Importers, Exporters, and Exchange Rate Disconnect

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Princeton IES Workshop
July 2013

Motivation

- Large movements in exchange rates have small effects on the prices of internationally traded goods
  - this exchange rate disconnect constitutes one of the central puzzles in international macroeconomics
- The vast empirical pass-through literature has neglected one of the most salient features of international trade:
  - the largest exporters are the largest importers
- We show this pattern is key to understanding low aggregate pass-through and the variation in pass-through across firms

Our Approach

1. Develop theory to guide our empirical strategy
   - Variable mark-ups due to strategic complementarities
   - Firm's choice to import intermediate inputs

   - Methodology:
     - pass-through estimation in a GE environment
     - structural interpretation of the pass-through equation

2. Use detailed firm-level Belgium data to test and quantify the mechanism
   - merge firm data on *exports by destination*, *imports by source-country*, and *domestic cost data*
   - construct firm import intensity from outside the Euro Area (as a share of total variable cost)
   - construct firm-industry-export destination market shares as a proxy for markup

Main Findings

1. A firm in the 5th percentile, with zero import intensity and market share, has nearly complete pass-through

2. A firm in the 95th percentile of import intensity and market share distributions has 55% pass-through

3. Marginal cost and markup channels contribute roughly equally to this cross-sectional variation
   - import intensity proxies for marginal cost
   - market share proxies for markup elasticity

4. Low aggregate exchange rate pass-through: 62%
   - Firm import intensity, as well as export market shares, are heavily skewed towards the largest exporters

Related Literature

1. Exporters and importers
   — e.g., Bernard, Redding and Schott (2009)

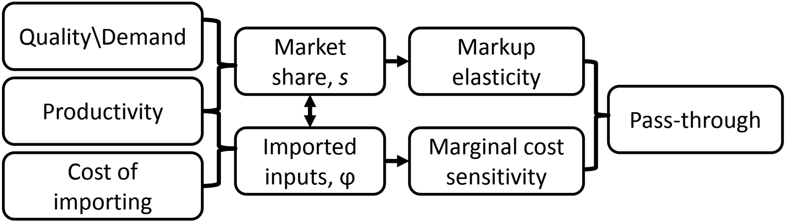
2. Imports and productivity
   — e.g., Amiti and Konings ('07), Halpern, Koren and Szeidl ('11)

3. Incomplete pass-through (exchange rate disconnect)
   — Pricing-to-market (PTM)
   (Dornbusch '87; Krugman '87; Atkeson and Burstein, 2008)
   — Sticky prices and local currency pricing (LCP)
   (Engel, 2006; Gopinath, Itskhoki and Rigobon, 2010)
   — Local distribution margin (Campa and Goldberg, 2010)
   — Firm size and pass-through (Berman, Martin and Mayer, 2011)
   — Market share and pass-through (Feenstra,Gagnon&Knetter'96)
   — Structural demand estimation (Goldberg and Hellerstein, 2008)

THEORY

Model Ingredients and Mechanism

1. Nested CES + oligopoly = variable markups (Atkeson and Burstein, 2008)
2. Access to imported inputs at a fixed cost (Halpern, Koren and Szeidl, 2011)



Demand

Atkeson and Burstein (2008)

- Nested-CES demand:

$$Q_{k,i} = \xi_{k,i} P_{k,i}^{-\rho} P_k^{\rho-\eta} D_k, \qquad \rho > \eta \geq 1,$$

where k–destination, s–industry (omitted), i–firm-product

- Price index:

$$P_k \equiv \left[\sum_i \xi_{k,i} P_{k,i}^{1-\rho}\right]^{\frac{1}{1-\rho}}$$

- Market share:

$$S_{k,i} \equiv \frac{P_{k,i} Q_{k,i}}{\sum_{i'} P_{k,i'} Q_{k,i'}} = \xi_{k,i} \left(\frac{P_{k,i}}{P_k}\right)^{1-\rho} \in [0,1]$$

- Demand elasticity and markup:

$$\sigma_{k,i} \equiv -\frac{\mathrm{d}\log Q_{k,i}}{\mathrm{d}\log P_{k,i}} = \rho(1 - S_{k,i}) + \eta S_{k,i},$$
$$\mathcal{M}_{k,i} \equiv \frac{\sigma_{k,i}}{\sigma_{k,i} - 1}$$

- Markup elasticity (holding price index constant):

$$\Gamma_{k,i} \equiv -\frac{\partial \log \mathcal{M}_{k,i}}{\partial \log P_{k,i}} = \frac{S_{k,i}}{\left(\frac{\rho}{\rho-\eta} - S_{k,i}\right)\left(1 - \frac{\rho-\eta}{\rho-1} S_{k,i}\right)}$$

Proposition

(i) *Market share of the firm $S_{k,i}$ is a sufficient statistic for markup;*
(ii) *both markup $\mathcal{M}_{k,i}$ and markup elasticity $\Gamma_{k,i}$ are increasing in the market share.*

Imported inputs

details of derivation

Marginal cost:

$$MC_i^* = \frac{C^*}{\Omega_i} \cdot \left(\frac{\mathcal{E}_m U}{V^*} \right)^{\varphi_i}$$

— $C^* \equiv W^{*1-\phi} V^{*\phi}$ is local cost index

— φ_i is import intensity of the firm

Proposition

(i) *Firms with larger total material cost or smaller fixed cost of importing have a larger import intensity,* φ_i.

(ii) *Import intensity and market share are positively correlated in the cross-section.*

(iii) *Partial elasticity of the marginal cost to the (import-weighted) exchange rate equals* φ_i.

Price setting and Pass-through

- Problem of the firm (given the choice of import intensity):

$$\max_{\substack{\{P_{k,i},Q_{k,i}\}_k \\ Y_i=\sum_k Q_{k,i}}} \left\{ \sum_{k\in K_i} \mathcal{E}_k P_{k,i} Q_{k,i} - \frac{C^*}{B_i^{\phi}\Omega_i} Y_i \right\}$$

$$\Rightarrow \qquad P^*_{k,i} \equiv \mathcal{E}_k P_{k,i} = \frac{\sigma_{k,i}}{\sigma_{k,i}-1}\frac{C^*}{B_i^{\phi}\Omega_i}$$

- The full differential of the export price:

$$\mathrm{d}\log P^*_{k,i} = \mathrm{d}\log \mathcal{M}_{k,i} + \mathrm{d}\log MC^*_i$$

where

$$\mathrm{d}\log \mathcal{M}_{k,i} = -\,\Gamma_{k,i}\big(\mathrm{d}\log P_{k,i} - \mathrm{d}\log P_k\big) + \frac{\Gamma_{k,i}}{\rho-1}\mathrm{d}\log \xi_{k,i}$$

$$\mathrm{d}\log MC^*_i = \varphi_i\ \mathrm{d}\log \frac{\mathcal{E}_m U}{V^*} + \mathrm{d}\log \frac{C^*}{\Omega_i}$$

Proposition (theory)

Exchange rate pass-through elasticity into producer price:

$$\Psi^*_{k,i} \equiv \mathbb{E}\left\{\frac{\mathrm{d}\log P^*_{k,i}}{\mathrm{d}\log \mathcal{E}_k}\right\} = \alpha_{s,k} + \beta_{s,k}\cdot\varphi_i + \gamma_{s,k}\cdot S_{k,i}.$$

- $(\varphi_i, S_{k,i})$ form a firm-level sufficient statistic for pass-through
- e.g., coefficient $\beta_{s,k} = \frac{1}{1+\bar{\Gamma}_{s,k}}\mathbb{E}\left\{\frac{\mathrm{d}\log\mathcal{E}_m}{\mathrm{d}\log\mathcal{E}_k}\cdot\frac{\mathrm{d}\log(\mathcal{E}_m U/V^*)}{\mathrm{d}\log\mathcal{E}_m}\right\}$

Pass-through

Proposition (theory)

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Proposition (implementation)

OLS estimates of β and $\tilde{\gamma}$ in

$$\Delta\log P^*_{k,i,t} = \left[\alpha_{s,k} + \beta\varphi_{i,t-1} + \tilde{\gamma}\tilde{S}_{k,i,t-1}\right]\Delta\log\mathcal{E}_{k,t} + \ldots + \tilde{u}_{k,i,t}$$

identify weighted averages of $\beta_{s,k}$ and $\gamma_{s,k}\cdot\mathbf{S}_{s,k,t-1}$ respectively.

EMPIRICS

1. DATA, STYLIZED FACTS

Dataset

- Belgian firm-level data (annual, 2000-2008):
  1. NBB import and export data by firm-product-country at HS 8-digit (10K product codes): values and quantities
  2. Belgian Business Registry firm panel with firm characteristics, including firm's inputs (wages and material costs)

- Export price (unit value):

$$\Delta p^*_{f,i,k,t} \equiv \Delta \log \left(\frac{\text{Export value}_{f,i,k,t}}{\text{Export quantity}_{f,i,k,t}} \right)$$

- Focus on manufacturing exports to non-Euro OECD countries in major IO category

Key Variables

1. Import Intensity:

$$\varphi_{f,t} \equiv \frac{\text{Total non-Euro import value}_{f,t}}{\text{Total costs}_{f,t}}$$

2. Marginal Cost:

$$\Delta mc^*_{f,t} \equiv \sum_{j \in J_{f,t}, m \in M_{f,t}} \omega_{f,j,m,t} \Delta \log U^*_{f,j,m,t}$$

3. Market Share:

$$\underbrace{\frac{\text{Export Value}_{f,s,k,t}}{\text{Total Sales}_{s,k,t}}}_{\equiv S_{f,s,k,t}} = \underbrace{\frac{\text{Export Value}_{f,s,k,t}}{\text{Total Belgium Exports}_{s,k,t}}}_{\equiv \tilde{S}_{f,s,k,t}} \cdot \underbrace{\frac{\text{Total Belgium exports}_{s,k,t}}{\text{Total Sales}_{s,k,t}}}_{\equiv \mathbf{S}_{s,k,t}}$$

Importers and Exporters

	Exporters and/or importers	All exporters
Fraction of all firms	32.6%	23.7%
of them:		
— exporters and importers	57.0%	78.4%
— only exporters	15.8%	21.6%
— only importers	27.2%	—

Exporters by import intensity

	Exporters		Non-
	Import intensive	Not import intensive	exporters
Import intensity	0.37	0.17	0.02
Non-Euro import intensity (φ_f)	0.17	0.01	0.00
Employment (# workers)	270.9	112.1	20.7
Average wage bill (KK Euros)	48.8	42.3	34.9
Material cost (MM Euros)	103.5	28.1	3.0
Total Factor Productivity	0.36	0.07	
Total manuf. exports (MM Euros)	66.5	14.1	
— to non-Euro OECD	14.4	2.4	
Total imports (MM Euros)	49.3	6.8	
— outside Euro Zone	20.8	0.5	
# of import source countries	14.4	6.6	
# of HS 8-digit products imported	79.8	53.4	

Import intensity

Cross-section correlations

	Import intensity	TFP	Revenues	Empl't	Material cost
Market share	0.16	0.20	0.28	0.25	0.27
Material cost	0.23	0.70	0.99	0.83	
Employment	0.10	0.60	0.86		
Revenues	0.21	0.72			
TFP	0.15				

Import intensity

Distribution

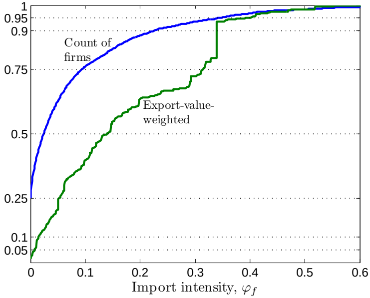
	# firms	frac firms	frac exp. value
$\varphi_f = 0$	716	24.9%	1.2%
$0 < \varphi_f \leq 0.1$	1,478	51.3%	38.5%
$0.1 < \varphi_f \leq 0.2$	348	12.1%	23.8%
$0.2 < \varphi_f \leq 0.3$	154	5.4%	8.9%
$0.3 < \varphi_f \leq 0.4$	95	3.3%	22.7%
$\varphi_f > 0.4$	89	3.1%	4.9%

- Time-averaged firm import intensity φ_f, contributes over 85% to the variation in $\varphi_{f,t}$
- For a given firm, $\Delta\varphi_{f,t}$ responds little to $\Delta e^M_{f,t}$

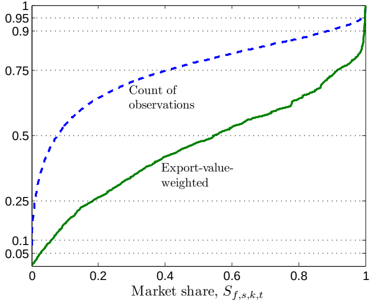
Import intensity and Market share

Cumulative distributions

Import intensity



Market share



EMPIRICS

2. MAIN RESULTS

Main specification

$$\Delta p^*_{f,i,k,t} = \left[\alpha + \beta\varphi_f + \tilde{\gamma}\tilde{S}_{f,s,k,t}\right] \cdot \Delta \log e_{k,t} + \ldots + \epsilon_{f,i,k,t}$$

Dep. var.: $\Delta p^*_{f,i,k,t}$	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta e_{k,t}$	0.203***	0.127***	0.157***	0.149***	0.098***	0.057*	—
	(0.026)	(0.027)	(0.028)	(0.037)	(0.030)	(0.031)	
$\Delta e_{k,t} \cdot \varphi_f$		0.604***	0.370***	0.341*	0.263**	0.473***	0.470**
		(0.112)	(0.117)	(0.201)	(0.115)	(0.104)	(0.236)
$\Delta e_{k,t} \cdot \tilde{S}_{f,s,k,t}$					0.238***	0.284***	0.299***
					(0.060)	(0.063)	(0.100)
$\Delta mc^*_{f,t}$			0.512***		0.506***		
			(0.030)		(0.031)		
SD + Y FE	yes	yes	yes	no	yes	yes	no
SDY FE	no	no	no	no	no	no	yes
FPY FE	no	no	no	yes	no	no	no

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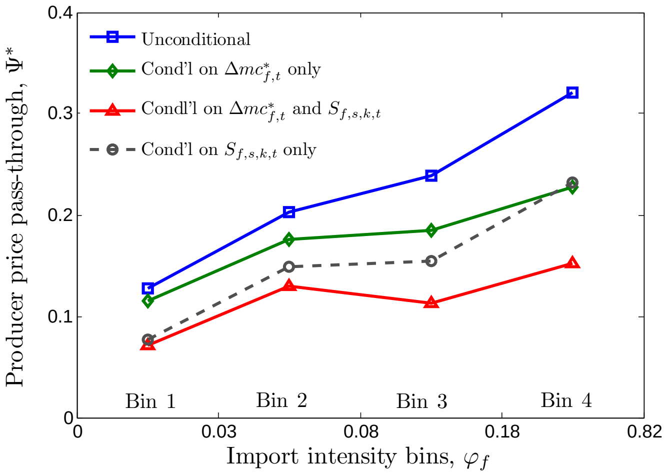
SD + Y FE	yes	yes	yes	no	yes	yes	no
SDY FE	no	no	no	no	no	no	yes
FPY FE	no	no	no	yes	no	no	no

$$\text{Pass-through} = \underbrace{1 - 0.06}_{=\mathbf{0.94}} - \underbrace{0.47 \cdot 0.38}_{=0.18} - \underbrace{0.28 \cdot 0.75}_{=0.21} = \mathbf{0.55}$$

Non-parametric

By quartiles of import intensity



Pass-through matrix

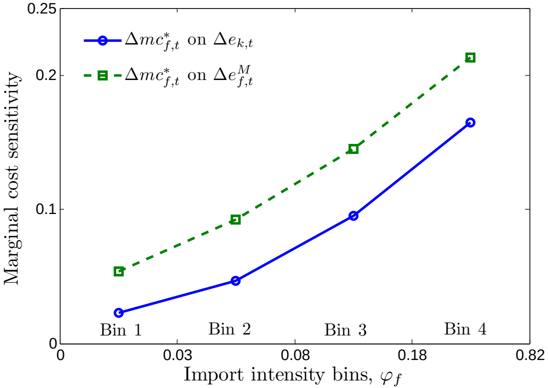
	Low import intensity	High import intensity
Low market share	0.131***	0.194***
Fraction of observations	*30.0%*	*21.0%*
Share in export value	*8.1%*	*9.6%*
High market share	0.214***	0.339***
Fraction of observations	*20.0%*	*29.2%*
Share in export value	*21.3%*	*61.1%*

- Weighted pass-through is 62% versus unweighted pass-through of 80%

EMPIRICS

3. EXTENSIONS/ROBUSTNESS

Marginal Cost Mechanism



- The projection of $\Delta e^M_{f,t}$ on $\Delta e_{k,t}$ has a coefficient of 0.45, stable around φ_f-quartiles
- Share of OECD imports decreases from 75% to 55% across the quartiles of φ_f-distribution

Which imports matter?

- Recall: β increases in correlation and pass-through

Dep. var.: $\Delta p^{*}_{f,i,k,t}$	Exchange rate ▸ correlation (1)	Import ▸ pass-through (2)	OECD and Euro Area (3)
$\Delta e_{k,t} \cdot \varphi^{High}_{f,k}$	0.864^{***}	0.763^{***}	0.472^{***}
	(0.277)	(0.239)	(0.154)
$\Delta e_{k,t} \cdot \varphi^{Low}_{f,k}$	0.376^{***}	0.348	0.505^{**}
	(0.131)	(0.241)	(0.210)
$\Delta e_{k,t} \cdot \varphi^{Other}_{f}$	—	0.058	0.057
		(0.314)	(0.126)
$\Delta e_{k,t} \cdot S_{f,s,k,t}$	0.284^{***}	0.285^{***}	0.282^{***}
	(0.063)	(0.063)	(0.064)

- import pass-through from a given source country does not vary systematically with firm size or type of product (manuf.)

Robustness

1. additional controls ▸ show
   — employment, productivity, etc.

2. alternative samples ▸ show
   — countries, firms, and products

3. definitions of import intensity ▸ show
   — including specification with lagged $\varphi_{f,t-1}$ and $S_{f,s,k,t-1}$

4. Measurement error and selection bias
   — likely upward bias in α and downward bias in β and γ

Conclusion

- Import intensity is a prime predictor of low pass-through
  - — operates both directly through marginal cost and indirectly through mark-up (selection)

- Large cross-sectional variation:
  - o Small non-importing firms: nearly complete pass-through
  - o Large import-intensive exporters: pass-through of 55%
  - o Variation roughly equally due to marginal cost and markup

- Import intensity heavily skewed towards largest exporters:
  - $\Rightarrow$ aggregate pass-through is 62%

- Additional issues:
  - — LCP versus PTM details
  - — Expenditure switching
  - — Welfare implications
  - — Firm-level misallocation and gains from trade

APPENDIX

Additional issues

1. Price stickiness and currency choice
   - Low flexible-price pass-through (PTM) versus LCP?
   - GIR (2010): work in the same direction

2. Financial and real hedging:
   - Without liquidity frictions, financial hedging has no effect on marginal cost and pricing
   - Our mechanism can be viewed as ‘real hedging’: offsetting movements in marginal costs
   - We find little effects of switching source countries in response to exchange rate

Robustness

Additional controls

Dep. var.: $\Delta p^*_{f,i,k,t}$	(1)	(2)	(3)
$\Delta e_{k,t} \cdot \varphi_f$	0.413***	0.433***	0.418***
	(0.106)	(0.109)	(0.119)
$\Delta e_{k,t} \cdot S_{f,s,k,t}$	0.219***	0.249***	0.245***
	(0.065)	(0.064)	(0.065)
$\Delta e_{k,t} \cdot \log L_{f,t}$	0.044***		
	(0.012)		
$\Delta e_{k,t} \cdot \log TFP_{f,t}$		0.070***	0.080***
		(0.023)	(0.024)
$\Delta \log W^*_{f,t}$			0.004*
			(0.002)
$\Delta \log TFP_{f,t}$			0.035***
			(0.007)
FE: $\delta_{s,k} + \delta_t$	yes	yes	yes
# obs.	92,576	92,106	87,608
R^2	0.058	0.058	0.061

▸ back to slides

Robustness

Alternative samples

Dep. var.: $\Delta p^{*}_{f,i,k,t}$	Destinations			All firms including wholesalers	Dropping intra-firm trade	Products		
	all countries	w/out US	only US			all products	HS 4-digit major	HS 4-digit major*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta e_{k,t}$	-0.011	0.034	0.184**	0.094***	0.070**	0.062**	0.102**	0.090**
	(0.016)	(0.035)	(0.062)	(0.028)	(0.033)	(0.027)	(0.042)	(0.045)
$\Delta e_{k,t} \cdot \varphi_f$	0.263***	0.438***	0.652*	0.335***	0.479***	0.587***	0.400**	0.505***
	(0.064)	(0.122)	(0.385)	(0.079)	(0.120)	(0.107)	(0.175)	(0.165)
$\Delta e_{k,t} \cdot S_{f,s,k,t}$	0.097***	0.292***	0.312***	0.162***	0.211***	0.224***	0.195***	0.198**
	(0.029)	(0.062)	(0.110)	(0.057)	(0.071)	(0.051)	(0.070)	(0.087)
Fixed Effects:								
$\delta_{s,k} + \delta_t$	yes	yes	no	yes	yes	yes	yes	yes
δ_s	no	no	yes	no	no	no	no	no
# countries	55	11	1	12	12	12	12	12
# obs.	218,879	82,438	10,957	158,804	79,461	143,912	62,679	53,037
R^2	0.077	0.058	0.055	0.041	0.062	0.043	0.057	0.060

▸ back to slides

Robustness

Definition of import intensity

Dep. var.: $\Delta p^{*}_{f,i,k,t}$	Lagged time-varying $(\varphi_{f,t-1}, S_{\cdot,\cdot,t-1})$ (1)	Only manuf. imports (2)	Drop consumer goods (3)	Drop capital goods (4)	Only IO-table inputs (5)	Only IO-table inputs* (6)	Drop inputs in export CN8 (7)
$\Delta e_{k,t}$	0.054*	0.062**	0.068**	0.065**	0.057*	0.056*	0.077**
	(0.032)	(0.030)	(0.030)	(0.032)	(0.031)	(0.031)	(0.033)
$\Delta e_{k,t} \cdot \varphi_{f,\cdot}$	0.452***	0.459***	0.429***	0.450***	0.471***	0.486***	1.062***
	(0.154)	(0.114)	(0.135)	(0.153)	(0.106)	(0.106)	(0.376)
$\Delta e_{k,t} \cdot S_{f,s,k,\cdot}$	0.278***	0.294***	0.292***	0.286***	0.287***	0.286***	0.288***
	(0.058)	(0.064)	(0.063)	(0.062)	(0.063)	(0.063)	(0.060)
FE: $\delta_{s,k} + \delta_t$	yes	yes	yes	yes	yes	yes	yes
# obs.	87,799	93,395	93,395	93,395	93,395	93,395	93,395
R^2	0.059	0.058	0.057	0.057	0.057	0.057	0.057

back to slides

High exchange rate correlation

source-destination pairs

	# of source countries		Share of imports from	
Destination	pegs	*corr* $\geq$ 0.7	destination	*corr* $\geq$ 0.7
Australia	1	6	0.5%	5.2%
Canada	0	79	2.5%	58.7%
Iceland	0	6	0.1%	2.3%
Israel	0	77	0.5%	41.2%
Japan	0	22	5.1%	16.0%
Korea	0	24	1.6%	33.9%
New Zealand	0	3	0.3%	0.6%
Norway	0	1	1.2%	1.3%
Sweden	0	4	5.0%	6.8%
Switzerland	0	1	6.3%	6.7%
United Kingdom	0	12	23.0%	30.3%
United States	20	79	17.6%	38.0%

back to slides

High and low pass-through

source countries

High pass-through (≥ 0.50)			Low pass-through (< 0.50)		
Country	Pass-through	Import share	Country	Pass-through	Import share
Peru	1.20***	0.5%	Israel†	0.45***	0.2%
Bangladesh	0.93***	0.2%	India	0.42***	1.0%
Chile	0.75***	0.2%	Brazil	0.41***	3.1%
Taiwan	0.74***	0.5%	Thailand	0.41***	1.0%
Canada†	0.71***	1.8%	Sri Lanka	0.40**	0.2%
Australia†	0.69**	1.5%	Malaysia	0.40***	0.3%
Saudi Arabia	0.67**	1.3%	Egypt	0.39***	0.4%
China	0.67***	3.8%	Philippines	0.39*	0.5%
United States†	0.63***	16.6%	Venezuela	0.36**	0.4%
Russia	0.62***	3.8%	Singapore	0.31	0.2%
Hong Kong	0.61***	0.2%	Sweden†	0.31***	14.3%
Japan†	0.55***	5.4%	South Korea†	0.24***	0.9%
Colombia	0.55***	0.3%	United Kingdom†	0.19***	15.7%
Switzerland†	0.53***	1.5%	Indonesia	0.18**	0.6%
Mexico	0.50***	0.4%	Ukraine	0.15	0.2%
			Argentina	0.08**	0.3%
			Turkey	0.02	1.5%
			Pakistan	−0.02	0.2%
			Vietnam	−0.03	0.3%
			South Africa	−0.09	1.0%

back to slides

Production and imported inputs

Halpern, Koren and Szeidl (2011)

- Production function:

$$Y_i = \Omega_i X_i^{\phi} L_i^{1-\phi}, \qquad \phi \in (0,1),$$

$$X_i = \exp\left\{\int_0^1 \gamma_j \log X_{i,j} \mathrm{d}j\right\}, \qquad \int_0^1 \gamma_j \mathrm{d}j = 1,$$

$$X_{i,j} = \left[Z_{i,j}^{\frac{\zeta}{1+\zeta}} + a_j^{\frac{1}{1+\zeta}} M_{i,j}^{\frac{\zeta}{1+\zeta}}\right]^{\frac{1+\zeta}{\zeta}}, \qquad \zeta > 0$$

- Cost minimization:

$$TC_i^* = W^* L_i + \int_0^1 V_j^* Z_{i,j} \mathrm{d}j + \int_{J_{0,i}} \left(\mathcal{E}_m U_j M_{i,j} + W^* f_i\right) \mathrm{d}j$$

back to slides

Production and imported inputs

Total cost

$$TC_i^*(Y_i) = \frac{C^* Y_i}{B_i^{\phi} \Omega_i} + W^* f_i \cdot j_{0,i}$$

- Cost index:

$$C^* = \kappa W^{*1-\phi} V^{*\phi}$$

- Import cost-reduction factor:

$$B_i \equiv B(j_{0,i}) = \exp\left\{ \int_0^{j_{0,i}} \gamma_j \log b_j \mathrm{d}j \right\}, \quad b_j \equiv \left[1 + a_j \left(\frac{\mathcal{E}_m U_j}{V_j^*} \right)^{-\zeta} \right]^{\frac{1}{\zeta}}$$

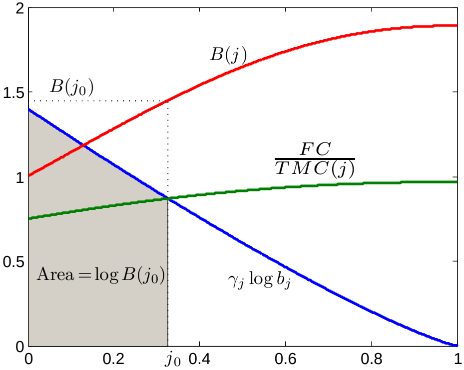
- Set of imports $J_{0,i} = [0, j_{0,i}]$

$$j_{0,i} = \max\left\{ j \in [0,1] : \ \gamma_j \log b_j \cdot \phi \frac{C^* Y_i}{B(j)^{\phi} \Omega_i} \geq W^* f_i \right\}$$

Production and imported inputs

Import cost-reduction factor

$$TC_i^*(Y_i) = \frac{C^* Y_i}{B_i^{\phi} \Omega_i} + W^* f_i \cdot j_{0,i}$$



Production and imported inputs

Import intensity

- Import intensity = expenditure share on imported inputs:

$$\varphi_i = \phi \cdot \mu_i, \qquad \mu_i = \int_0^{j_{0,i}} \gamma_j \mu_j \mathrm{d}j$$

- Marginal cost sensitivity to exchange rate:

$$\varphi_i \equiv \frac{\partial \log MC_i^*}{\partial \log \mathcal{E}_m}, \qquad \text{where} \quad MC_i^* = \frac{C^*}{B_i^{\phi} \Omega_i}$$

back to slides

Proposition

(i) *Within sectors, firms with larger total material cost or smaller fixed cost of importing have a larger import intensity,* φ_i.
(ii) *Partial elasticity of the marginal cost to the (import-weighted) exchange rate equals* φ_i.

Equilibrium relationships

- Problem of the firm:

$$\max_{Y_i,\{P_{k,i},Q_{k,i}\}_k} \left\{ \sum_{k\in K_i} \mathcal{E}_k P_{k,i} Q_{k,i} - TC^*(Y_i) \right\}$$

s.t. demand for $Q_{k,i}$, production of Y_i, and $Y_i = \sum_k Q_{k,i}$

- Optimal producer price for market k:

$$P^*_{k,i} = \frac{\sigma_{k,i}}{\sigma_{k,i}-1} MC^*_i = \mathcal{M}_{k,i} \frac{C^*}{B_i^{\phi}\Omega_i}$$

Equilibrium relationships

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  — Consider two firms i and i':

$$\frac{S_{k,i}}{S_{k,i'}} = \frac{\xi_{k,i}}{\xi_{k,i'}} \left(\frac{\mathcal{M}_{k,i}}{\mathcal{M}_{k,i'}} \frac{B_{i'}^{\phi}\Omega_{i'}}{B_i^{\phi}\Omega_i} \right)^{1-\rho}$$

Imports, Market share, Pass-through I

Proposition

(i) *Consider two firms i and i' supplying market k only in a given industry:*

$$\log \frac{S_{k,i}}{S_{k,i'}} = \frac{\kappa_2}{1-\kappa_1}\left[\log \frac{\xi_{k,i}}{\xi_{k,i'}} + (\rho-1)\log \frac{\Omega_i}{\Omega_{i'}} - \kappa_3 \log \frac{f_i}{f_{i'}}\right],$$

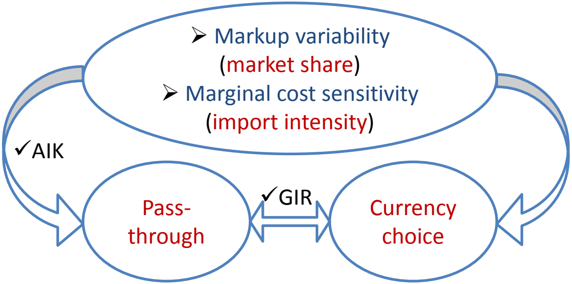
$$(\rho-1)\phi \log \frac{B_i}{B_{i'}} = \frac{\kappa_1}{1-\kappa_1}\left[\log \frac{\xi_{k,i}}{\xi_{k,i'}} + (\rho-1)\log \frac{\Omega_i}{\Omega_{i'}} - \frac{\kappa_3}{\kappa_1} \log \frac{f_i}{f_{i'}}\right],$$

$$\varphi_i - \varphi_{i'} = \kappa_4 \log \frac{B_i}{B_{i'}}, \qquad \textit{where} \quad \kappa_1 \in (0,1), \quad \kappa_2, \kappa_3, \kappa_4 > 0.$$

(ii) *Consider two identical firms i and i', with firm i serving more destinations ($K_i \supset K_{i'}$). Then $\varphi_i > \varphi_{i'}$ and $S_{k,i} > S_{k,i'}$ for all $k \in K_{i'}$.*

PTM and LCP

- Two reasons for low pass-through:
  1. LCP: price stickiness in local currency
  2. PTM and imported inputs (when prices adjust)
- PTM and LCP have common determinants
- PTM and LCP reinforce each other



back to slides