Lecture 10: Welfare Gains from Trade

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Université Paris-Saclay Master in Economics, 2nd year

16 December 2015

Introduction

- In Lectures 1-8 we have studied a number of trade models...
- ... which under some parametric restrictions are all consistent with the gravity equation (Lecture 9)
- In today's class, we are going to compare what they imply in terms of the welfare gains from trade
  - Quantitatively
  - And qualitatively (Ricardian gains from trade / Gains from increased diversity / Aggregate productivity gains due to selection)

New Trade Models, Same Old Gains ?

See analytical details in ACRC (2012) and Appendix

New Trade Models, Same Old Gains ?

- Arkolakis, Costinot & Rodrìguez-Clare (ACRC). 2012. "New Trade Models, Same Old Gains ?" *American Economic Review*, 102(1) : 94-130
- Show that, in a large class of trade models that encompasses the most popular ones (Armington-Krugman, Eaton-Kortum and Melitz-Chaney), welfare gains from international trade can be summarized by a unified welfare measure
- Welfare gains from trade only depend on the share of domestic goods in aggregate expenditures and the price elasticity of imports

$\Rightarrow$ (Wrong) interpretation : Despite structurally different underlying mechanisms, a given shock to international trade shocks has identical aggregate effects

$\Rightarrow$ (Correct) interpretation : One does not need to take a stand on the driver of trade to be able evaluate the magnitude of welfare gains

General assumptions

ACRC's demonstration applies to the class of models with N countries that feature four primitive assumptions...

i) Dixit-Stiglitz preferences :

$$P_j = \left[\int_{\omega \in \Omega} p_j(\omega)^{1-\sigma} d\omega \right]^{1/(1-\sigma)}$$

ii) One factor of production : labor, inelastically supplied and immobile across countries, L_j

iii) Linear cost functions :

$$C_i(\mathbf{w}, \mathbf{q}, \mathbf{t}, \varphi) = \sum_{j=1}^{N} \left[\underbrace{c_{ij}(w_i, \tau_{ij}, \varphi)}_{\textit{Cst MC in dom L}} q_j + \underbrace{f_{ij}(w_i, w_j, \xi_{ij}, \varphi)}_{\textit{Fixed cost in dom/for L}} 1(q_j > 0) \right]$$

where φ is the firm's productivity

iv) Perfect or monopolistic competition (restricted or free entry)

General assumptions (ii)

...and 3 macro-level restrictions :

i) Balanced trade :

$$\sum_i X_{ij} = \sum_i X_{ji}$$

$$with \quad X_{ij} \equiv \int_{\omega \in \Omega_{ij}} x_{ij}(\omega) d\omega$$

ii) Aggregate profits are a constant share of aggregate revenues : $\Pi_j / R_j = cst$ where Π_j is aggregate profits gross of entry costs

iii) A CES import demand system :

$$\frac{\partial \ln(X_{ij}/X_{jj})}{\partial \ln \tau_{i'j}} = \begin{cases} \varepsilon < 0 & if \quad i' = i \\ 0 & if \quad i \neq i' \end{cases}$$

(Changes in relative demand are separable across exporters)

General assumptions (iii)

$\Rightarrow$ In this class of models, welfare is equal to real income :

$$W_j = \frac{R_j}{P_j}$$

- Question : What is the impact of foreign shocks on aggregate welfare ?
- Definition of "foreign" shocks : Changes in parameters affecting foreign endowments $\mathbf{L} = \{L_i\}$, entry costs $\mathbf{F} = \{F_i\}$, variable trade costs $\tau = \{\tau_{ij}\}$ and fixed trade costs $\xi = \{\xi_{ij}\}$ that do not affect country j's endowment or its ability to serve its own market (L_j, F_j, τ_{jj} and ξ_{jj} constant)
- We will focus on changes in τ

Proposition

$\Rightarrow$ In this class of models, the welfare impact of a foreign shock is :

$$\hat{W}_j = \hat{\lambda}_{jj}^{1/\varepsilon}$$

where $\hat{v} = v'/v$ is the change in v between the initial and the new equilibrium and λ_{jj} the share of domestically produced goods in consumption

- In the special case of moving to autarky : $\hat{W}_j^A = \lambda_{jj}^{-1/\varepsilon}$
- (Observed) changes in the share of domestic consumptions, together with the price elasticity of trade are sufficient statistics for evaluating welfare gains !

CES National Product Differentiation

- Armington CES utility :

$$U_j = \left[\sum_{i=1}^{N} q_{ij}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

- Linear cost function :

$$C_i(\mathbf{w}, \mathbf{q}, \mathbf{t}, \varphi) = \sum_{j=1}^{N} [w_i \tau_{ij}] \quad (f_{ij} = 0)$$

$\Rightarrow$ Bilateral trade flows :

$$X_{ij} = \left(\frac{w_i \tau_{ij}}{P_j} \right)^{1-\sigma} R_j$$

$\Rightarrow$ CES Import demand system :

$$\varepsilon \equiv \frac{d \ln X_{ij}/X_{jj}}{d \ln \tau_{ij}} = 1 - \sigma, \quad \frac{d \ln X_{ij}/X_{jj}}{d \ln \tau_{i'j}} = 0$$

CES National Product Differentiation

- Welfare impact of a foreign shock :

$$
\begin{aligned}
& d \ln W_j = d \ln R_j - d \ln P_j \\
\textit{with} \quad & d \ln R_j = d \ln w_j + d \ln L_j = 0 \\
\textit{and} \quad & d \ln P_j = \sum_i \lambda_{ij} (d \ln w_i + d \ln \tau_{ij}) \\
\textit{where} \quad & \lambda_{ij} \equiv \frac{X_{ij}}{R_j}
\end{aligned}
$$

CES National Product Differentiation

- From the demand functions :

$$d \ln \lambda_{ij} - d \ln \lambda_{jj} = (1 - \sigma)[d \ln w_i + d \ln \tau_{ij} - d \ln w_j]$$

- By construction : $\sum_{i=1}^{N} \lambda_{ij} = 1$

$\Rightarrow$ Which implies :

$$d \ln W_j = \frac{d \ln \lambda_{jj}}{1 - \sigma} \quad or \quad \hat{W}_j = \hat{\lambda}_{jj}^{1/(1-\sigma)} = \hat{\lambda}_{jj}^{1/\varepsilon}$$

- Welfare gains only depend on terms-of-trade changes, which can be inferred from changes in the relative demand for domestic and foreign goods

CES Monopolistic Competition

- Armington CES utility :

$$U_j = \left[\sum_{i=1}^{N} q_{ij}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

- Linear cost function :

$$C_i(\mathbf{w}, \mathbf{q}, \mathbf{t}, \varphi) = \sum_{j=1}^{N} [w_i \tau_{ij}] - w_i F \quad (f_{ij} = 0)$$

$\Rightarrow$ CES Import demand system :

$$X_{ij} = \left(\frac{w_i \tau_{ij}}{P_j} \right)^{1-\sigma} R_j \;\Rightarrow\; \varepsilon \equiv \frac{d \ln X_{ij}/X_{jj}}{d \ln \tau_{ij}} = 1-\sigma, \quad \frac{d \ln X_{ij}/X_{jj}}{d \ln \tau_{i'j}} = 0$$

$\Rightarrow$ Welfare gains :

$$\hat{W}_j = \hat{\lambda}_{jj}^{1/(1-\sigma)} = \hat{\lambda}_{jj}^{1/\varepsilon}$$

Heterogeneous Industries

- CES utility across industries :

$$U_j = \left[\int_0^1 q_j(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$$

- Linear cost function :

$$C_i(\mathbf{w}, \mathbf{q}, \mathbf{t}, \varphi) = \sum_{j=1}^{N} \frac{w_i \tau_{ij}}{\varphi_i(\omega)}$$

- Perfect competition :

$$\Omega_{ij} = \left\{ \omega \in \Omega \mid \frac{w_i \tau_{ij}}{\varphi_i(\omega)} < \frac{w_{i'} \tau_{i'j}}{\varphi_{i'}(\omega)} \forall i' \neq i \right\}$$

Heterogeneous Industries

⇒ Bilateral trade :

$$X_{ij} = \frac{\int_0^{+\infty} \left(\frac{w_i \tau_{ij}}{\varphi_i(\omega)}\right)^{1-\sigma} g_i(\varphi_i(\omega)) d\omega}{\sum_{i'=1}^{N} \int_0^{+\infty} \left(\frac{w_{i'} \tau_{i'j}}{\varphi_{i'}(\omega)}\right)^{1-\sigma} g_{i'}(\varphi_{i'}(\omega) d\omega} R_j$$

with $g_i(\varphi_i(\omega))$ the density of goods with productivity $\varphi_i(\omega)$ in Ω_{ij}

⇒ Trade elasticity :

$$\frac{\partial \ln(X_{ij}/X_{jj})}{\partial \ln \tau_{i'j}} = \begin{cases} \underbrace{1-\sigma}_{Intensive} + \underbrace{\gamma_{i'j}^{i'} - \gamma_{jj}^{i'}}_{Extensive} & for \quad i' = i \\ \gamma_{ij}^{i'} - \gamma_{jj}^{i'} & for \quad i' \neq i \end{cases}$$

with $\gamma_{ij}^{i'} \equiv \partial \ln[\int_0^{+\infty} \varphi_i(\omega)^{\sigma-1} g_i(\varphi_i(\omega)) d\omega] / \partial \ln(w_{i'} \tau_{i'j})$

- Under Fréchet distribution :

$$\frac{\partial \ln(X_{ij}/X_{jj})}{\partial \ln \tau_{i'j}} = \begin{cases} -\theta & for \quad i' = i \\ 0 & for \quad i' \neq i \end{cases}$$

Heterogeneous Industries

- Under Fréchet :

$$P_j = \left[\Gamma\left(\frac{\theta+1-\sigma}{\theta}\right)\right]^{\frac{1}{1-\sigma}} \left[\sum_{i=1}^{N} T_i(\tau_{ij} w_i)^{-\theta}\right]^{\frac{-1}{\theta}}$$

- Impact of a foreign shock :

$$\begin{aligned} & d\ln W_j = d\ln R_j - d\ln P_j \\ \textit{with} \quad & d\ln R_j = d\ln w_j + d\ln L_j = 0 \\ \textit{and} \quad & d\ln P_j = \sum_i \lambda_{ij}(d\ln w_i + d\ln \tau_{ij}) \\ \textit{where} \quad & \lambda_{ij} \equiv \frac{X_{ij}}{R_j} \end{aligned}$$

Note that the extensive effect is second-order as consumers are indifferent between the cutoff goods produced by different countries

Heterogeneous Industries

- From the bilateral trade flows :

$$d \ln \lambda_{ij} - d \ln \lambda_{jj} = (1 - \sigma + \gamma_{ij}^{i} - \gamma_{jj}^{i}) d \ln(w_i \tau_{ij}) + \sum_{i' \neq i,j} (\gamma_{ij}^{i'} - \gamma_{jj}^{i'}) d \ln(w_{i'} \tau_{i'j})$$

$$\Rightarrow \quad d \ln W_j = - \sum_{i=1}^{N} \lambda_{ij} \frac{d \ln \lambda_{ij} - d \ln \lambda_{jj}}{-\theta}$$

- Since $\sum_i \lambda_{ij} = 1$, welfare gains become :

$$d \ln W_j = \frac{d \ln \lambda_{jj}}{-\theta} \quad or \quad \hat{W}_j = \hat{\lambda}_{jj}^{1/(-\theta)} = \hat{\lambda}_{jj}^{\varepsilon}$$

Extensive margin is key now since it is at the root of the terms-of-trade gains

Heterogeneous Firms

- CES utility across firms :

$$U_j = \left[\sum_{i=1}^{N} \int_{\Omega_{ij}} q_{ij}(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}}$$

- Linear cost function :

$$C_i(\mathbf{w}, \mathbf{q}, \mathbf{t}, \varphi) = \sum_{j=1}^{N} \left[\frac{w_i \tau_{ij}}{\varphi} + w_i^{\mu} w_j^{1-\mu} \xi_{ij} 1(q_{ij}(\varphi) > 0) \right]$$

- Selection :

$$\Omega_{ij} = \left\{ \varphi \in \Omega | \varphi > \varphi_{ij}^* = \sigma^{\frac{\sigma}{\sigma-1}} (\sigma - 1) \left(\frac{w_i \tau_{ij}}{P_j} \right) \left(\frac{f_{ij}}{Y_j} \right)^{1/(\sigma-1)} \right\}$$

$\Rightarrow$ Bilateral trade :

$$X_{ij} = \frac{N_i \int_{\varphi_{ij}^*}^{+\infty} \left(\frac{w_i \tau_{ij}}{\varphi} \right)^{1-\sigma} g_i(\varphi) d\varphi}{\sum_{i'=1}^{N} N_{i'} \int_{\varphi_{i'j}^*}^{+\infty} \left(\frac{w_{i'} \tau_{i'j}}{\varphi} \right)^{1-\sigma} g_{i'}(\varphi) d\varphi} R_j$$

Heterogeneous Firms

- Effect of the foreign shock :

$$\frac{\partial \ln \varphi_{ij}^*}{\partial \ln \tau_{ij}} = \frac{\partial \ln \varphi_{jj}^*}{\partial \ln \tau_{ij}} + 1 \quad \textit{and} \quad \frac{\partial \ln \varphi_{ij}^*}{\partial \ln \tau_{i'j}} = \frac{\partial \ln \varphi_{jj}^*}{\partial \ln \tau_{i'j}} \quad \forall i \neq i'$$

$\Rightarrow$ Trade elasticity :

$$\frac{\partial \ln(X_{ij}/X_{jj})}{\partial \ln \tau_{i'j}} = \begin{cases} 1 - \sigma - \gamma_{ij} - (\gamma_{ij} - \gamma_{jj}) \frac{\partial \ln \varphi_{\boldsymbol{jj}}^*}{\partial \ln \tau_{\boldsymbol{ij}}} & \textit{for} \quad i' = i \\ -(\gamma_{ij} - \gamma_{jj}) \frac{\partial \ln \varphi_{\boldsymbol{jj}}^*}{\partial \ln \tau_{\boldsymbol{i'j}}} & \textit{for} \quad i' \neq i \end{cases}$$

with $\gamma_{ij} \equiv d \ln[\int_{\varphi_{\boldsymbol{ij}}^*}^{+\infty} \varphi^{\sigma-1} g_i(\varphi) d\varphi] / d \ln \varphi_{ij}^*$

- With a Pareto distribution :

$$\frac{\partial \ln(X_{ij}/X_{jj})}{\partial \ln \tau_{i'j}} = \begin{cases} -\theta & \textit{for} \quad i' = i \\ 0 & \textit{for} \quad i' \neq i \end{cases}$$

Heterogeneous Firms

- Welfare under free entry :

$$
\begin{aligned}
& d \ln W_j = d \ln R_j - d \ln P_j \\
\textit{with} \quad & d \ln R_j = d \ln w_j + d \ln L_j = 0 \\
\textit{and} \quad & d \ln P_j = \sum_i \lambda_{ij} \left(d \ln w_i + d \ln \tau_{ij} + \frac{d \ln N_i - \gamma_{ij} d \ln \varphi_{ij}^*}{1-\sigma} \right) \\
& = \sum_i \frac{\lambda_{ij}}{1-\sigma-\lambda_j} \left[(1-\sigma-\lambda_j)(d \ln w_i + d \ln \tau_{ij}) \right. \\
& \left. + \frac{\gamma_{ij}}{1-\sigma} (d \ln \xi_{ij} + \mu d \ln w_i) + d \ln N_i \right]
\end{aligned}
$$

where $\gamma_j = \sum_i \gamma_{ij} \lambda_{ij}$

Heterogeneous Firms

- From bilateral trade :

$$d \ln \lambda_{ij} - d \ln \lambda_{jj} = (1 - \sigma - \gamma_{ij}) d \ln(w_i \tau_{ij})$$
$$+ \frac{\gamma_{ij}}{1 - \sigma} (d \ln \xi_{ij} + \mu d \ln w_i) - (\gamma_{ij} - \gamma_{jj}) d \ln \varphi^*_{jj} + d \ln N_i - d \ln N_j$$

- and from the definition of cutoffs :

$$d \ln \varphi^*_{ij} = d \ln \varphi^*_{jj} + d \ln(w_i \tau_{ij}) - \frac{d \ln \xi_{ij} + \mu d \ln w_i}{1 - \sigma}$$

Heterogeneous Firms

- Finally welfare :

$$d \ln W_j = \frac{d \ln \lambda_{jj} - d \ln N_j}{-\theta}$$

- Under free entry : $\Pi_j = N_j F_j = cst \times Y_j$ (macro-level restriction (ii)) and thus

$$d \ln N_j = 0$$

- Under restricted entry : $d \ln N_j = 0$
- Welfare gains due to terms-of-trade adjustments (through the intensive and extensive margins)

Extensions

- Multi-sector model : With Cobb-Douglas across sectors and CES over varieties :

$$d \ln W_j = \sum_{s=1}^{S} \frac{\eta_j^s}{\varepsilon^s} d \ln \lambda_{jj}^s \quad (\textit{perfect competition})$$

$$d \ln W_j = \sum_{s=1}^{S} \frac{\eta_j^s}{\varepsilon^s} (d \ln \lambda_{jj}^s - d \ln L_j^s) \quad (\textit{monopolistic})$$

  where $d \ln L_j^s \neq 0$ because of potential reallocation across sectors

- Welfare gains due to large trade flows in those sectors that account for a large enough share of expenditures and that are little elastic

Extensions

- Tradable intermediate goods (See Blaum, Lelarge, Peters, 2014) : Ω is either consumed or used as intermediate goods in production $\rightarrow$ Cost function :

$$C_i(\mathbf{w}, \mathbf{q}, \mathbf{t}, \mathbf{P}, \omega) = \sum_{j=1}^{n} \left[\underbrace{c_{ij}(w_i, \tau_{ij}, P_i, \omega)}_{\textit{Cst MC in dom L}} q_{ij} + \underbrace{f_{ij}(w_i, P_i, w_j, P_j, \xi_{ij}, \omega)}_{\textit{Fixed cost in dom/for L}} 1(q_{ij} > 0) \right]$$

With β the share of intermediates in production and κ their share in entry costs, welfare gains are given by :

$$d \ln W_j = \frac{d \ln \lambda_{jj}}{\varepsilon(1-\beta)} \ (\textit{perfect competition})$$

$$d \ln W_j = \frac{d \ln \lambda_{jj}}{\varepsilon(1-\beta) - \beta\left(\frac{\varepsilon}{1-\sigma} + 1\right) + (1-\kappa)} \ (\textit{monopolistic})$$

Under PC, IO linkages amplify the gains from trade (see Lecture on vertical fragmentation). Under MC, 2 additional effects : decrease in fixed exporting and entry costs

Extensions

- Variable mark-ups (Arkolakis et al, 2012b) :

$$d \ln W_j = (1 - \delta) \frac{d \ln \lambda_{jj}}{\varepsilon}$$

with δ a structural parameter that depends, among other things, on the elasticity of markups with respect to firm productivity

$\Rightarrow$ Welfare gains are (weakly) lower with a pro-competitive effect of trade !

Intuition : under variable mark-ups, the model features incomplete pass-through of changes in trade costs : Firms becoming more competitive thanks to a decrease in trade costs *increase* their mark-up which reduces the gains from trade

Empirical welfare gains

Empirical welfare gains

- Based on ACRC, welfare gains are easy to quantify, using measures of λ_{jj} and estimates of ε
- The gravity equation offers a common way to estimate the trade elasticity, despite once again different structural interpretations. This is because the gravity equation is based on the macro-restriction iii) :

$$\ln X_{ij} = A_i + B_j + \varepsilon \ln \tau_{ij} + \nu_{ij}$$

- Note that for the gravity equation to provide the trade elasticity necessary to quantify welfare gains in all models, it must be true that the orthogonality condition is equally verified in all models

Summary on $\hat{\theta}$ from Lecture 2

Table: Estimated θ parameters and corresponding welfare gains

	$\hat{\theta}$	$\hat{W}^A_{US}$	$\hat{W}^A_{open}$
EK, Method of moments	8.28	.991	.875
EK, 2Stages GLS+OLS	2.84	.975	.677
EK, 2Stages GLS+2SLS	3.60	.980	.735
EK, OLS Trade Eq.	2.44	.971	.635
EK, 2SLS Trade Eq.	12.86	.994	.917
SW, SMM	4.12	.983	.764
CDK, IV	6.53	.989	.844
CP, (mean)	8.22	.991	.874

EK=Eaton & Kortum (2002), CDK=Costinot et al (2011)
SW=Simonovska & Waugh (2011), CP=Caliendo & Parro (2014)
$\hat{W}^A_{US}$ uses $\lambda_{US,US} = .93$ from ACRC and $\hat{W}^A_{US} = \lambda^{-1/\varepsilon}_{US,US}$
$\hat{W}^A_{open}$ uses $\lambda_{open} = .33$, the value for Singapore.

Multi-sector empirical welfare gains

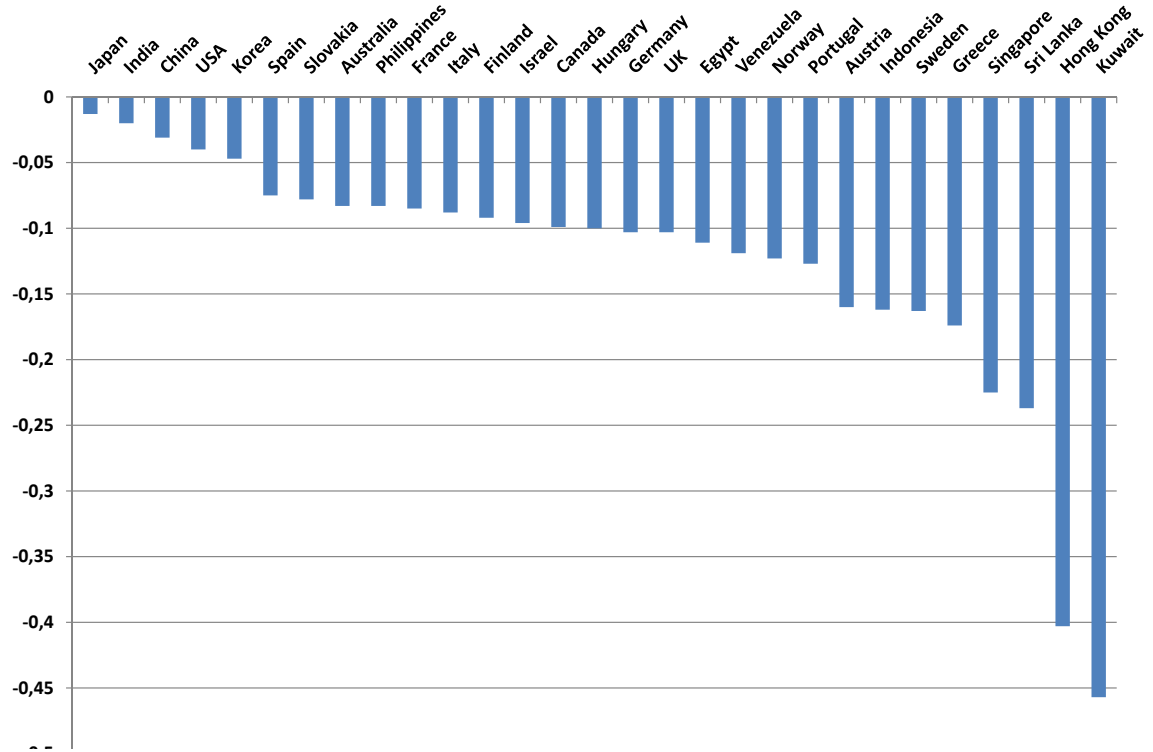
- Imbs & Mejean (2015) discuss the welfare predictions of a multi-sector trade model based on ACRC
- Intuition : One-sector models are simplifications of an heterogeneous world. For the simplification to be meaningful, their predictions must be consistent with a multi-sector version. Ask what value for the trade elasticity must be used to calibrate a one-sector model in this context.
- Given $d \ln W_j^{MS} = \sum_s \frac{\eta_j^s}{\varepsilon_j^s} d \ln \lambda_{jj}^s$ and $d \ln W_j^{OS} = \frac{1}{\varepsilon_j} d \ln \lambda_{jj}$ then :

$$\varepsilon_j^{OS} = \frac{d \ln \lambda_{jj}}{\sum_s \frac{\eta_j^s}{\varepsilon_j^s} d \ln \lambda_{jj}^s}$$

Multi-sector empirical welfare gains (ii)

- λ_{jj} and $\{\lambda^s_{jj}\}$ observed (IO data, STAN)
- $\{\varepsilon^s_j\}$ estimated using two alternative methods (see Appendix) :
  - One structural estimation based on Armington, See Feenstra (1994)
  - One reduced form gravity approach, See Caliendo & Parro (2014)
- Both approaches give qualitatively similar results : ε^{OS}_{US} around -4 for the US which implies $d \ln W_{US} = .06$
  Elasticity is higher than what is typically found using aggregate data which are close to $\varepsilon = -2$ which implies $d \ln W = .13$

Results $\partial \ln W_j^{MS}$



- Welfare losses from autarky correlated with measures of overall openness : highest in small open economies and lowest in large, closed economies
- Also depends on the cross-sectoral distribution of trade elasticities and their correlation with sectoral openness. Welfare loss higher if open sectors tend to display low elasticities, as in Kuwait

$\Rightarrow$ **The specialization of trade matters for welfare**

Explaining Cross-Country Heterogeneity

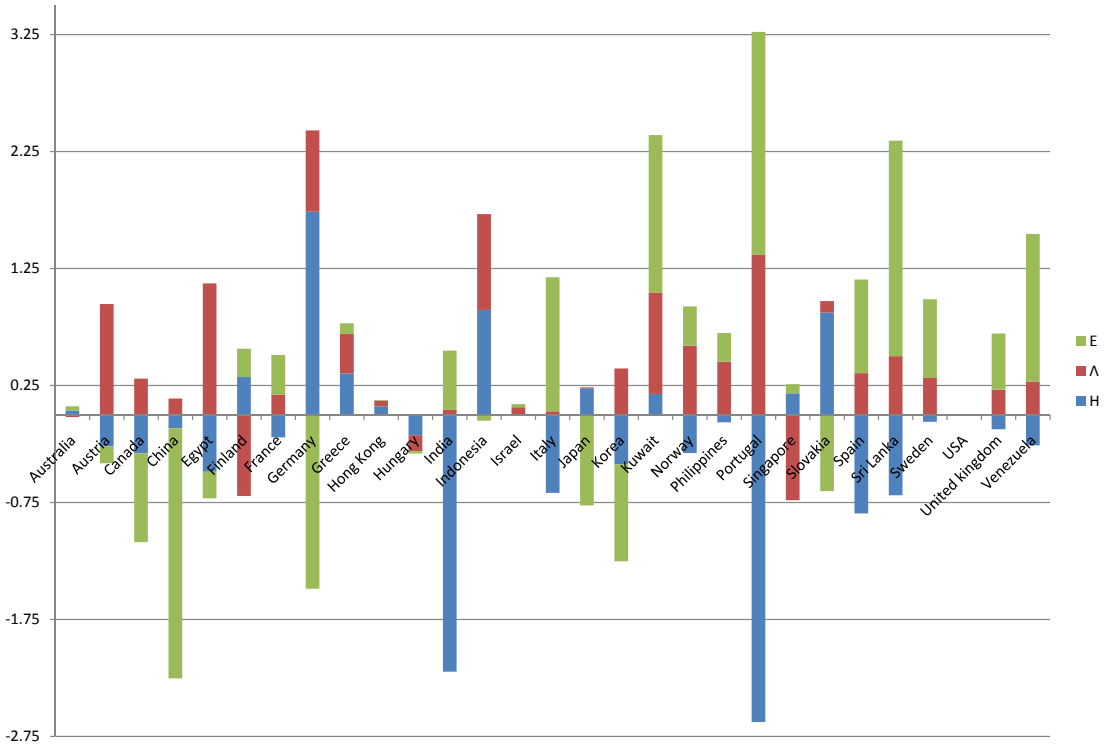
- Theory can be used to ascribe the sources of such heterogeneity :

$$\frac{\varepsilon_j^{OS} - \varepsilon_r^{OS}}{\varepsilon_r^{OS\,2}} = \underbrace{-\sum_s \frac{\Delta\lambda_{rr}^s}{\varepsilon_r^s}(\eta_j^s - \eta_r^s)}_{\textit{Expenditure Comp. } (H)} \underbrace{-\sum_s \frac{\eta_r^s}{\varepsilon_r^s}(\Delta\lambda_{jj}^s - \Delta\lambda_{rr}^s)}_{\textit{Sectoral Openness } (\Lambda)} + \underbrace{\sum_s \frac{\eta_r^s \Delta\lambda_{rr}^s}{\varepsilon_r^{s\,2}}(\varepsilon_j^s - \varepsilon_r^s}_{\textit{Trade Elasticities } (E)}$$

  where r is a reference country and $\Delta\lambda_{jj}^s \equiv \frac{\partial \ln \lambda_{jj}^s}{\partial \ln \lambda_{jj}}$ is the sectoral openness relative to the country average

- Elasticity in country j is relatively high if (i) consumers spend less in open and inelastic sectors, (ii) large and inelastic sectors are also closed (relative to the reference), and (iii) sectors that are elastic also tend to be large and open

Explaining Cross-Country Heterogeneity



- Distribution of sectoral openness displays relatively small cross-country dispersion, as compared with consumption expenditures or sectoral elasticities (Λ tends to be small)
- Both China and India display substantially larger elasticities than the US but this happens for different reasons : larger sectoral elasticities in China, expenditures concentrated in close sectors in India.
- European countries tend to display smaller elasticities mainly because of lower sectoral elasticities
- An exception in Europe is Germany which discrepancy with respect to the US comes from the structure of consumption (H)
- **Analysis carries through to welfare - since welfare decreases in trade elasticity.**

Limits : Melitz & Redding (2014)

- A common interpretation of ACRC (induced by their title) is that having different trade models is useless in as much as they "predict" the same welfare gains from trade
- This is a wrong interpretation : The right interpretation would be that we don't need to know which model is the right one in order to evaluate welfare gains **ex post** since, up to the micro and macro assumptions, they do imply welfare gains that can be summarized by the same aggregate statistics
- Simple example : In Melitz-Chaney, $\varepsilon = -\gamma < 1 - \sigma$ and thus gains from trade are larger than in Krugman, for a given domestic trade share

Limits : Melitz & Redding (2014)

- Idea : In order to compare different trade models in terms of their predictions for welfare gains, one cannot use ACRC. Instead, one needs to compare models keeping structural parameters identical, which can eventually imply different trade shares and/or elasticities
- Not that the argument is also somewhat similar to Simonovska & Waugh (2014)
- Illustration : Start from the Melitz model and kill the heterogeneity across firms by assuming the distribution of productivities is a Dirac measure $\Rightarrow$ Comparing welfare gains of both models help identify to what extent selection mechanisms generate additional gains from trade

$\Rightarrow$ Starting from the same autarkic equilibrium, welfare gains are larger with heterogeneous firms

Assumptions

- Preferences, production and entry as in Melitz
- 2 symmetric countries ($w = w^*$ and $R = R^*$)
- Static version (probability of death is zero)
- cdf of productivities is $G(\varphi)$ in the version with heterogeneous firms and a degenerate distribution in the homogeneous case where firms either draw zero (probability $G(\bar{\varphi})$) or $\bar{\varphi}$ (probability $1 - G(\bar{\varphi})$)
- A sunk entry cost f_e and a fixed production cost f.
- Homogeneous case is isomorphic to Krugman (1980) in which the representative firm has productivity $\bar{\varphi}$ and pays a fixed cost $F = f + \frac{f_e}{1-G(\bar{\varphi})}$
- In the open economy equilibria, a fixed exporting cost f_{ex} and a variable iceberg trade cost τ

Autarky

- With heterogeneous firms :
  - ZCP implies φ^* such that $RP^{\sigma-1}p(\varphi^*)^{1-\sigma} = \sigma f$
  - Unique equilibrium under free entry : $(1 - G(\varphi^*))\bar{\pi} = f_e$
  - Mass of entrants : $M_e = \frac{M}{1-G(\varphi^*)} = \frac{R}{\sigma[f_e+(1-G(\varphi^*))f]}$

  $\Rightarrow$ Welfare under autarky :

$$W^A_{het} \equiv \frac{w}{P} = \left(\frac{L}{\sigma f}\right)^{\frac{1}{\sigma-1}} \frac{\sigma-1}{\sigma}\varphi^*$$

- With homogeneous firms :
  - Free entry implies :$RP^{\sigma-1}p(\bar{\varphi})^{1-\sigma} = \sigma F$
  - Labor market equilibrium implies : $M = \frac{L}{\sigma F}$

  $\Rightarrow$ Welfare under autarky :

$$W^A_{hom} \equiv \frac{w}{P} = \left(\frac{L}{\sigma F}\right)^{\frac{1}{\sigma-1}} \frac{\sigma-1}{\sigma}\bar{\varphi}$$

Autarky (ii)

- Choose $\bar{\varphi} = \tilde{\varphi}(\varphi^*)$ and $G(\bar{\varphi}) = G(\tilde{\varphi}(\varphi^*)$ such that autarkic equilibria are isomorphic in the sense of all aggregate variables being the same given the same values for $\{f, f_e, L, \sigma\}$

$\Rightarrow$ Normalize so that welfare gains under autarky are identical :

$$W^A_{het} = W^A_{hom}$$

Open Economy

- With heterogeneous firms :
  - Productivity cutoffs defined by the ZCP conditions : ${\varphi^*}^T$ and ${\varphi_x^*}^T$ such that

    $$RP^{\sigma-1}p({\varphi^*}^T)^{1-\sigma} = \sigma f \quad \textit{and} \quad RP^{\sigma-1}p({\varphi_x^*}^T)^{1-\sigma}\tau^{1-\sigma} = \sigma f_{ex}$$

    which implies

    $${\varphi_x^*}^T = \tau\left(\frac{f_{ex}}{f}\right)^{\frac{1}{\sigma-1}} {\varphi^*}^T$$

  - Free entry implies :

    $$[1 - G({\varphi^*}^T)]\bar{\pi} = f_e$$

    $$\textit{where} \quad \bar{\pi} = \pi_d(\tilde{\varphi}({\varphi^*}^T)) + \frac{1 - G({\varphi_x^*}^T)}{1 - G({\varphi^*}^T)}\pi_x(\tilde{\varphi}_x({\varphi_x^*}^T))$$

    Note : ${\varphi^*}^T > \varphi^*$ for $f_{ex} > 0$
  - Mass of entrants :
    $M_e = \frac{M}{1-G({\varphi^*}^T)} = \frac{R}{\sigma[f_e+[1-G({\varphi^*}^T)]f+[1-G({\varphi_x^*}^T)]f_{ex}}$

Open Economy (ii)

- Welfare in open economy :
  - If selection into export ($\varphi_x^{*T} > \varphi^{*T}$) :

$$W_{het}^{T} \equiv \frac{w}{P} = \left(\frac{L}{\sigma f}\right)^{\frac{1}{\sigma-1}} \frac{\sigma-1}{\sigma}\varphi^{*T} > W_{het}^{A}$$

  - If all firms export :

$$W_{het}^{T} \equiv \frac{w}{P} = \left(\frac{(1+\tau^{1-\sigma})L}{\sigma(f+f_{ex})}\right)^{\frac{1}{\sigma-1}} \frac{\sigma-1}{\sigma}\varphi^{*T} > W_{het}^{A}$$

Open Economy (iii)

- With homogeneous firms :
  - $\bar{\varphi}$ and $G(\bar{\varphi})$ unchanged
  - Representative firm exports if and only if $\frac{\tau^{\sigma-1} f_{ex}}{F} > 1$
  - If $\frac{\tau^{\sigma-1} f_{ex}}{F} < 1$,

$$W_{hom}^{T} = W_{hom}^{A} = W_{het}^{A} < W_{het}^{T}$$

  - If $\frac{\tau^{\sigma-1} f_{ex}}{F} \geq 1$:
    - Free entry implies : $RP^{\sigma-1} p(\bar{\varphi})^{1-\sigma}(1+\tau^{1-\sigma}) = \sigma(F+f_{ex})$
    - Labor market equilibrium implies : $M = \frac{L}{\sigma(F+f_{ex})}$

    $\Rightarrow$ Welfare in open economy :

$$W_{Hom}^{T} \equiv \frac{w}{P} = \left(\frac{(1+\tau^{1-\sigma})L}{\sigma(F+f_{ex})}\right)^{\frac{1}{\sigma-1}} \frac{\sigma-1}{\sigma}\bar{\varphi}$$

Relative welfare

- The proportional welfare gains from trade are larger in the heterogeneous firm model than in the homogeneous firm model :

$$\frac{W_{Het}^{T}}{W_{Het}^{A}} \geq \frac{W_{Hom}^{T}}{W_{Hom}^{A}}$$

- The inequality is strict whenever the fixed exporting cost is non zero
- To achieve the same proportional welfare gains from trade requires strictly lower trade costs (f_{ex} and/or τ) in the homogeneous firm model than in the heterogeneous firm model (except with zero fixed exporting cost)
- With an unbounded Pareto distribution of productivities, $\frac{W_{Het}^{T}}{W_{Het}^{A}}$ is increasing in the dispersion of productivities (θ)

Conclusion

- Welfare gains from trade is THE crucial question in international economics
- ACRC (2012) analyzes the sufficient set of assumptions that is needed for the predictions of a model to imply welfare gains that can easily be computed in the data
- Still a lot to do on the empirical side : The elasticity of trade is NOT observed in the data. Under small deviations from the (quite restrictive) assumptions in ACRC, it is a combination of structural and endogenous variables and is thus not invariant to the sample
- ACRC should NOT be interpreted as a negative result. Having welfare gains in different models summarized by the same statistics does not mean the magnitude of those gains is the same in all models.

References

- Arkolakis, C., Costinot, A. & Rodrìguez-Clare, A. 2012. "New Trade Models, Same Old Gains ?" *American Economic Review*, 102(1) :94-130.
- Arkolakis, C., Costinot, A., Donaldson D. & Rodrìguez-Clare, A. 2012b. "The Elusive Pro-Competitive Effects of Trade" Mimeo.
- Blaum, J., C. Lelarge & M. Peters, 2014. "Estimating the Productivity Gains of Importing," mimeo.
- Caliendo, L. & F. Parro, 2014, "Estimates of the Trade and welfare Effects of NAFTA", *Review of Economic Studies* 82(1) :1-44
- Costinot, A. & A. Rodriguez-Clare, 2013. "Trade Theory with Numbers : Quantifying the Consequences of Globalization," NBER Working Papers 18896.
- Feenstra, R. 1994. "New Product Varieties and the Measurement of International Prices" *American Economic Review*, 84(1) : 157-177.
- Imbs, J. & Mejean, I. 2015. "Trade elasticities," mimeo.
- Melitz, M. & Redding, S. 2014. "New Trade Models, New Welfare Implications." *American Economic Review*, forthcoming
- Simonovska, I. & M. Waugh, 2014, "Trade Models, Trade Elasticities, and the Gains from Trade", mimeo