Trade Elasticity

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Topics in International Trade

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Motivation : Trade Elasticity

- Trade elasticity is a key element of the trade theory
  - Exchange rate and the J-curve (Marshall-Lerner condition)
  - Gains for trade (see Arkolakis et al, 2012)
  - ...
- Definition : (Percentage) response of trade flows to an (exogenous) price shock :

$$\varepsilon = \left| \frac{d \ln X_{ijt}}{d \ln P_{ijt}} \right|$$

Less studied (Though potentially important with GVCs) :

$$\varepsilon^o = \left| \frac{d \ln X_{i'j't}}{d \ln P_{ijt}} \right|$$

See Amiti, Itskhoki and Konings (2016)

Empirical Evidence on Trade Elasticities

- Macro evidence of low elasticities
  - Orcutt (1950) : Macro trade elasticities "have been widely accepted as supporting the view that a depreciation would be ineffective" on countries' trade balance ⇒ "Elasticity pessimism"
  - Below one in Hooper, Johnson and Marquez (2000)
  - IRBC literature needs elasticities in the range of 1 to 2 to match the quarterly fluctuations in trade balances and the ToT
- Evidence from the gravity literature of relatively high elasticities
  - "Consensus" around 4 to 6
  - High elasticities needed to account for the growth in trade following trade liberalization

⇒ **International Elasticity Puzzle** (Ruhl, 2008)

Empirical difficulties

- Exogenous price shock ?
  - Tariff shocks (Might not be exogenous see Strategic Trade Policy)
  - Exchange rate shocks (More likely to be exogenous at the disaggregated rather than at the aggregate level)
  - Pass-through rates ?
- Identification strategy ?
  - Cross-sectional versus time-series (Ruhl, 2008)
  - Aggregated versus disaggregated (Imbs & Mejean, 2015)
  - Across foreign varieties versus across domestic and foreign varieties (Feenstra et al, 2014)

Road Map

- Estimating trade elasticities
- From micro to macro elasticities

Estimating Trade Elasticities

Conceptual Framework

- Armington framework :

$$U_j = \left[\sum_i (A_i X_{ij})^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

$$\Rightarrow X_{ij} = \frac{1}{A_i} \left(\frac{P_{ij}}{A_i P_j} \right)^{-\sigma} \frac{R_j}{P_j}$$

- Thus the price-elasticity of trade (volume) :

$$\frac{d \ln X_{ij}}{d \ln P_{ij}} = -\sigma + (1-\sigma) \frac{d \ln P_j}{d \ln P_{ij}} = -\sigma + (1-\sigma) \left(\frac{P_{ij}}{P_j} \right)^{1-\sigma}$$

or in nominal terms :

$$\frac{d \ln P_{ij} X_{ij}}{d \ln P_{ij}} = (1-\sigma) + (1-\sigma) \left(\frac{P_{ij}}{P_j} \right)^{1-\sigma}$$

Conceptual Framework

- Above definition holds true in a large class of models (see Head and Mayer, 2013)
  - "Gravity-type" models which assume i) a constant price elasticity ($\frac{d \ln X_{ij}}{d \ln P_{ij}} = cst$) ii) no "third country effects" ($\frac{d \ln X_{ij}}{d \ln P_{i'j}} = 0 \; \forall i, i'$)
  - Most of the time, monopolistic/perfect competition implies $(P_{ij}/P_j)^{1-\sigma} \approx 0$

  ⇒ Trade elasticities can be estimated in the cross-section of countries and/or over time

- Not in every model : See eg Novy (2013) :
  - With translog preferences (thus variable mark-ups), the trade elasticity becomes :

$$\varepsilon_{ij} = \frac{\gamma n_i}{X_{ij}/Y_j}$$

    Neither constant over time, nor across country pairs !

Empirical Framework

- From the previous conceptual framework :

$$d \ln X_{ijt} = -\varepsilon \; d \ln P_{ijt} + Controls_{ijt} + u_{ijt}$$

  where ε can be estimated across country pairs and/or over time
- Problem : Prices are not exogenous to quantities
  - IV strategy
  - Structural estimation of a demand-supply model (Feenstra, 1994)

"IV" Strategies

- Most commonly used strategy
- Most often skip first stage, thus assuming complete pass-through ($d \ln P_{ij} = d \ln Inst_{ij}$)
- Candidate instruments :
  - Distance
    - Purely cross-sectional
    - Cannot assume pass-through $= 1$
  - Tariffs
    - highly disaggregated
    - Not much time variations
  - Exchange rates
    - Endogenous in aggregate data
    - Lots of variations across time and countries
    - Some attempt to build firm-specific measures of exchange rate exposure

Tariffs as instruments : Caliendo and Parro

- Strategy :
  - ε^k estimated in the cross-section of country pairs using asymmetries in bilateral tariffs
  - Start from a gravity equation and "instrument" prices by tariffs and other measures of bilateral trade barriers

$$\ln s_{ij}^k = \Phi_i^k + \Theta_j^k + \alpha^k D_{ij}^k - \varepsilon^k \ln \tau_{ij}^k + e_{ij}^k$$

Allow estimating ε^k under the assumption that $\frac{d \ln P_{ij}^k}{d \ln \tau_{ij}^k} = 1$

  - Use a method of tetrads :

$$\ln \frac{s_{ij}^k s_{jl}^k s_{li}^k}{s_{ji}^k s_{il}^k s_{lj}^k} = -\varepsilon^k \ln \frac{\tau_{ij}^k \tau_{jl}^k \tau_{li}^k}{\tau_{ji}^k \tau_{il}^k \tau_{lj}^k} + e_{ij}^k + e_{jl}^k + e_{li}^k - e_{ji}^k - e_{il}^k - e_{lj}^k$$

Identification assumption : Unobserved asymmetric trade costs OG to tariffs

- Data : Comtrade (bilateral trade) and Trains (bilateral tariffs)

Estimated elasticities (CP, 2015)

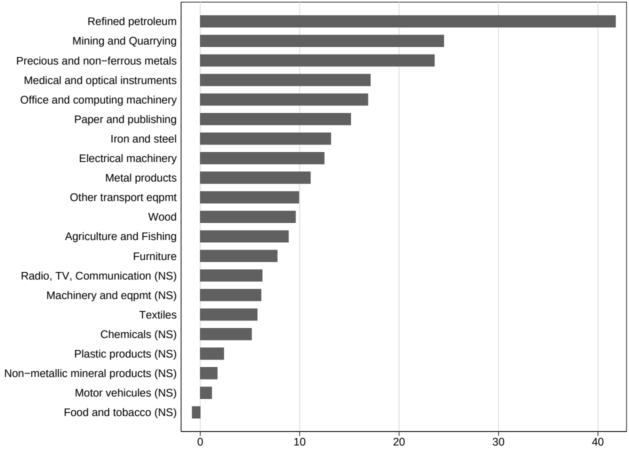


Figure 1. Estimates of the tariff elasticity of imports based on Caliendo and Parro (2012).

Note: The figure plots minus the gravity estimates, by sector. (NS) indicates non-significance at the 10% level.

Tariffs as instruments : Head and Ries

- Strategy :
  - ε^k estimated in the cross-section of importers, using panel data
  - Start from a gravity equation and "instrument" prices by tariffs and other measures of bilateral trade barriers

$$\ln b_{jt}^k = \underbrace{\varepsilon^k \ln NTB_t^k}_{FE_t} - \varepsilon^k \ln \tau_{jt}^k + (FE_k) + e_{jt}^k$$

  b_{jt}^k the relative advantage of domestic against imported goods in country j Allow estimating ε^k under the assumption that $\frac{d \ln P_{jt}^k}{d \ln \tau_{jt}^k} = 1$

  Identification assumption : Unobserved country-specific trade costs OG to tariffs

- Data : Industry Canada at the SIC level (manufacturing)

Estimated elasticities (Head Ries, 2001)

TABLE 1—DECOMPOSING CHANGES IN TRADE COSTS INTO TARIFF AND NONTARIFF EFFECTS

			Average NTB (percent)	
Method	OLS	Fixed effects	OLS	FE
Ln 1 + tariff	10.409	6.882		
	(1.916)	(1.532)		
Intercept (1990)	2.742	2.883	30.1	52.0
	(0.139)	(0.070)		
1991	−0.074	−0.082	29.2	50.2
	(0.159)	(0.040)		
1992	−0.123	−0.156	28.6	48.6
	(0.161)	(0.044)		
1993	−0.166	−0.240	28.1	48.6
	(0.164)	(0.050)		
1994	−0.212	−0.30	27.5	45.5
	(0.167)	(0.056)		
1995	−0.242	−0.335	27.1	44.8
	(0.169)	(0.061)		
N	615	615		
R^2	0.073	0.387		
RMSE	1.133	0.275		

Note: Standard errors are in parentheses. Dependent variable: Ln border effect: $\ln(b)$.

ER as instruments : Berman, Martin, Mayer

- Strategy :
  - ε^k estimated over time within a firm-destination, using panel firm-level data
  - Estimate the heterogeneity of elasticities, depending on the size of the firm
  - Start from a gravity equation and "instrument" prices by exchange rates

    $$\ln X_{fjt} = \alpha_x \ln Prod_{ft-1} + \varepsilon_x \ln RER_{jt} + \gamma_x \ln Prod_{ft-1} \ln RER_{jt} + \delta Z_{jt} + FE_t + FE_{fj} + e_{fjt}$$

    where RER_{jt} is defined in the destination's currency per unit of the firm's currency and Z_{jt} contains the country's REER and its GDP
  - Account for the possibility that the ERPT is less than one ($\frac{d \ln P_{fjt}}{d \ln RER_{jt}} \neq 1$) :

    $$\ln P_{fjt} = \alpha_p \ln Prod_{ft-1} + \varepsilon_p \ln RER_{jt} + \gamma_p \ln Prod_{ft-1} \ln RER_{jt} + FE_t + FE_{fj} + e_{fjt}$$
- Data : French firm-level export data over 1995-2005 + BRN data (balance-sheet)

Estimated elasticities : BMM, 2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Single product	Main Product (val.)	Main Product (dest.)	Stable Mix	Single NC4	Firm level	Firm-product level
# observations	355996	429022	486403	364672	489079	858271	2289051
Dep. Var:	**ln unit value**						
	Coefficients						
ln TFP_{t-1}	0.012^a	0.018^a	0.006^b	0.014^a	0.012^a	0.010^a	0.010^a
	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)
ln RER	0.084^a	0.135^a	0.108^a	0.097^a	0.078^a	0.052^a	0.124^a
	(0.019)	(0.015)	(0.016)	(0.018)	(0.016)	(0.017)	(0.020)
ln $TFP_{t-1} \times$ ln RER	0.047^a	0.059^a	0.055^a	0.042^a	0.040^a	0.024^a	0.023^a
	(0.015)	(0.009)	(0.009)	(0.014)	(0.013)	(0.009)	(0.008)
rank product							-0.003^a
							(0.000)
rank product $\times$ ln RER							-0.003^a
							(0.001)
	Quantification: change in the effect of RER (%), for						
mean TFP $\rightarrow$ mean + s.d TFP	8.4 $\rightarrow$ 13.4	13.5 $\rightarrow$ 19.5	10.8 $\rightarrow$ 16.4	9.7 $\rightarrow$ 14.1	7.8 $\rightarrow$ 12.2	5.2 $\rightarrow$ 7.9	12.4 $\rightarrow$ 15.2
1st $\rightarrow$ 5th product							12.4 $\rightarrow$ 11.0
1st $\rightarrow$ 10th product							12.4 $\rightarrow$ 9.3

Estimated elasticities : BMM, 2011

Dep. Var:	ln volume						
	Coefficients						
ln TFP_{t-1}	0.082^a	0.125^a	0.115^a	0.089^a	0.097^a	0.104^a	0.076^a
	(0.008)	(0.007)	(0.007)	(0.009)	(0.007)	(0.006)	(0.006)
ln RER	0.399^a	0.542^a	0.560^a	0.419^a	0.498^a	0.704^a	0.481^a
	(0.044)	(0.059)	(0.057)	(0.054)	(0.048)	(0.070)	(0.055)
ln $TFP_{t-1} \times$ ln RER	-0.105^a	-0.074^b	-0.075^b	-0.052	-0.091^a	-0.006	0.022
	(0.035)	(0.029)	(0.029)	(0.034)	(0.033)	(0.027)	(0.033)
rank product							-0.060^a
							(0.002)
rank product × ln RER							0.015^b
							(0.007)
ln GDP	0.628^a	0.942^a	0.941^a	0.725^a	0.744^a	0.984^a	0.849^a
	(0.051)	(0.071)	(0.063)	(0.055)	(0.055)	(0.073)	(0.057)
ln importer price index	0.054^a	0.088^a	0.085^a	0.064^a	0.056^a	0.081^a	0.072^a
	(0.012)	(0.016)	(0.015)	(0.014)	(0.011)	(0.016)	(0.013)
	Quantification: change in the effect of RER (%), for						
mean TFP → mean + s.d TFP	39.9 → 28.5	54.2 → 46.6	56.0 → 48.4	41.9 → 36.5	49.8 → 40.0	70.4→ 69.8	48.1→ 50.8
1st → 5th product							48.1 → 54.3
1st → 10th product							48.1 → 61.9

Note: Robust standard errors clustered by destination-year in parentheses with [a], [b] and [c] respectively denoting significance at 1%, 5% and 10%. Columns (1) to (6) include firm-destination fixed effects and year dummies. Column (7) has firm-destination-product fixed effects together with year dummies. TFP is demeaned, and the rank product variables are computed by firm-destination, and normalized such that the core product has rank 0.

Estimated elasticities : BMM, 2011

- Assumption of complete pass-through is counterfactual
  - ER adjustments are not passed-through one-to-one into prices
  - Firms reduce their mark-up when facing an appreciation of their currency
  - More so the largest they are
  - Consistent with pricing-to-market behaviours (Krugman, 1987)
  - When regressing exports on exchange rates, one estimates the product of the price elasticity and the pass-through rate :

$$\ln X_{ij} = \varepsilon \ln P_{ij} = \varepsilon\gamma \ln RER_{ij}$$

- Exports flows are (little) responsive to ER movements
  - This does not mean that trade elasticities are low
  - Response of trade flows to ER movements is even smaller for high productive firms
  - Rationalized in a model of trade with additive trade costs

ER versus tariffs as instruments : Fitzgerald & Haller

- Strategy :
  - Use firm-destination panel data to estimate the elasticity of trade to both tariffs and ERs
  - Estimated equation :

$$Pr[X_{fjt} > 0] = FE_j + FE_{ft} + \alpha \ln RER_{jt} + \beta \ln \tau_{kjt} + X_{kjt} + e_{fjt}$$

$$\ln P_{fjt} X_{fjt} = FE_j + FE_{ft} + \alpha \ln RER_{jt} + \beta \ln \tau_{kjt} + X_{kjt} + e_{fjt}$$

  with k the sector of activity of firm f

- Data : Irish firm-level export and total revenues data over 1996-2009

ER versus tariffs as instruments : Fitzgerald & Haller

	Impact of $d \ln RER = -.1$	Impact of $d\tau = -.1$
Entry rate (f 100-249 empl.)	from 3 to 3.1%	from 3 to 3.3%
Exit rate (f 100-249 empl.)	from 23 to 22.7%	from 23 to 20%
Revenues (median f)	+6.4%	+24.2%

- Participation and revenues respond more to tariffs than to RER, especially in the LR
- Impact on participation is stronger for larger firms
- Interpretation ?
  - Hedging against ER movements ?
  - Reaction to temporary/permanent shocks ?

Structural Estimation

- Endogeneity of prices comes from prices responding to quantities in equilibrium $\Rightarrow$ Estimate the full demand-supply system
- Feenstra (1994) estimates :

$$\begin{cases} X_{ijkt} & = \left(\frac{P_{ijkt}}{P_{jkt}}\right)^{-\sigma^k} \frac{R_{jkt}}{P_{jkt}} e^{u_{ijkt}} \quad (CES - Demand) \\ P_{ijkt} & = X_{ijkt}^{\frac{\omega^k}{1-\omega^k}} e^{v_{ijkt}} \quad (Supply) \end{cases}$$

$$\Rightarrow \begin{cases} d\ln s_{ijkt} & = \varepsilon^k d\ln P_{ijkt} + \Phi_{jkt} + \xi_{ijkt}, \quad s_{ijkt} \equiv \frac{P_{ijkt}X_{ijkt}}{R_{jkt}} \\ d\ln P_{ijkt} & = \omega^k d\ln s_{ijkt} + \Psi_{jkt} + \delta_{ijkt}, \quad \varepsilon^k \equiv 1 - \sigma^k \end{cases}$$

$(\varepsilon^k, \omega^k)$ jointly estimated in the cross-section of exporters i serving a given country j in good k

Identification assumption : $\xi_{ijkt} \perp \delta_{ijkt}$

Structural Estimation

- Combining the demand-supply equations :

$$Y_{ijkt} = \psi_1^k X_{1ijkt} + \psi_2^k X_{2ijkt} + e_{ijkt}$$

where :

$$\begin{aligned} Y_{ijkt} &= (d \ln P_{ijkt} - d \ln P_{rjkt})^2 \\ X_{1ijkt} &= (d \ln s_{ijkt} - d \ln s_{rjkt})^2 \\ X_{2ijkt} &= (d \ln s_{ijkt} - d \ln s_{rjkt})(d \ln P_{ijkt} - d \ln P_{rjkt}) \\ e_{ijkt} &= \frac{-1}{\varepsilon^k}(\xi_{ijkt} - \xi_{rjkt})(\delta_{ijkt} - \delta_{rjkt}) \end{aligned}$$

- Endogeneity : $e_{ijkt} \not\perp X_{1ijkt}$, $e_{ijkt} \not\perp X_{2ijkt}$

$\Rightarrow$ Instrument with time averages since $e_{ijkt} \perp \bar{X}_{1ijk}$, $e_{ijkt} \perp \bar{X}_{2ijk}$ where $\bar{X}_{.ijk} = \frac{1}{T} \sum_t X_{.ijkt} \Rightarrow \hat{\psi}_1^k$ and $\hat{\psi}_2^k$

- Finally recover $(\hat{\varepsilon}^k, \hat{\omega}^k)$ from the structural model :

$$\psi_1^k = -\frac{\omega^k}{\varepsilon^k}, \quad \psi_2^k = \omega^k + \frac{1}{\varepsilon^k}$$

$$\Rightarrow \quad \varepsilon^k = \frac{\psi_2^k + \sqrt{{\psi_2^k}^2 + 4\psi_1^k}}{-2\psi_1^k}, \quad \psi_1^k > 0$$

Note : When $\psi_1^k < 0$, use a grid search procedure to find a local minimum

Estimated elasticities (Feenstra, 1994)

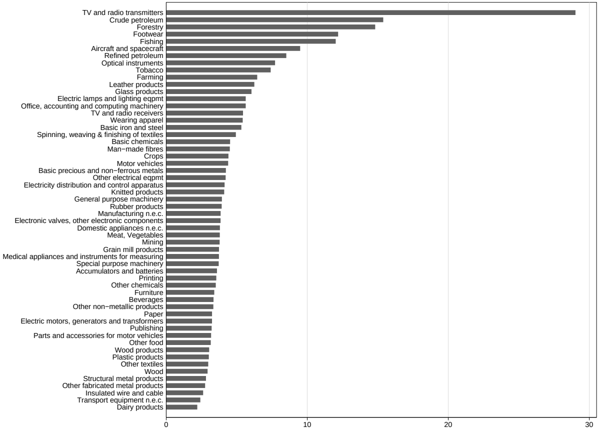


FIGURE 2. ESTIMATES OF THE ARMINGTON ELASTICITY BASED ON FEENSTRA (1994)

Note: The figure plots the value of substitution elasticities $(1 - \varepsilon^k)$ obtained with Feenstra's (1994) methodology. The elasticity is obtained using a grid search procedure when the IV strategy implies parameters that are not consistent with the model.

From Micro to Macro Elasticities

From Micro to Macro Elasticities

- Previous analysis shows elasticities estimated from disaggregated (product or firm-level) data
  - Huge amount of heterogeneity in trade elasticities
- Models of international macro/trade usually require to calibrate one trade elasticity
- Solutions :
  - Use aggregate data (see almost 100% of the macro literature) $\Rightarrow$ Problems of endogeneity can be massive
  - Use disaggregated data but constrain elasticities to equality across sectors (eg Head & Ries, 2001)
  - Calibrate multi-sector models (Caliendo & Parro, 2015)
  - Aggregate disaggregated elasticities (Imbs & Mejean, 2015)

Aggregation bias : Imbs & Mejean

- Because heterogeneity is important in micro-level estimates of trade elasticities, aggregate/pooled estimation might suffer from a heterogeneity bias
- Illustration in a simple example :
  - Suppose the "true" relation is :

    $$d \ln X^k = c^k + \varepsilon^k d \ln P^k + e^k$$

    Assume e^k is well-behaved so that ε^k can be estimated from micro data ($\hat{\varepsilon}^k = \varepsilon$)
  - Structure of heterogeneity :

    $$\varepsilon^k = \varepsilon - o^k$$

    High elastic sectors display large o^k
    ε is the average elasticity / common-component of ε^k across sectors

Aggregation bias : Imbs & Mejean

- In the absence of an heterogeneity bias, ε would be implied by aggregate data :

$$\sum_k w^k d \ln X^k = \sum_k w^k c^k + \sum_k w^k \varepsilon^k d \ln P^k + \sum_k w^k e^k$$
$$\Rightarrow \quad d \ln X = c + \varepsilon \, d \ln P + u$$

where $u \equiv \sum_k w^k e^k - \sum_k w^k o^k d \ln P^k$

- With well-behaved residuals :

$$\begin{aligned} \hat{\varepsilon} &\equiv \varepsilon + \frac{cov(d \ln P, u)}{var(d \ln P)} \\ &= \varepsilon = \sum_k w^k \varepsilon^k \end{aligned}$$

Aggregation bias : Imbs & Mejean

- In presence of heterogeneous elasticities ($o^k \neq 0$), aggregate data can yield $\hat{\varepsilon} \neq \varepsilon$ if :

$$cov(d \ln P, u) = -cov\left(\sum_k w^k d \ln P^k, \sum^k w^k o^k d \ln P^k\right) \neq 0$$

  i.e. if the volatility of sectoral prices is systematically correlated with the magnitude of elasticities

- Orcutt (1950) : "most of the price changes in the historical price indices of imports lumped together were due to price changes of commodities with inelastic demands. Since these price changes were associated with only small quantity adjustments, the estimated price elasticity of all imports might well be low" $\Rightarrow$ Attenuation bias : $|\hat{\varepsilon}| < \varepsilon$

Aggregation bias : Imbs & Mejean

- Paper shows it is actually the case in US data
- Use two alternative identification strategies :
  - "IV" (Caliendo Parro, 2015)
  - Structural (Feenstra, 1994)
- Estimate ε :
  - In aggregate data
  - In disaggregated data, imposing homogenous elasticities
  - In disaggregated data, accounting for the heterogeneity and aggregating ex-post, using a theoretically-consistent formula

Estimated elasticities : Imbs Mejean, 2015

Table 1—Aggregate, constrained and unconstrained elasticities

	Caliendo-Parro	Feenstra
Aggregate elasticity	-1.790***	-2.001***
	(0.426)	(0.116)
Constrained elasticity	-2.375***	-2.005***
	(0.506)	(0.150)
Unconstrained elasticity	-5.639***	-4.174***
	(1.171)	(0.106)

*** denotes significance at the 1% level

Estimated elasticities : Imbs Mejean, 2015

- Heterogeneity bias is substantial and matters quantitatively
  - Models calibrated with heterogeneity-consistent elasticities are better able to reproduce the behaviour of a multi-sector model
  - Show this is the case of a standard IRBS model (Backus, et al, 1994) and a strandard trade model (Arkolakis et al, 2012)
- Might explain the "International Elasticity Puzzle"

Other source of aggregation issues

- Short-run / Long-run Elasticities
  - Macro literature typically distinguishes between short-run and long-run elasticities using time-series analysis
  - Ruhl (2008) : Difference bw SR/LR elasticities might come from the response at the extensive margin to temporary/permanent shocks
  - Permanent shocks (eg tariff) are more likely to induce extensive adjustments
  - Might explain discrepancies between elasticities estimated in macro (identification in the time-series using ER shocks) versus in trade (identification in the cross-section using tariff shocks)
- Heterogeneous firms
  - Same argument as before
  - Pooling across firms might induce an heterogeneity bias if the size of firms is systematically correlated with the trade elasticity (which seems to be the case, Berman et al, 2011)

SR/LR elasticities : Ruhl, 2008

- Model of business cycle fluctuations with
  - Entry cost of exporting and heterogeneous firms (Melitz, 2003)
  - Aggregate TFP shocks (BKK, 1994)

⇒ Endogenous export participation based on expected future value of exporting

- Extensive adjustments more pronounced after permanent shocks than after temporary shocks

- In the SR, ie before extensive adjustments take place, trade elasticity is small / In the LR, trade elasticity is large for large enough / permanent shocks

SR/LR elasticities : Ruhl, 2008

- With extensive margin adjustments :

$$d \ln P_{ijt} X_{ijt} = \underbrace{d \ln \int_{\Omega} x_{ijt}(\omega) d\omega}_{Intensive\ margin} + \underbrace{d \ln \frac{\int_{\Omega_t} x_{ijt}(\omega) d\omega}{\int_{\Omega} x_{ijt}(\omega) d\omega}}_{Extensive\ margin}$$

where $\Omega = \Omega_t \cap \Omega_{t-1}$

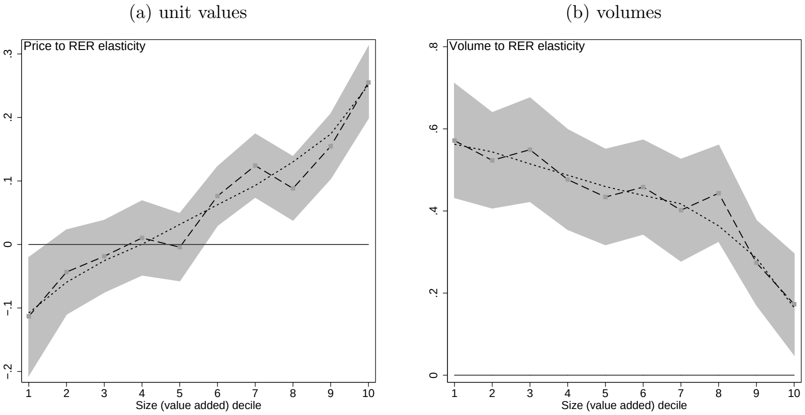
- Trade elasticity :

$$\varepsilon = \frac{d \ln P_{ijt} X_{ijt}}{d \ln P_{ijt}} = \underbrace{\int_{\Omega} \frac{d \ln x_{ijt}(\omega)}{d \ln P_{ijt}} d\omega}_{Intensive\ margin} + \underbrace{d \ln \frac{\int_{\Omega_t} x_{ijt}(\omega) d\omega}{\int_{\Omega} x_{ijt}(\omega) d\omega} \frac{1}{d \ln P_{ijt}}}_{Extensive\ margin}$$

- Simulation results :
    - Intensive / SR elasticity = -2 (calibrated)
    - Total / LR elasticity to a permanent (tariff) shock = -6.38

Firm heterogeneity : BMM, 2011

Figure I: Responses to RER changes by decile of size



Firm heterogeneity : BMM, 2011

- Individual firms react in a systematically different way to a price shock, depending on this size
- Trade elasticity :

$$\varepsilon = \frac{d \ln P_{ijt} X_{ijt}}{d \ln P_{ijt}} = \underbrace{\int_{\Omega} \frac{d \ln x_{ijt}(\omega)}{d \ln P_{ijt}} d\omega}_{\text{Intensive margin}} + \underbrace{d \ln \frac{\int_{\Omega_t} x_{ijt}(\omega) d\omega}{\int_{\Omega} x_{ijt}(\omega) d\omega} \frac{1}{d \ln P_{ijt}}}_{\text{Extensive margin}}$$

$$= \underbrace{\sum_{d=1}^{D} w_{ijt-1}^{d} \frac{d \ln x_{ijt}^{d}(\omega)}{d \ln P_{ijt}}}_{\text{Intensive margin}} + \underbrace{d \ln \frac{\int_{\Omega_t} x_{ijt}(\omega) d\omega}{\int_{\Omega} x_{ijt}(\omega) d\omega} \frac{1}{d \ln P_{ijt}}}_{\text{Extensive margin}}$$

where $x_{ijt}^{d}(\omega)$ denotes the nominal sales of a firm ω which belongs to the d-percentile of the distribution and $w_{ijt-1}^{d} \equiv \frac{\int_{\Omega_d} x_{ijt-1}(\omega) d\omega}{\int_{\Omega} x_{ijt-1}(\omega) d\omega}$ is the share of firms in percentile d in total sales at $t-1$

Firm heterogeneity : BMM, 2011

- IV strategy implies :

$$\frac{d \ln x_{ijt}^{d}(\omega)}{d \ln P_{ijt}} = 1 - \varepsilon^{d} = 1 - \frac{\varepsilon_x^{d}}{\varepsilon_p^{d} - 1}$$

  where $\varepsilon_x^d \equiv \frac{d \ln X_{fjt}^d}{d \ln RER_{jt}}$ and $\varepsilon_p^d \equiv \frac{d \ln P_{fjt}^d}{d \ln RER_{jt}}$

- Estimation results suggest ε^d increasing in d (quantities less responsive to prices for large firms) because
  - quantities are less responsive to ER (ε_x^d decreasing in d)
  - prices are more responsive to ER (ε_p^d increasing in d)
- Since large firms account for a disproportionate share of aggregate exports, aggregate elasticities are driven down by large firms

Conclusion

- Trade elasticity is *the* key variable in international economics which determines :
  - The welfare gains from trade
  - The transmission of shocks across countries (expenditure switching effect)
  - ...
- Given the importance, it is surprising that so little is known about its value and variability across countries / sectors / time / etc.

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