

$$\tilde{\psi}_i \equiv \mathbb{E} \frac{d\tilde{p}_i}{de} = \frac{1}{1 + \Gamma_i} \varphi_i + \frac{\Gamma_i}{1 + \Gamma_i} (1 - \Psi_k^*)$$

- $\varphi_i = dmc_i/de$ is the cost exposure to the exchange rate
- $\Psi_k^* \equiv -dz_k^*/de$ is the ERPT into the industry price

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Prices Stickiness

- Prices are set before the uncertainty in Ω is realized
Specifically, in currency ℓ the preset price is:

$$\bar{p}_i^\ell = \arg \max_{\bar{p}_i^\ell} \mathbb{E} \Pi_i(\bar{p}_i^\ell + e_\ell - e | \Omega)$$

- Ex post, firm can reset price with a Calvo probability θ
(θ is increasing with time interval)
 - Gopinath, Itskhoki & Rigobon (2010) study a dynamic environment
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- **Lemma 1 (Preset Prices)** *Normalize $\mathbb{E}e = \mathbb{E}e_\ell = 0$. Then the following certainty equivalence holds up to first order:*

$$\bar{p}_i = \bar{p}_i^* = \bar{p}_i^\ell = \mathbb{E}\{\tilde{p}_i^\ell + e_\ell - e\} = \mathbb{E}\tilde{p}_i^* \text{ for any currency } \ell.$$

Currency Choice

- Optimal currency choice ℓ for the preset prices solves:

$$\ell = \arg \max_{\ell} \left\{ \max_{\bar{p}_i^{\ell}} \mathbb{E} \Pi_i(\bar{p}_i^{\ell} + e_{\ell} - e|\Omega) \right\}$$

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- **Lemma 2 (Currency Choice)** *The optimal currency choice is second-order equivalent to:*

$$\ell = \arg \min_{\ell} \left\{ \text{var}(\tilde{p}_i^{\ell}) \right\} = \arg \min_{\ell} \left\{ \text{var}(\tilde{p}_i^* + e - e_{\ell}) \right\}.$$

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- PCP \succ LCP: $\text{var}(\tilde{p}_i) < \text{var}(\tilde{p}_i^*) = \text{var}(\tilde{p}_i - e) \Leftrightarrow \frac{\text{cov}(\tilde{p}_i, e)}{\text{var}(e)} < \frac{1}{2}$

Estimating Equation I

Currency choice

- Currency choice:

$$l_i = \begin{cases} 0 \text{ (PCP)}, & \text{if } \tilde{\psi}_i \approx 0 \\ 1 \text{ (LCP or DCP)}, & \text{otherwise, i.e. if } \tilde{\psi}_i \gg 0 \end{cases}$$

and recall desired pass-through $\tilde{\psi}_i = \varphi_i + \frac{\Gamma_i}{1+\Gamma_i} [(1 - \Psi_k^*) - \varphi_i]$

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- Estimating equation:

$$\mathbb{P}\{l_i = 1\} = \alpha_{sk} + \beta\varphi_i + \gamma S_i + \delta \bar{l}_{-i} \quad (*)$$

- Euro (PCP) less likely for import-intensive firms (high φ_i) and large exporters (high S_i)
- Euro is less likely in industries with few firms choosing euro (high \bar{l}_{-i}) — strategic complementarities in currency choice

Estimating Equation II

Exchange rate pass-through

- Exchange rate pass-through:

$$\psi_i = \mathbb{E} \frac{\partial p_i}{\partial e} = (1 - \theta) \cdot \underbrace{\iota_i \chi_i}_{\text{sticky}} + \theta \cdot \underbrace{\tilde{\psi}_i}_{\text{flex}},$$

where $\chi_i = 1$ for LCP and $\chi_i \in [0, 1]$ for DCP

Estimating Equation II

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- Estimating equation for ERPT (augmenting AIK 2014):

$$\mathbb{E} \Delta p_i \approx a_{sk} + \left[b\varphi_i + cS_i + d\iota_i \right] \Delta e \quad (**)$$

- ERPT into foreign-currency prices is low for large (high S_i) and import-intensive (high φ_i) exporters
- ERPT is low for non-PCP (euro) firms, particularly in short run (d decreases with time horizon)

DATA

Dataset

- We merge 3 micro-level datasets on Belgian firms:
 - ① **NBB and Customs:** New data on currency choice of Belgian firms at the firm-product-country-month level for both imports and exports from February 2017 to March 2018
 - CN 8-digit level (over 10,000 products)
 - Only extra-EU trade. We focus on 11 OECD countries.
 - ② **Customs:** Import and export data on values and quantities at firm-product-country level
 - annual data from 2012 to 2017
 - ③ **VAT:** firm-level data on firm characteristics
 - includes material costs, wagebill and employment
- Baseline industry s definition: NACE 4-digit level

Key Variables

- **Currency use:** $\iota_{ikt} = 0$ for Euro and $\iota_{ikt} = 1$ for non-Euro, by firm-industry-destination-time
- **Export price change:** in euros by firm-product-destination-time

$$\Delta p_{ikt} = \Delta \log \frac{\text{Export Value}_{ikt}}{\text{Export Quantity}_{ikt}}$$

- **Import intensity:** at the firm-year level

$$\varphi_{it} \equiv \frac{\text{Total non-EU import value}_{it}}{\text{Total variable costs}_{it}}$$

— and further split by currency (Euro vs non-Euro):

$$\varphi_{it} = \varphi_{it}^E + \varphi_{it}^X$$

- **Firm size:** market share S_{ikt} and $\log \text{Employment}_{it}$

STYLIZED FACTS

Currency Use in Trade

Outside EU

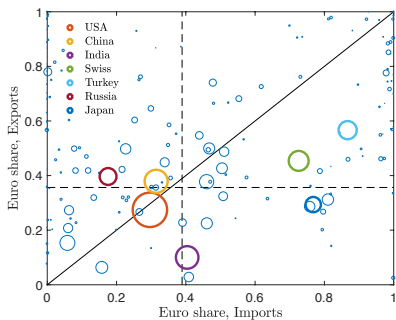
	Exports				Imports			
	Count share	Value share			Count share	Value share		
		All	Diff	Non-diff		All	Diff	Non-diff
Euro	0.691	0.388	0.425	0.324	0.418	0.414	0.512	0.283
Dollar	0.207	0.475	0.374	0.645	0.495	0.501	0.354	0.701
Other	0.102	0.137	0.201	0.031	0.087	0.084	0.134	0.017

- 1 Euro and US dollar dominate trade flows
 - PCP is uncommon for imports and LCP uncommon for exports
 - some presence of LCP in exports for differentiated goods
- 2 Euro is dominant by count vs Dollar dominates by value
 - even though US accounts for less than 5% of Belgian exports
 - smaller transaction are predominantly priced in Euros

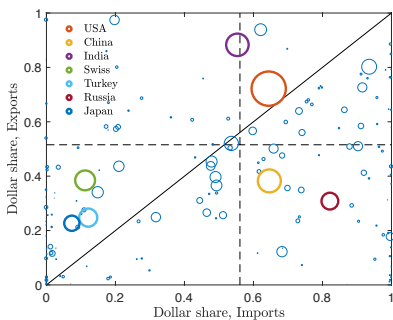
Euro and US Dollar

Imports vs exports

(a) Euro

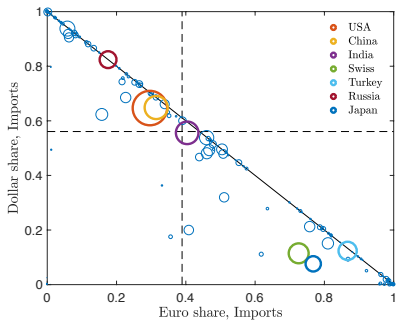


(b) Dollar

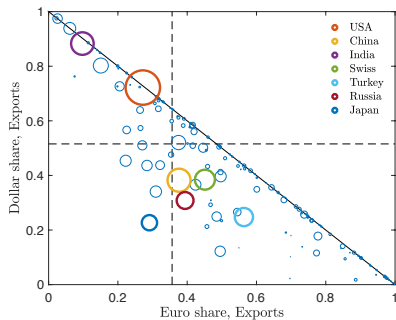


Dominant Currencies

(a) Imports



(b) Exports



Variance Decomposition

Currency choice in exports

Dep.var.: l_{ikt}	(1)	(2)	(3)	(4)	(5)	(6)
Adjusted R^2	0.126	0.386	0.461	0.539	0.563	0.681
Fixed effects:						
country	✓	✓	✓		✓	
HS-4 industry		✓				
HS-8 industry			✓			
country×HS-4				✓		✓
firm					✓	✓

- Value-weighted projections of l_{ikt} on different sets of fixed effects
- Almost *no* variation in currency choice over time, at the level of the firm-product-destination
- Firm fixed effects are key determinants of currency choice

EMPIRICAL RESULTS

Currency Choice

Linear probability regressions

Dep. var.: $\mathbb{P}\{l_{ikt} = 1\}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
φ_i	0.403** (0.187)	0.275** (0.130)	0.239* (0.140)				
φ_i^E				0.222 (0.282)	0.161 (0.193)	0.110 (0.206)	0.186 (0.280)
φ_i^X				0.637*** (0.165)	0.419*** (0.130)	0.398*** (0.142)	0.565*** (0.171)
log Empl _i	0.098*** (0.030)	0.085*** (0.017)	0.085*** (0.019)	0.099*** (0.029)	0.086*** (0.017)	0.086*** (0.019)	0.100*** (0.029)
\bar{l}_{-ikt}							0.119*** (0.024)
# obs.	138,913	138,146	137,988	139,109	138,341	138,185	125,327
R ²	0.259	0.440	0.495	0.263	0.441	0.496	0.275
Fixed Effects:							
year	✓	✓	✓	✓	✓	✓	✓
country	✓	✓		✓	✓		✓
HS8		✓			✓		
country×HS4			✓			✓	

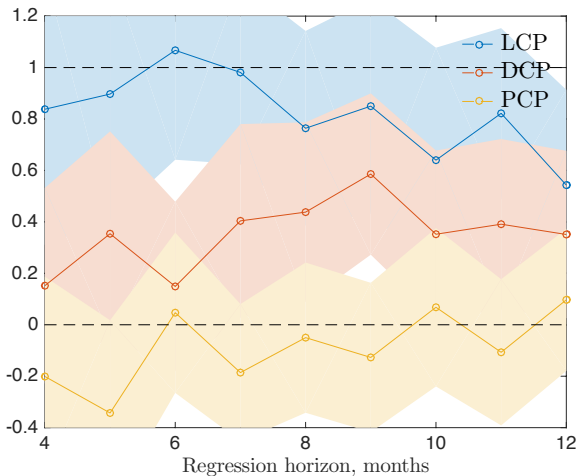
- Variation in φ_i or φ_i^X explains an 18p.p. variation in prop currency choice
- Variation in size (employment) explains up to 50p.p. variation

Exchange rate pass-through

Dep. var.: Δp_{ikt}	(1)	(2)	(3)	(4)	(5)
Δe_{kt}	0.002 (0.031)	-0.044 (0.030)	-0.048 (0.032)	0.001 (0.032)	-0.048 (0.032)
$\Delta e_{kt} \cdot \varphi_i$	0.609*** (0.187)	0.366** (0.163)	0.350** (0.161)		
$\Delta e_{kt} \cdot \varphi_i^E$				0.332 (0.266)	0.144 (0.274)
$\Delta e_{kt} \cdot \varphi_i^X$				0.846*** (0.253)	0.534*** (0.192)
$\Delta e_{kt} \cdot S_{ik}$	0.110* (0.058)	0.098 (0.059)	0.094 (0.059)	0.110* (0.059)	0.094 (0.059)
$\Delta e_{kt} \cdot l_{ikt}$		0.264*** (0.046)	0.295*** (0.064)		0.291*** (0.062)
# obs.	73,514	73,514	73,514	73,514	73,514
R ²	0.063	0.064	0.064	0.063	0.064
Year F.E.	✓	✓	✓	✓	✓
Country×HS4 F.E.	✓	✓	✓	✓	✓

Dynamics of ERPT

by currency of invoicing



- Value-weighted projection coefficients of Δp_{ikt} on Δe_{kt} at different time horizons by bins of currency choice

SUMMARY

Summary and Future Work

- Two dominant currencies: global US dollar and regional Euro
- Currency choice is shaped by firm-level characteristics, which determine desired ERPT
- Currency choice feeds back into the dynamics of ERPT, and still matters at an annual horizon
- There are strategic complementarities in currency choice, which may lead to multiple equilibria and persistence
- Consistent with sticky-price model of currency choice
- Effects of a shift in currency use away from the US dollar?