

# Heterogeneity in Exchange Rate Pass-Through to Import Prices in Thailand: Evidence from Micro Data

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# Motivation

- Exchange rate pass through (ERPT) has important implications for inflation dynamics, international trade activities and international transmissions of shocks
- At the macro level, there is weak evidence of ERPT, but ERPT can be masked by aggregate data
- Increasing availability of detailed micro data provides evidence of strong and heterogeneous ERPT effects
- Nature of ERPT can vary widely across countries and research on ERPT using micro data is still lacking especially for emerging countries

# This Paper

Exploits transaction-level customs data to examine ERPT to import prices at the Thai border along 3 dimensions:

## [1] Is ERPT related to the currency of pricing?

- Theoretically, ERPT is 100% for PCP/DCP and 0% for LCP, but no difference in the LR.
- Empirically, ERPT depends on the currency of invoice both in the SR and LR
- Given a strong case for DCP, the exchange rate vis-à-vis USD should be a more relevant parity in determining ERPT

→ Gopinath et al. (2010), Gopinath (2015), Gillitzer and Moore (2016), Boz et al. (2017), Casas et al. (2017), Bonadio et al. (2018), Giuliano and Luttini (2019), Chen et al. (2019), Auer et al. (2020), Gopinath et al. (2020)

# This Paper (cont.)

## [2] Does ERPT depend on the characteristics of goods or firms?

- **Goods:** earlier papers show that pass-through depends on the use of imported inputs, product quality and etc. (Amiti et al. (2014), Bernini and Tomasi (2015))
- This paper examines ERPT across homogenous versus differentiated goods
- **Firms:** does importer market power matter?
- Previous research, however, focuses on the exporters' market share.  
→ Berman et al. (2012), Devereux et al. (2017), Hjortsoe and Lewis (2020)

## [3] Are the effects of ERPT asymmetric or nonlinear?

- Theoretically, ERPT should be stronger during depreciation episodes and large ER changes due to, for example, downward price rigidities.
- Empirical results are inconclusive  
→ Berner (2011), Delatte and López Villavicencio (2012), Bussiere (2013), Brun-Aguerre and Greenwood-Nimmo (2016), Caselli and Roitman (2016), Kim et al. (2019), Colavecchio and Rubene (2020)

# Data

- Quarterly data spanning 2007Q1 to 2019Q4
- Macroeconomic data from CEIC, IFS and Datastream
- Customs Data from the Thai Customs Database (Ministry of Finance)
  - Prices proxied by unit values:

$$P_{ID,t} = \frac{ImportValue_{ID,t}}{ImportQuantity_{ID,t}}.$$

- Unique ID formed from: (i) Good [HS-11], (ii) Importing Firm, (iii) Exporting country, (iv) Origin country, (v) Unit, (vi) Currency of invoice

# Data (cont.)

- Clean out anomalies, missing fields, and outliers by excluding:
  - Gold transactions
  - obs. with zero import quantity/value
  - obs. with non-classified industry/exporting country/source country
  - obs. from exporting country whose sum of import value is less than 0.5% of total
  - IDs that trade infrequently
  - obs. whose prices are less or greater than 1.5 sd of all prices for a given HS-11 code, country, invoicing currency, unit and quarter combination, and for a given ID.
  - Trim at 5 and 95 pctl of unit value changes for a given exporting country, currency of invoice, and quarter combination.
  - Further trim at 1 and 99 pctl of all unit value changes.

→ Observations (after cleaning): 4.8 million

# Data (cont.)

Table 1: Summary Statistics

	Mean	Median	Stdev	Min	Max
Goods (HS-11)	11,624				
Importing firms	23,199				
Origin countries	156				
Exporting countries	28				
Invoicing currencies	33				
Goods per importer	9	3	24.6	1	1,397
Origins per importer	3	1	3.2	1	105
Exporters per importer	2	1	2.3	1	23
Invoicing currencies per importer	1	1	0.9	1	27
Change in unit values (percent)	2.5	-0.2	23.8	-50.4	101.3
Import value (baht)	8.2m	0.5m	193m	2	70.9b

Note: Summary statistics for the cleaned dataset obtained from the Thai Customs database, Ministry of Finance, over 2007-2019.

# Empirical Methodology

Fixed-effect panel estimation:

$$\Delta P_{ID,t} = \sum_{k=0}^8 \beta_k^{FCTHB} \Delta FCTHB_{x,t-k} + \sum_{k=0}^8 \gamma_k \Delta Z_{t-k} + \alpha + \epsilon_{ID,t}$$

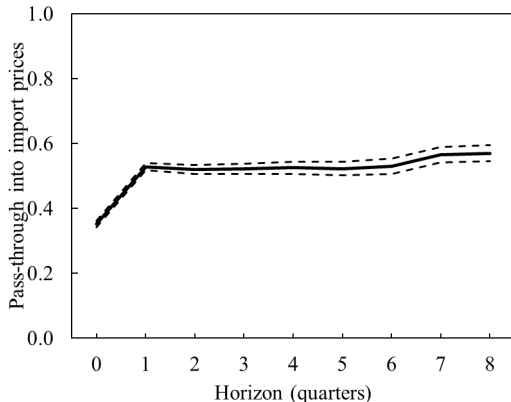
- $P_{ID,t}$  is import prices (proxied by unit values) in THB
- $FCTHB_{x,t}$  is the ER between THB and the exporter country ( $x$ )'s currency
- $Z_t$  is a set of control variables which includes exporting country's PPI and GDP, Thailand's CPI and GDP, and oil prices
- $\alpha$  is a set of fixed effects, which include quarterly dummies for each good and origin country combination



# Baseline Estimates

Full-sample estimates of ERPT are moderate and incomplete in both the short and medium run

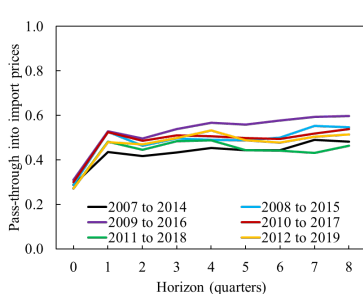
Figure 1: Exchange Rate Pass-through to Import Prices (Baseline)



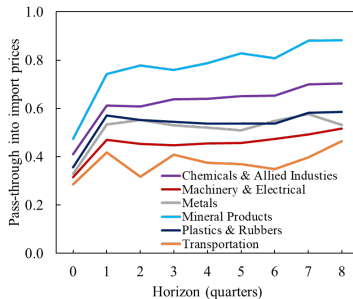
# Heterogeneity in ERPT

We observe significant heterogeneity in ERPT, **both across time**  
**but more so across sectors**

Figure 2: Heterogeneity in ERPT



(a) Time-varying Sample



(b) Sectoral Pass-through

# Any ERPT differences across goods and/or firms?

- Product Types
  - Homogenous goods vs. differentiated goods
- Firm Market Power
  - ERPT is u-shaped in the market share of exporting firms. (Auer and Schoenle (2016), Garetto (2016), Devereux et al. (2017))
  - Some papers find a monotonically negative association between ERPT and the exporters' market share (Berman et al. (2012), Amiti et al. (2014)).
  - Evidence is limited on the importer side.

# Product Classification

Table 2: Product Classification by Sectors

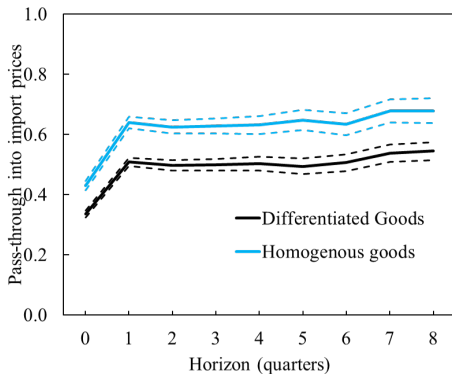
HS-2	Sector	Homogeneous	Differentiated
01-05	Animal & Animal Products	50	50
06-15	Vegetable Products	84	16
16-24	Foodstuffs	52	48
25-27	Mineral Products	99	1
28-38	Chemicals & Allied Industries	55	45
39-40	Plastics & Rubbers	38	62
41-43	Raw Hides, Skins, Leather, & Furs	0	100
44-49	Wood & Wood Products	82	18
50-63	Textiles	44	56
64-67	Footwear & Headgear	0	100
68-71	Stone & Glass	50	50
72-83	Metals	62	38
84-85	Machinery & Electrical	0	100
86-89	Transportation	0	100
90-97	Miscellaneous	0	100

Note: As shown are the percentage share of goods (based on import value) that can be classified by product type to be 'homogenous' or 'differentiated' according to the Rauch (1999) classification.

# ERPT heterogeneity across product types

Homogenous goods exhibit significantly higher pass-through than differentiated goods

Figure 3: Exchange Rate Pass-through across Product Types

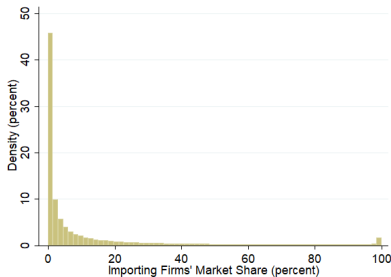


# ERPT heterogeneity across firms

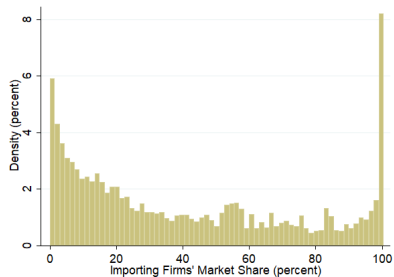
## Two measures of firm market power:

- (1) importing firms' market share - the market share of firm  $m$  within the import market  $n$  of a given HS6 product category and exporting country
- (2) Herfindahl-Hirschman Index (HHI)

Figure 4: Distributions of Importing Firms' Market Share



(a) By Observations



(b) By Import Value

# Empirical Methodology

Fixed-effect panel estimation:

$$\begin{aligned}\Delta P_{ID,t} = & \sum_{k=0}^8 \beta_k \Delta FCTHB_{x,t-k} + \sum_{k=0}^8 \beta_k^{MP} \Delta FCTHB_{x,t-k} \times MP_{m,n,t} \\ & + \sum_{k=0}^8 \beta_k^{MP^2} \Delta FCTHB_{x,t-k} \times MP_{m,n,t}^2 + \delta MP_{m,n,t} \\ & + \sum_{k=0}^8 \gamma_k \Delta Z_{t-k} + \alpha + \epsilon_{ID,t}\end{aligned}$$

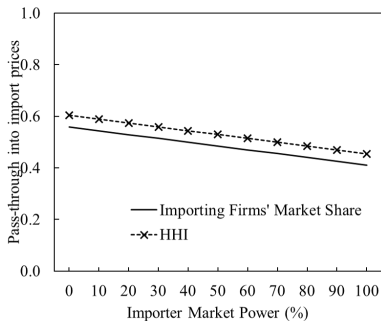
where,  $MS_{m,n,t}$  is one of the two market power measures for an importing firm  $m$  in the import market  $n$ .

Squared terms: to examine whether the relationship between ERPT and importer market power is monotonic.

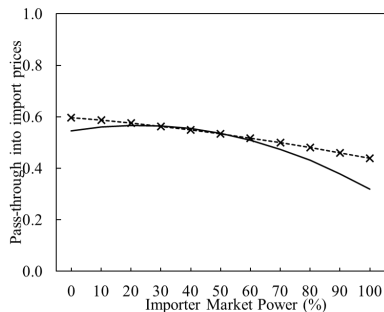
# ERPT heterogeneity across firms

**ERPT declines in the market share of importing firms, hence underscoring the role of market power**

**Figure 5:** Medium-run Pass-through across Firm Market Power



**(a)** Without Squared Terms



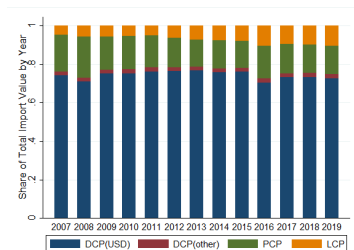
**(b)** With Squared Terms



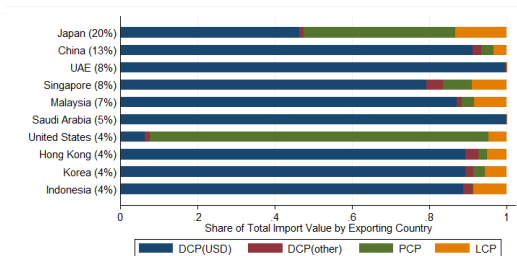
# Stylized Facts on Invoicing Currency

The majority of imported goods in Thailand are invoiced in USD, both across time and exporting country.

Figure 6: Share of Imports by Invoicing Currencies



(a) Over Time

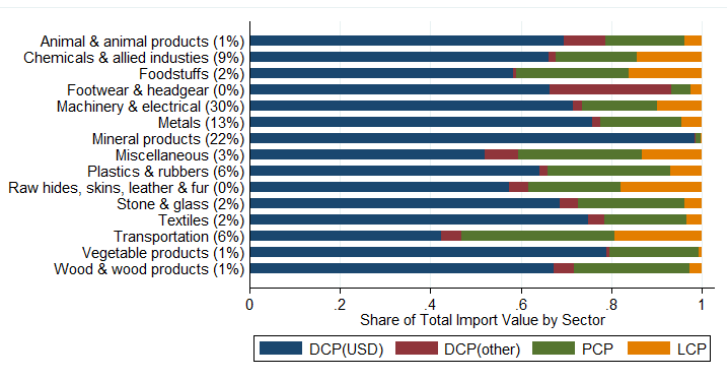


(b) Across Exporting Countries

# Stylized Facts on Invoicing Currencies (cont.)

DCP is prevalent in all industries, but more popular for homogeneous goods esp. in the Mineral Products sector.

Figure 7: Invoicing Currency across Sectors



# Role of Invoicing Currency: Empirical Methodology

Fixed-effect panel estimation:

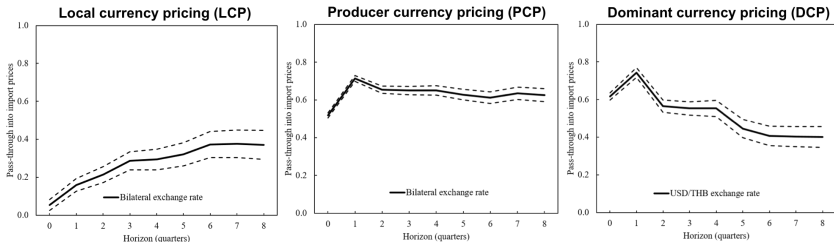
$$\begin{aligned} \Delta P_{ID,t} = & \sum_{k=0}^8 \beta_k^{LCP} \Delta FCTHB_{x,t-k} \times D_{invoice=THB} + \sum_{k=0}^8 \beta_k^{PCP} \Delta FCTHB_{x,t-k} \times D_{invoice=x} \\ & + \sum_{k=0}^8 \beta_k^{DCP} \Delta USDTHB_{t-k} \times D_{invoice=USD} + \sum_{k=0}^8 \gamma_k \Delta Z_{t-k} + \alpha + \epsilon_{ID,t} \end{aligned}$$

- $P_{ID,t}$  is import prices (proxied by unit values) in THB
- $FCTHB_{x,t}$  is the ER between THB and the exporter country ( $x$ )'s currency
- $USDTHB_t$  is the ER between THB and USD
- $Z_t$  is a set of control variables which includes exporting country's PPI and GDP, Thailand's CPI and GDP, and oil prices
- $\alpha$  is a set of fixed effects

# Is ERPT related to the currency of pricing?

**Accounting for currency of invoice**, we observe significant heterogeneity in ERPT

Figure 8: Exchange Rate Pass-through by Invoicing Currency

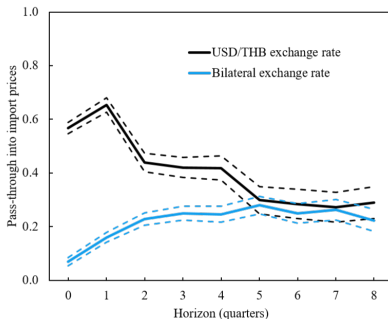


- ERPT much larger for PCP and DCP than LCP, esp. in the short run.
- High passthrough from USDTHB for DCP transactions
- Over the medium run, ERPT under LCP and DCP converges to 0.4, while pass-through under PCP remains elevated at 0.6 → mild support to the theory of endogenous currency invoicing

# Relevant Parity for DCP

**Including the bilateral exchange rate for DCP**, USDTHB is dominant in the SR but both ERs are relevant in the medium run

Figure 9: Exchange Rate Pass-through under the DCP Paradigm

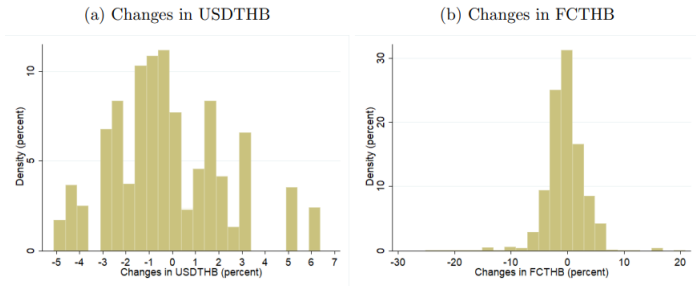


- Results are in line with Giuliano and Luttini (2019), but against the strong version of Dominant Currency Paradigm

# Is there asymmetry or nonlinearity in ERPT?

- Asymmetry with respect to appreciations versus depreciations
- Non-linearity with respect to large versus small exchange rate changes

Figure 10: Distribution of Exchange Rate Changes



Note: The figures show the frequency of changes in the USDTHB exchange rate and the bilateral exchange rate of the exporting country's currency against THB over the full sample.

# Empirical Methodology

## [1] Asymmetry

$$\Delta P_{ID,t} = \sum_{k=0}^8 \beta_k^{FCTHB} \Delta FCTHB_{x,t-k} + \sum_{k=0}^8 \beta_k^{FCTHB,dep} \Delta FCTHB_{x,t-k} \times D_{t-k}^{FCTHB,dep} \\ + \sum_{k=0}^8 \gamma_k \Delta Z_{t-k} + \alpha + \epsilon_{ID,t}$$

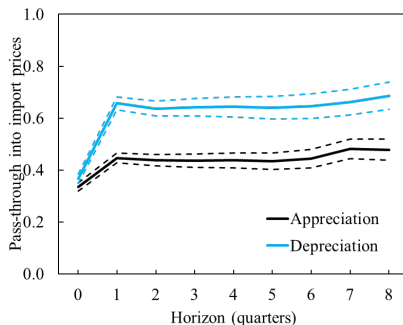
## [2] Asymmetry + Nonlinearity

$$\Delta P_{ID,t} = \sum_{k=0}^8 \beta_k \Delta FCTHB_{x,t-k} + \sum_{k=0}^8 \beta_k^{dep} \Delta FCTHB_{x,t-k} \times D_{t-k}^{FCTHB,dep} \\ + \sum_{k=0}^8 \beta_k^{sq} \Delta FCTHB_{x,t-k}^2 + \sum_{k=0}^8 \beta_k^{sq,dep} \Delta FCTHB_{x,t-k}^2 \times D_{t-k}^{FCTHB,dep} \\ + \sum_{k=0}^8 \beta_k^{cu} \Delta FCTHB_{x,t-k}^3 + \sum_{k=0}^8 \beta_k^{cu,dep} \Delta FCTHB_{x,t-k}^3 \times D_{t-k}^{FCTHB,dep} \\ + \sum_{k=0}^8 \gamma_k \Delta Z_{t-k} + \alpha + \epsilon_{ID,t}$$

# Directional Asymmetry in ERPT

There is strong evidence of ERPT asymmetry wrt. the direction of exchange rate change.

Figure 11: Directional Asymmetry in ERPT



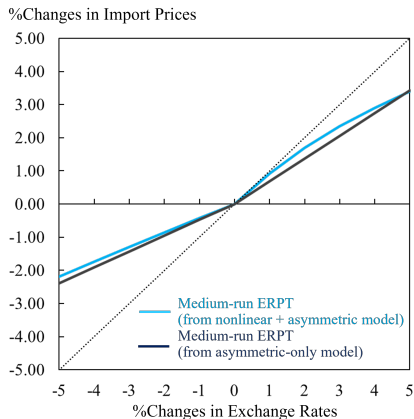
- Potential explanations: downward rigidity of export price (Bussière, 2013), weak competition structure (Delatte and López Villavicencio, 2012)



# No evidence of size nonlinearities

Large depreciations **do not** lead to a more pronounced change in import prices.

Figure 12: Asymmetries and Non-linearities in Medium-run ERPT



# ERPT Asymmetry across Invoicing Currencies

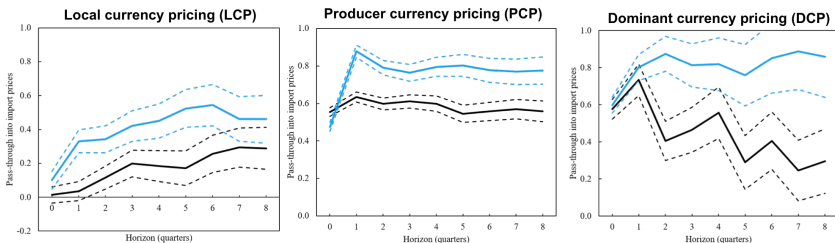
## Model Specification

$$\begin{aligned}
 \Delta P_{ID,t} = & \sum_{k=0}^8 \beta_k^{LCP} \Delta FCTHB_{x,t-k} \times D_{invoice=LCP} \\
 & + \sum_{k=0}^8 \beta_k^{LCP,dep} \Delta FCTHB_{x,t-k} \times D_{invoice=LCP} \times D_{t-k}^{FCTHB,dep} \\
 & + \sum_{k=0}^8 \beta_k^{PCP} \Delta FCTHB_{x,t-k} \times D_{invoice=PCP} \\
 & + \sum_{k=0}^8 \beta_k^{PCP,dep} \Delta FCTHB_{x,t-k} \times D_{invoice=PCP} \times D_{t-k}^{FCTHB,dep} \\
 & + \sum_{k=0}^8 \beta_k^{DCP} \Delta USDTHB_{t-k} \times D_{invoice=DCP} \\
 & + \sum_{k=0}^8 \beta_k^{DCP,dep} \Delta USDTHB_{t-k} \times D_{invoice=DCP} \times D_{t-k}^{USDTHB,dep} \\
 & + \sum_{k=0}^8 \gamma_k \Delta Z_{x,t-k} + \alpha + \epsilon_{ID,t}
 \end{aligned}$$

# ERPT Asymmetry across Invoicing Currencies (cont.)

**Across all currencies of invoice**, there is strong evidence of ERPT asymmetry

Figure 13: Directional Asymmetry in ERPT by Invoicing Currency



- ERPT is stronger during depreciations for all invoicing currencies, with steep decline in ERPT for appreciations in DCP case
- Importers' gains from appreciation could be lower than losses from depreciation

# Takeaways and Policy Implications

- Considerable heterogeneity in both short and medium term horizons, with various factors responsible.
  - Policymakers should move beyond using aggregate 'rules of thumb' in predicting pass-through.
- ERPT varies with currency of invoice, with lower pass through for LCP and higher for PCP/DCP.
  - Consider monitoring inflationary pressures via an effective nominal exchange rate based on invoicing currency, although a trade-weighted measure could still be relevant over the medium term.
  - Promoting LCP can help limit exposure to foreign exchange rate fluctuations

# Takeaways and Policy Implications (cont.)

- ERPT is stronger for depreciations
  - Limited disinflationary pressures from appreciations, but price pressures could materialize under depreciations
  - Importers face asymmetric gains and losses over the exchange rate appre. and depre. episodes
- Structural characteristics can lead to considerable variations in EPRT
  - Exchange rate changes can have significant allocative consequences