

Gains from Openness with Heterogenous Firms

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Overview

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Measure of gains from Trade

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- ▶ International trade research has devoted a lot of attention on trade gains, less attention has been paid to measure gains from FDI

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- ▶ In the first quarter of 2013, the magnitude of global FDI inflows and outflows were 357 and 353 billion US dollars respectively. [OECD (2013) FDI statistics report]
- ▶ Multinationals comprise a substantial majority of U.S. trade, roughly 90% of U.S. exports and imports (Bernard et al (2009))

- ▶ **Are total gains from openness underestimated by omission of gains from FDI: To that effect how does the welfare measure of trade [a'la Arkolakis et al(2012)] change with FDI(gains from openness measure)**
- ▶ **Result Preview** Define country j 's gains from international trade(openness) $G_j(C_j)$, as the absolute value of the % change in real income associated with moving from an observed equilibrium to autarky

| Gains from Trade | Gains from Openness |
|--|--|
| $G_j = 1 - (\lambda_j)^{-\frac{1}{\varepsilon}}$ | $C_j = 1 - \left[\lambda_j^{\text{ex} - \frac{1}{\varepsilon}} + (\mathcal{R}_j^{\mu(\sigma-1)} - 1)^{\frac{(\sigma-1)-\varepsilon}{(\sigma-1)\varepsilon}} \lambda_j^{\text{fdi} - \frac{1}{\varepsilon}} \right]$ |

Example: Trade Gains

- ▶ In 2000, US import penetration ratio (IPR) was 7%
- ▶ Share of domestic expenditures on domestic goods
 $\lambda = 1 - IPR = 0.93$
- ▶ Anderson and Wincoop (2004) provide estimates of trade elasticities, for US (-5,-10)
- ▶ Gains from trade USA: 0.7% – 1.4%

Proximity concentration trade off

- ▶ Brainard(1997) presents a simple theory to understand the trade-off between export and FDI.
- ▶ Markusen and Venables (2000)add factor endowment differences between countries to this simple model.
- ▶ Helpman, Melitz and Yeaple (2004) add firm heterogeneity

Gains from Openness...?

- ▶ Eaton-Kortoum(2002), the only way of serving a foreign market is via exporting.
- ▶ Ramondo Rodriguez-Clare(2009),Trade and multinational MP in an Eaton and Kortum model.
- ▶ Arkolakis et al(2012)New trade models same old gains with average sectoral elasticity.
- ▶ Ralph Ossa (2012) Average elasticity underestimates gains from trade, different sectoral elasticities more trade gains.

- ▶ Following Helpman et al (2004), there are N countries.
- ▶ Each country i is endowed with L_i units of labour with wage rate w_i .
- ▶ Each country comprises 2 sectors, sector 0 produces a homogeneous good with 1 unit of labour per unit output,
- ▶ H sectors produce differentiated products.
- ▶ The homogeneous good is freely traded with wage rate equal to 1 this ensures factor price equalisation as long as each and every country produces it.
- ▶ An exogenous fraction of income $\sum_h 1 - \beta_h$ is spent on the homogeneous sector and,
- ▶ β_h is spent on the differentiated goods sector

- ▶ Preferences are a Cobb-Douglas aggregate of the homogeneous good sector and differentiated traded goods
- ▶ CES across a continuum of differentiated goods in $h = 1, \dots, H$ sectors, (Krugman, 1980)

$$U = q_0^{1-\beta_0} \prod_{h=1}^H \left(\int_{\omega_h \in \Omega} q_h(\omega)^{\frac{\sigma_h-1}{\sigma_h}} \right)^{\frac{\sigma_h}{\sigma_h-1} \beta_h} \quad (1)$$

where $\sigma > 1$ is the elasticity of substitution ($\rho = \frac{\sigma-1}{\sigma}$)

- ▶ Utility maximization implies quantity demanded in county j of good ω is

$$q_j(\omega) = \beta \frac{p_j(\omega)^{-\sigma}}{P_j^{1-\sigma}} Y_j \quad (2)$$

► Exporting firm costs

Exporting firms pay fixed costs ($f_{ij}^{ex} > 0$) for each export destination. These marginal costs are given by,

$$C_{ij}^{ex} = \frac{w_i \tau_{ij}}{\varphi_{ij}} \quad (3)$$

► FDI firm costs

FDI firms pay fixed costs of FDI defined as f_{ij}^{fdi} . FDI marginal costs are :

$$C_{ij}^{fdi} = \left(\frac{1}{\varphi_{ij}^{fdi}} \right) \left(\frac{w_j}{\mu} \right)^\mu \left(\frac{w_i \tau_{ij}}{1 - \mu} \right)^{1-\mu} \quad (4)$$

Zero Profit Conditions

A firm will serve a foreign country if the operating profits are sufficient to cover fixed costs

- ▶ If firm chooses to supply foreign market via export, profits are given by:

$$\pi_{ij}^{ex} = 0 \rightarrow \beta P_j^{\sigma-1} \left(\frac{\rho w_i \tau_{ij}}{\varphi} \right)^{1-\sigma} \frac{Y_j}{\sigma} = f_{ex} \quad (5)$$

- ▶ accessing foreign markets via FDI gives the following profits

$$\pi_{ij}^{fdi} = 0 \rightarrow \beta P_j^{\sigma-1} \left(\frac{\rho w_j^\mu (w_i \eta_{ij})^{1-\eta}}{\varphi} \right)^{1-\sigma} \frac{Y_j}{\sigma} = f_{fdi} \quad (6)$$

Cutoff Productivities

From zero profit condition, we get cutoff productivities for export and FDI

► **Export Productivity cutoff**

$$\tilde{\varphi}_{ij}^{ex} = \kappa \left(\frac{f_{ij}^{ex}}{Y_j} \right)^{\frac{1}{\sigma-1}} P_j^{-1} w_i \tau_{ij} \quad (7)$$

such that $\kappa = \left(\frac{\sigma}{\beta} \right)^{\frac{1}{\sigma-1}} \rho$

► **FDI Productivity cutoff**

$$\tilde{\varphi}_{ij}^{fdi} = \kappa \left(\frac{f_{ij}^{fdi} - f_{ij}^{ex}}{Y_j [(\mathcal{R}_{ij} \tau_{ij})^{\mu(\sigma-1)} - 1]} \right)^{\frac{1}{\sigma-1}} P_j^{-1} w_i \tau_{ij} \quad (8)$$

To ensure that the fdi cutoff productivity is higher than export productivity, i.e. $\varphi_{ij}^{fdi} > \varphi_{ij}^{ex}$, assume that

$$f_{fdi} \mathcal{R}_{ij}^{\mu(\sigma-1)} > f_{ex} \tau^{\mu(\sigma-1)}$$

Entry and Exit

Timing

- ▶ Upon entry, firms draw their initial productivity level, φ from a common distribution $g(\varphi) = k(\varphi_{min})^k \varphi^{-(k+1)}$ with positive support over $(0, \varphi_{max})$. and a continuous cumulative distribution $G(\varphi) = 1 - \left(\frac{\varphi_{min}}{\varphi}\right)^k$
- ▶ A firm drawing a low productivity φ may decide to immediately exit and not produce.
- ▶ Productivities are distributed Pareto
- ▶ Firms face a constant probability of a bad shock in every period that would force them to δ exit.

Entry and Exit Continued

- ▶ Probability of entry in the home market, exporting (conditional on successful entry) and into FDI are given by

$$\theta_{iD} = 1 - G(\varphi_i^*) \quad (9)$$

$$\theta_{ex} = \frac{G(\varphi_{fdi}^*) - G(\varphi_{ex}^*)}{1 - G(\varphi_i^*)} \quad (10)$$

$$\theta_{fdi} = \frac{1 - G(\varphi_{fdi}^*)}{1 - G(\varphi_i^*)} \quad (11)$$

Aggregation

- ▶ Let M be the equilibrium mass of incumbent firms in any country,
- ▶ Mass of firms that enter foreign country via exports and FDI
 $M_{ex} = \theta_{ex} M$ and $M_{fdi} = \theta_{fdi} M$
- ▶ Total mass of varieties available to consumers in each country is given by the total mass of firms competing in the country,

$$M = M + nM_{ex} + nM_{fdi} \quad (12)$$

- ▶ Weighted productivity average

$$\hat{\varphi} = \frac{1}{M} \left(M \hat{\varphi}_{iD}^{\sigma-1} + nM_{ex} \tau^{1-\sigma} \hat{\varphi}_{ex}^{\sigma-1} + nM_{fdi} \tau^{(1-\sigma)(1-\eta)} \hat{\varphi}_{fdi}^{\sigma-1} \right)^{\frac{1}{\sigma-1}} \quad (13)$$

$$P = M^{\frac{1}{1-\sigma}} p(\hat{\varphi}), \quad W = M^{\frac{1}{\sigma-1}} \rho \hat{\varphi}$$

Aggregation continued...

► Trade only Price Index

$$P_j^{ex} = \frac{G(\varphi_{fdi}^*) - G(\varphi_{ex}^*)}{1 - G(\varphi_i^*)} M_{ij}^{ex} \left(\int_{\varphi_{ij}^{ex}}^{\varphi_{ij}^{fdi}} \varphi^{\sigma-1} \left(\frac{\sigma}{\sigma-1} w_{ij} \tau_{ij} \right)^{1-\sigma} dG(\varphi_{ij}) \right)^{\frac{1}{1-\sigma}} \quad (14)$$

► FDI only Price Index

$$P_{ij}^{fdi} = \frac{1 - G(\varphi_{fdi}^*)}{1 - G(\varphi_i^*)} M_{ij}^{fdi} \left(\int_{\varphi_{ij}^{fdi}}^{\infty} \varphi^{\sigma-1} \left(\frac{\sigma}{\sigma-1} \right)^{1-\sigma} [(\mathfrak{R}_{ij} \tau_{ij})^{\mu(\sigma-1)} - 1] (w_{ij} \tau_{ij})^{1-\sigma} dG(\varphi_{ij}) \right)^{\frac{1}{1-\sigma}} \quad (15)$$

Aggregation continued...

► Trade Sales

$$X_{ij}^{ex} = \frac{G(\varphi_{fdi}^*) - G(\varphi_{ex}^*)}{1 - G(\varphi_i^*)} M_{ij}^{ex} \left(\int_{\varphi_{ij}^{ex}}^{\infty} \varphi^{\sigma-1} \left(\frac{\sigma}{\sigma-1} w_{ij} \tau_{ij} \right)^{1-\sigma} \beta \frac{Y_j}{P_j^{1-\sigma}} dG(\varphi_{ij}^{ex}) \right) \quad (16)$$

Evaluating the integral and substituting for productivity cutoffs we get

$$X_{ij}^{ex} = \underbrace{\left(\frac{\varphi_{min}}{\varphi_{ex}} \right)^k}_{\text{extensive}} M_{ij}^{ex} \underbrace{\left(\frac{\sigma k}{k - \sigma + 1} \right) f_{ex} w_j}_{\text{intensive}} \quad (17)$$

Aggregation continued...

► FDI Sales

$$X_{ij}^{fdi} = \frac{1 - G(\varphi_{fdi}^*)}{1 - G(\varphi_i^*)} M_{ij}^{fdi} \int_{\varphi_{ij}^{fdi}}^{\infty} \varphi^{\sigma-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} [(\mathfrak{R}_{ij}\tau_{ij})^{\eta(\sigma-1)} - 1] (w_{ij}\tau_{ij})^{1-\sigma} \\ \beta \frac{Y_j}{P_j^{1-\sigma}} dG(\varphi_{ij}^{fdi})$$

$$X_{ij}^{fdi} = \underbrace{\left(\frac{\varphi_{min}}{\varphi_{fdi}}\right)^k}_{\text{extensive}} M_{ij}^{fdi} \underbrace{\left(\frac{\sigma k}{k - \sigma + 1}\right) w_j (f_{fdi} - f_{ex})}_{\text{intensive}} \quad (18)$$

Gains from openness

- ▶ ACR express country j trade gains as a function of the share of expenditure that falls on domestically produced goods (which is equal to 1 minus the import penetration ratio). This share, λ_j under autarky is 1, therefore total size of gains from openness will be equal to $1 - \lambda_j$
- ▶ Welfare is given by the per capita value of real income accruing to consumers:

$$W_j = \frac{Y_j}{L_j P_j} = \frac{w_j^{\text{ex}}}{P_j^{\text{ex}}} + \frac{w_j^{\text{fdi}}}{P_j^{\text{fdi}}} \quad (19)$$

- ▶ welfare depends on real labour income derived from export and foreign multinational affiliates

Knowing a country's domestic share of trade and FDI and shape parameter of the productivity distribution k is sufficient to determine gains from openness.

► **Trade expenditure share**

$$\lambda_{ij}^{ex} = \frac{X_{ij}^{ex}}{\sum_v X_{vj}} = \frac{\left(\frac{\varphi_{ii}^*}{\varphi_{ij}^*}\right)^k M_i w_i f_{ij_{ex}} \frac{\sigma k}{k-\sigma+1}}{\sum_v \left(\frac{\varphi_{ii}^*}{\varphi_{vj}^*}\right)^k M_i w_i f_{vj_{ex}} \frac{\sigma k}{k-\sigma+1}} \quad (20)$$

► **FDI expenditure share**

$$\lambda_{ij}^{fdi} = \frac{X_{ij}^{fdi}}{\sum_v X_{vj}} = \frac{\left(\frac{\varphi_{ii}^*}{\varphi_{ij}^*}\right)^k M_i w_i (f_{ij_{fdi}} - f_{ij_{ex}}) \frac{\sigma k}{k-\sigma+1}}{\sum_v \left(\frac{\varphi_{ii}^*}{\varphi_{vj}^*}\right)^k M_i w_i (f_{vj_{fdi}} - f_{vj_{ex}}) \frac{\sigma k}{k-\sigma+1}} \quad (21)$$

Derivation of Gains

► Trade Only Gains a'la Akorlakis et al(2012)

$$W_j^{ex} = \left(\frac{W_j^{ex}}{P_j^{ex}} \right) = \left[\left(\frac{\sigma}{\sigma-1} \right)^{-k} \sigma^{-\frac{k}{\sigma-1}} \frac{\sigma-1}{k-\sigma+1} \varphi_{min_j}^k f_{ex}^{1-\frac{k}{\sigma-1}} f_E \right]^{\frac{1}{k}} (L_j^{ex})^{\frac{1}{\sigma-1}} (\lambda_{jj}^{ex}) \quad (22)$$

Gains from trade are given by, (the domestic trade shares in the closed economy are fixed at $\lambda^{closed} = 1$):

$$\widehat{W}_j^{ex} = \frac{W_j^{open}}{W_j^{closed}} = \widehat{\lambda}_{jj}^{ex}^{-\frac{1}{k}} \quad (23)$$

► **Welfare derived from FDI**

$$W_j^{fdi} = \left(\frac{w_j^{fdi}}{P_j^{fdi}} \right) = \left[\left(\frac{\sigma}{\sigma-1} \right)^{-k} \sigma^{-\frac{k}{\sigma-1}} \frac{\sigma-1}{k-\sigma+1} \varphi_{\min_j}^k (f_{fdi} - f_{ex})^{1-\frac{k}{\sigma-1}} f_{jE}^{-1} \right]$$

$$(L_j^{fdi})^{\frac{1}{\sigma-1}} [\mathcal{R}_j^{\mu(\sigma-1)} - 1]^{\frac{(\sigma-1)-k}{(\sigma-1)k}} (\lambda_{jj}^{fdi})^{-\frac{1}{k}}$$

$$\widehat{W}_j^{fdi} = [\widehat{\mathcal{R}}_{jj}^{\mu(\sigma-1)} - 1]^{\frac{(\sigma-1)-k}{(\sigma-1)k}} \widehat{\lambda}_{jj}^{-\frac{1}{k}} \quad (24)$$

► **Gains from Openness**

$$\begin{aligned}\widehat{W}_j &= \widehat{W}_j^{ex} + \widehat{W}_j^{fdi} \\ &= \lambda_{jj}^{ex - \frac{1}{\varepsilon}} + (\mathcal{R}_j^{\mu(\sigma-1)} - 1) \frac{(\sigma-1)-\varepsilon}{(\sigma-1)\varepsilon} \lambda_{jj}^{fdi - \frac{1}{\varepsilon}}\end{aligned}$$

Country j 's gains from openness C_j is the absolute value of the percentage change in real income associated with moving to the counterfactual equilibrium:

$$C_j = 1 - \left[\lambda_j^{ex - \frac{1}{\varepsilon}} + (\mathcal{R}_j^{\mu(\sigma-1)} - 1) \frac{(\sigma-1)-\varepsilon}{(\sigma-1)\varepsilon} \lambda_j^{fdi - \frac{1}{\varepsilon}} \right] \quad (25)$$

Summary

- ▶ We have revisited the welfare gains from trade in the presence of FDI.
- ▶ Gains from openness are underestimated by a trade only model: FDI provides an additional source of gains to trade gains.

Thank you