International Trade, 31E00500

Lecture 09: FDI, Multinationals and Fragmentation

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Today

- Multinational Firms (MNEs)
- Foreign Direct Investment (FDI)
  - Horizontal FDI
  - Vertical FDI, Fragmentation and Offshoring

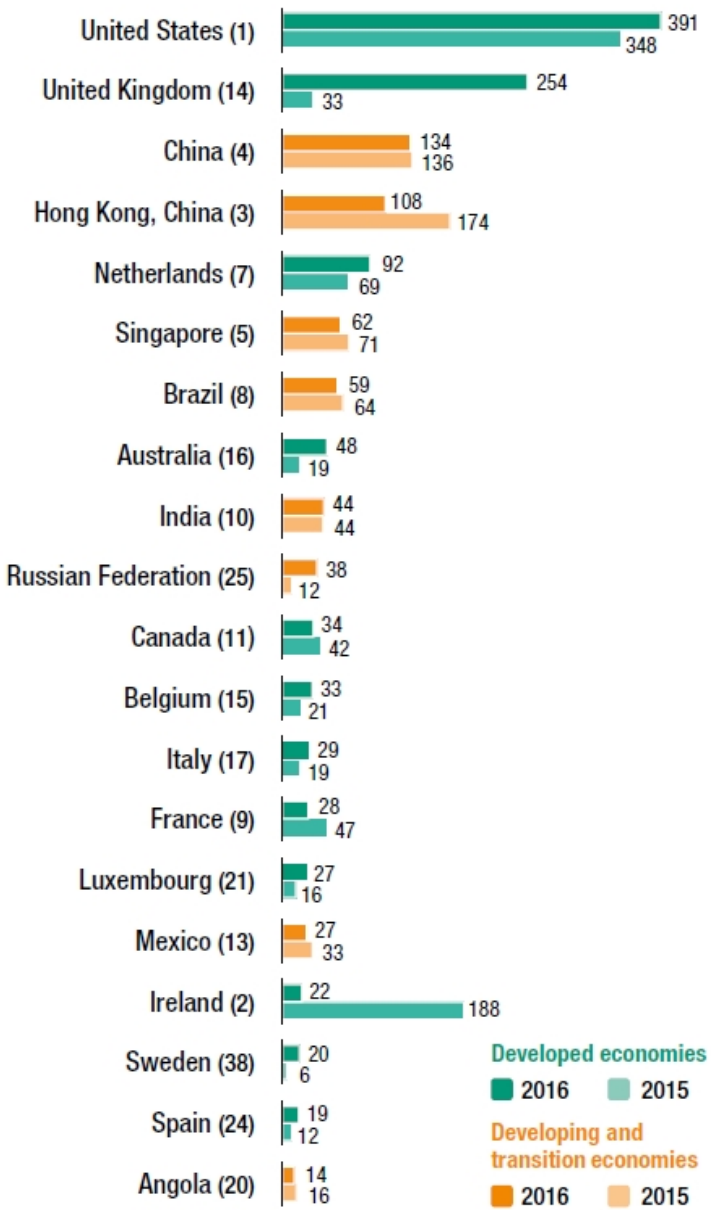
What Are Multinational Enterprises (MNEs)?

- Trade literature distinguishes between two broad types of MNEs:
  1. Horizontal MNE≡ Because of trade costs, firms duplicate production (e.g. car producers in EU,US and China)
  2. Vertical≡ Because of factor price differences, firm locates its headquarter in one country but does production in another (e.g. Apple, Nike)

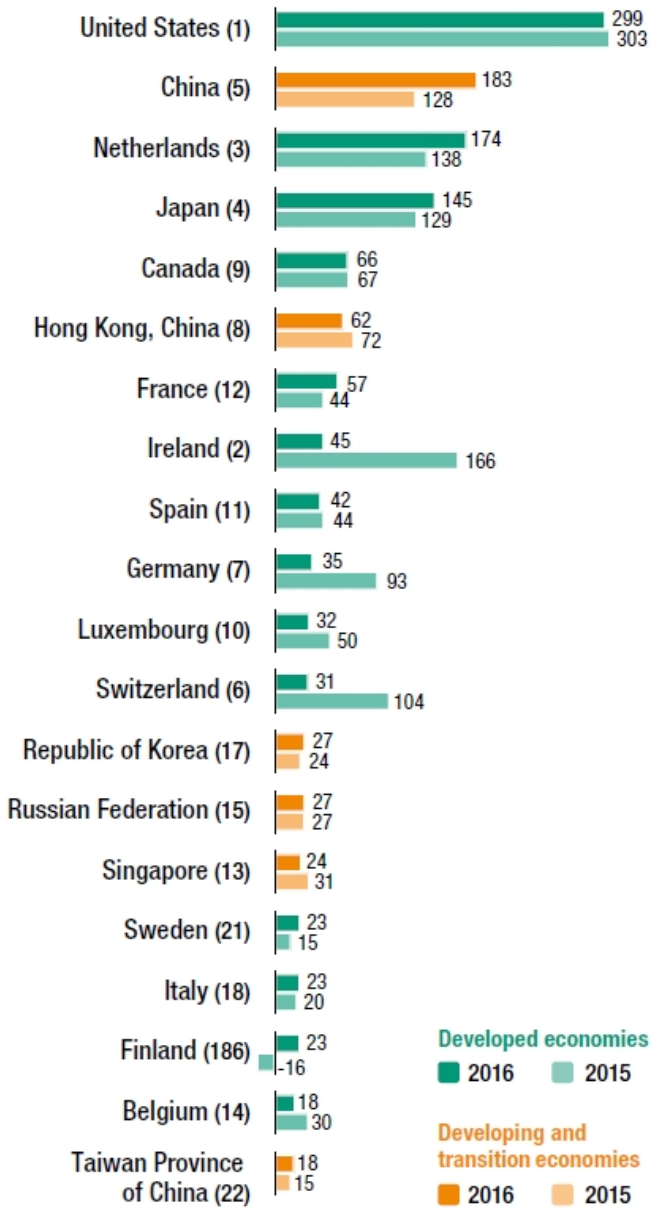
Why to study FDI and Multinationals?

- Growth in FDI has surpassed growth in both trade and production.
- The top 10 multinationals account for about one percent of world GDP.
- About a third of world trade is estimated to take place within MNEs. 43 percent of US imports is intra-firm (Zeile, 1997). One third of global exports (UNCTAD,2016)
- The increased importance of multinationals constitute the perhaps only truly new aspect of globalization compared with the 1870-1913 period.
    - Technological change, trade liberalisation, integration of China to the world economy

FDI inflows, top 20 economies



FDI outflows, top 20 economies



Theories of MNEs and FDI 1

- Why does the firm establish its own production facility in a foreign country instead e.g. of licensing the production to some local firm?
- Theories of the firm try to explain why some activities are conducted within the organization (firm) instead of being acquired through arms-length agreements.
- The general issue is to explain why internalization of the activities takes place.
- Coase: Transaction cost theory of firm boundaries, Williamson.

Theories of MNEs and FDI 2

- There is no generally accepted theory of the firm $\Rightarrow$ there is no generally accepted theory of MNEs, but some basic theories are widely used.
- Problems in the theory of the firm:
  - If we can explain why some activities are internalized, we may have difficulties in explaining why not all activities take place within a single firm.

Theories of MNEs and FDI 3

- A conceptual framework to explain FDI is the OLI-approach (Dunning 1977, 1981)
  - *Ownership advantages* (of a product or a process): E.g. the firm owns some assets (tangible or intangible) explaining why it exists and why it has some market power.
  - *Location advantage*: The spatial diversification of activities and location of production due to lower production costs or avoidance of trade costs.
  - *Internalization advantages*: Internalization of activities preferred to arms length transactions, e.g. licensing or sub-contracting.

Theories of MNEs and FDI 4

- One simple way to do this is to assume there are firm level increasing returns e.g. due to the ownership of some brand name or technology.
- The size of plant level increasing returns to scale then matter for the FDI decision.
- Largest share of FDI has been horizontal (replication) but the share of vertical FDI (fragmentation, international outsourcing) has been increasing as firms form international production networks / global value chains.
- Most MNEs do both vertical and horizontal FDIs, some even export platform FDI

Horizontal MNEs and FDI

- The key question: will a firm choose to supply a market through exports or by setting up a local production?
- HFDI involves the duplication of part of a firm's activities in a foreign country.
- Driven by market access to the host country.
- Modeled as a trade-off between savings on trade costs and additional fixed costs involved in setting up additional plants (proximity-concentration tradeoff), tariff-jumping.
- Basic references: Horstmann and Markusen, 1992 (JIE); Brainard, 1993 (1997, AER), Markusen and Venables, 1998, 2000 (JIE).

A simple theory of horizontal FDI 1

- Decision problem: The firm has to decide between the following two strategies:
  - All output is produced in one country (national firm).
  - Output is produced in both countries (multinational firm)
  - Decision made on basis of an evaluation of profits in each situation
- Solution: Analyse the choice and outcomes in a two-stage game
  - At the first stage firms choose mode of supply (exports or foreign production)
  - At the second stage a market interaction takes place: number of firms of each type, prices, quantities and profits are determined.

A simple theory of horizontal FDI 2

- The following is a simple theory of FDI based on Markusen and Venables(1998 and 2000).
- Assume 2 countries and 2 products, 1 factor of production (labor). One product, the numeraire, produced competitively and traded internationally and freely (no trade policies imposed).
    - May differ in terms of cost level (c_1 and c_2) and in terms of market size (E_1 and E_2).
- The other good produced by two firms, one in each country. The firms produce identical goods.

A simple theory of horizontal FDI 3

Profit of national firm headquartered in 1:

$$\Pi_1^N = \pi_{11} + \pi_{12} - (H + F)c_1$$

Profit of multinational firm headquartered in 1:

$$\Pi_1^M = \pi_{11} + \pi_{22} - (H + F)c_1 - Fc_2$$

- π_{ij} is operating profit related to output produced in country i and sold in country j, H is fixed costs (in terms of input requirements) for headquarters, F is fixed costs for production plant, c is marginal costs and also captures the factor price level in the economy

A simple theory of horizontal FDI 4

- The firms have three modes of production:
- They can serve only their national markets, they can export to the foreign market or they can establish a plant in the foreign country.
- A firm in 1 will set up an affiliate in 2 if:

$$\pi_{22} - \pi_{12} > Fc_1$$

- that is, if the difference in operating profits from sales in market 2 between local production and exports is greater than the additional fixed costs of the a multiplant strategy

A simple theory of horizontal FDI 5

- Solve profit maximization: and use FOC to rewrite the operating profits in terms of ε:

$$\pi_{22} = \frac{p_2 x_{22}}{\varepsilon_{22}} = \frac{s_2 E_2}{\varepsilon_{22}} = \frac{s_2 E_2}{\varepsilon(s_2)}$$

$$\pi_{12} = \frac{p_2 x_{12}}{\varepsilon_{12}} = \frac{s_2 \varphi_1 E_2}{\varepsilon_{12}} = \frac{s_2 \varphi_1 E_2}{\varepsilon(s_2 \varphi_1)}$$

- where ε is perceived elasticity of demand, $s_i^k = p_i^k x_i^k / E_i$ is the firm k's market share and $s_2 \varphi_1$ is the market share in 2 of a exporter from $1, \varphi_1 \leq 1$.
- We usually think that the perceived elasticity of demand is falling with the market share so that it is lower for local supply than for exports. ($\varepsilon_i(s_i)$,ranging $s_i = 1$ monopoly and $s_i = 0$, perfect competition.
- φ is freeness of trade, smaller φ the higher is τ and higher is c_j relative to c_i. Usually $\varphi \leq 1$.

A simple theory of horizontal FDI 6

- Thus, the firm will set up an affiliate in 2 if:

$$s_2 E_2 \left[\frac{1}{\varepsilon(s_2)} - \frac{\varphi_1}{\varepsilon(s_2 \varphi_1)} \right] - F c_2 > 0$$

- Factors affecting the choice:
  - the level of trade costs (τ), which affects φ_1
  - the size of the foreign market (E_2) and the market share (s_2)
  - the foreign cost level (c_2)
  - the size of plant-level fixed costs (F)
- Trade-off between low unit cost of supply and high fixed costs go through for monopoly, but strategic interaction may reinforce the benefits of local production

A simple theory of horizontal FDI 7

- Suppose there are N_1 firms in country 1 and N_2 firms in country 2
- These firms can be either national or multinational. Profits:

$$\begin{array}{rcl} & & \Pi_i^N\left(n_1, n_2, m\right) \\ & & \Pi_i^M\left(n_1, n_2, m\right) \\ i & = & 1, 2 \end{array}$$

- The headquarters of multinationals have no effect on profits.
- Market shares sum to one:

$$\begin{aligned} \left(n_1 + m_1 + m_2 + n_2\varphi_2\right) s_1 &= 1 \\ \left(n_2 + m_1 + m_2 + n_1\varphi_1\right) s_2 &= 1 \end{aligned}$$

A simple theory of horizontal FDI 8

- First stage: What supply model will firms choose?
- Suppose there are n_1 and n_2 national firms and m multinational firms
- Nash equilibrium if and only if neither type of firm has incentive to change strategy
- Let us ask whether a n_1-type firm has incentive to become a m_1-type firm? It has if:

$$\Pi_1^M\left(n_1-1,n_2,m+1\right)-\Pi_1^N\left(n_1,n_2,m\right)>0$$

Note this would be greenfield investment since n_2 is unaffected, the market share $s_2=\frac{1}{n_2+(m+1)+(n_1-1)\varphi_1}$ is affected.

- Suppose ε is constant (called σ),the condition becomes

$$\frac{E_2}{\sigma}\left[s_2\left(n_1-1,n_2,m+1\right)-\varphi_1 s_2\left(n_1,n_2,m\right)\right]-Fc_2>0$$

A simple theory of horizontal FDI 9

- Which can be expressed as:

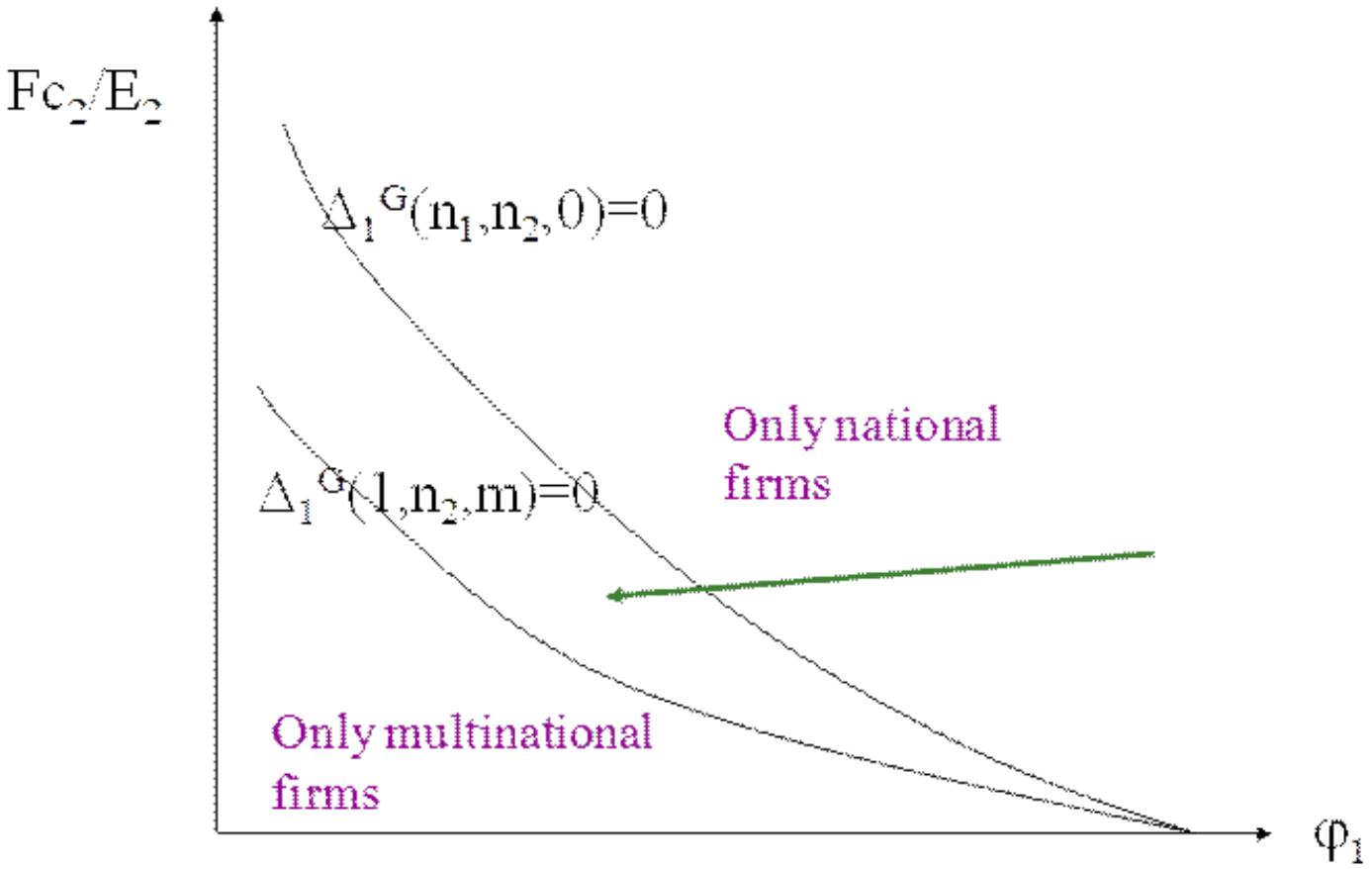
$$\triangle_1^G = \frac{E_2}{\sigma}\left[\frac{1}{n_2 + (m+1) + (n_1 - 1)\,\varphi_1} - \frac{\varphi_1}{n_2 + m + n_1\varphi_1}\right] - Fc_2 > 0$$

- The term in the square brackets (operating profit) decreases as m increases and n_1 falls. What is it when $\varphi_1 = 1$ (free trade)?
- If $\varphi_1 < 1$, as if $c_1 < c_2\tau$ then positive. Decreasing in φ_1 (freer trade).
- Implies that the value to become multinational decreases as more and more firms become multinationals.
- For indifference, implicit negative relationship between φ_1 and $Fc_2\,/\,E\varphi_1$ defined by:

$$\triangle_1^G = 0 \rightarrow \frac{1}{\sigma}\left[\frac{1}{n_2 + (m+1) + (n_1 - 1)\,\varphi_1} - \frac{\varphi_1}{n_2 + m + n_1\varphi_1}\right] = \frac{Fc_2}{E_2}$$

A simple theory of horizontal FDI 10

- Thus



A simple theory of horizontal FDI 11

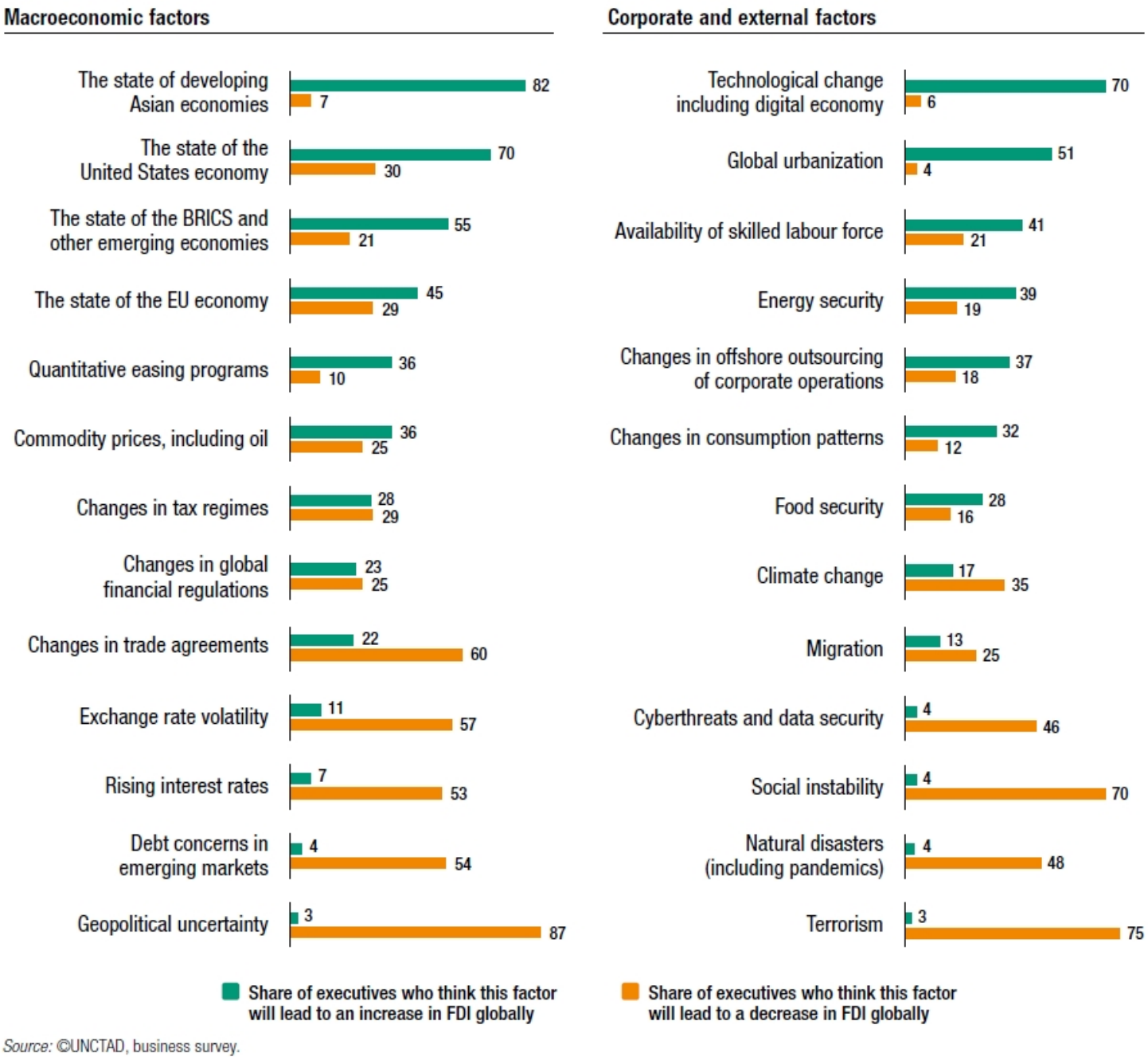
- Hypotheses derived from this theory:
  - The relative importance of multinationals increases with trade costs, the size of the market, the cost (wage) differential
  - It decreases with plant-level fixed costs
- Largely supported by empirical evidence, but:
  - Trade costs often found to reduce probability of observing FDI, but to increase the share of affiliate sales to exports conditioned on there being FDI.
  - Wage differentials rarely found to be important factor (and sometimes found to attract FDI, most likely because of lack of control for productivity/skills)

A simple theory of horizontal FDI 16

- With entry and exit of firms.
- Assume identical cost levels but different market sizes (or the other way around).
- Predictions: HFDI more likely if:
  - Trade costs are high
  - Firm-level scale economies are high relative to plant-level ones
  - Countries are relatively similar in market size and cost levels.

Helpman, Melitz and Yeaple HMY (2004)

- HMY revisit the proximity-concentration trade-off in the presence of firm-level heterogeneity à la Melitz
- Basic Idea:
  - Low-variable costs matter relatively more for more productive firms
  - So high productivity firms will become multinationals, whereas less productive firms will become exporters
- Main Insight:
  - Differences in the distribution of firm productivity across sectors have implications for export vs. FDI.
  - Industries with higher dispersion of productivity across firms should have a higher ratio of FDI versus export sales
- Intuition?



Source:WIR 2017, UNCTAD

Vertical MNEs and FDI

- In models of horizontal MNEs, trade and FDI are substitutes
  - But MNEs account for a very significant fraction of world trade flows and FDI is rising with trade!
  - There is substantial trade of intermediate inputs (and services!) within MNEs

Vertical FDI

- The key question: is it better to produce inputs at home or abroad?
- FDI involving the transfer of one or more of a firm's stages of production abroad.
- Firms typically face a trade-off between cost savings due to lower input prices and increases in trade costs.
- Basic references: Helpman (1984 (JPE) (1985 in RES), same as for fragmentation of production (e.g. Jones).
- Offshoring of tasks in H-O setting Grossman and Rossi-Hansberg (2008)

VFDI: Fragmentation 1

- When will a firm choose to split up its production process and make a vertical investment?
- Focus on:
  - Location advantage: Location of production abroad must yield advantages such as lower production costs or avoidance of trade costs.
  - Internalization advantages: Owning the foreign firm must be preferred over licensing or sub-contracting.

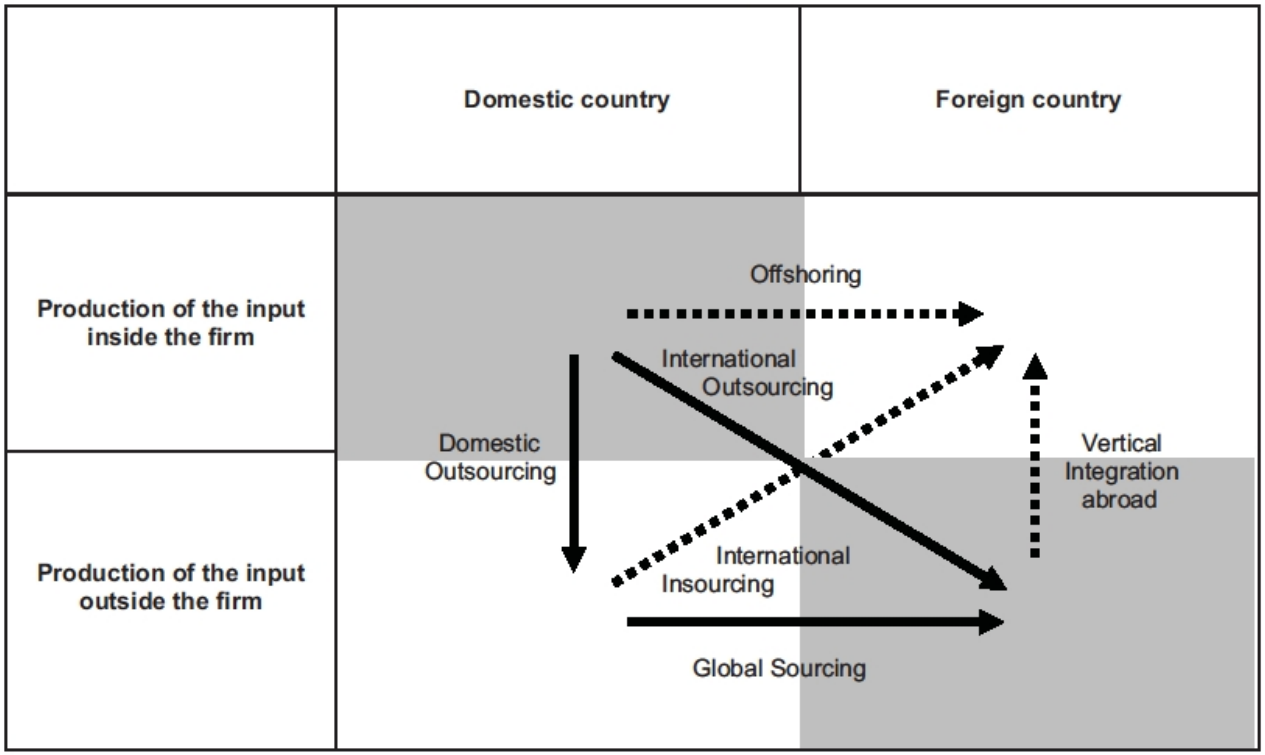
VFDI: Fragmentation 2

- Suppose a firm has the blueprint of a product which is produced in two stages: 1) Component production, C and 2) Assembly, A
- Possible outcomes:

i) The firm carries out C and A at home$\rightarrow$*national vertically integrated firm*
ii) The firm carries out C (or A) at home and A (or C) abroad $\rightarrow$*VFDI* (offshoring of A (or C))
iii) The firm carries out C (A) at home and licenses a domestic firm to carry out A (C) $\rightarrow$*national firm with domestic outsourcing*
iv) The firm carries out C (A) at home and licenses foreign firm to carry out A (C) $\rightarrow$*national firm with foreign outsourcing (offshoring of A (C))*

Table 1. Sourcing strategies: interactions between location and ownership

Columns indicate the location of production and rows indicate the boundaries of the firm. Vertical arrows represent a change in the boundaries of the firm. Horizontal arrows represent a change in the location of production. Dashed lines correspond to vertical FDI.



Source:OECD, 2009

VFDI: Fragmentation 3

- When will a firm fragment production? What will happen to factor prices?
- Suppose the product produced by using two inputs, labor and capital (or unskilled and skilled labor) at prices w_i and r_i in country i
- CRS, cost functions are $c(w_i, r_i)$ and $a(w_i, r_i)$
- Trade costs are incurred on shipping final products, and trade or disintegration costs are incurred on shipping components.

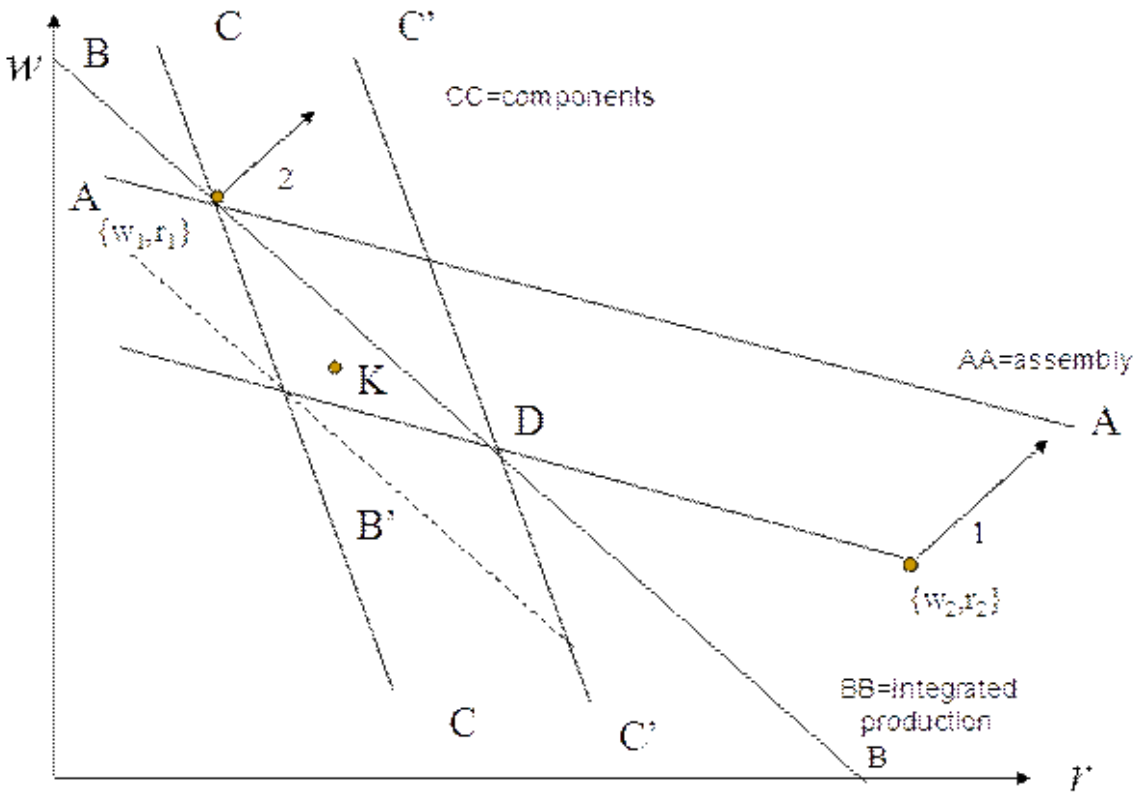
VFDI: Fragmentation 4

- Suppose the good is only demanded in country 1.
- Condition for firm to be indifferent between VFDI (offshoring) to country 2 and integrated production in country 1:

$$\left[c\left(w_1, r_1\right)\tau^c + a\left(w_2, r_2\right)\right]\tau^a = \left[c\left(w_1, r_1\right) + a\left(w_1, r_1\right)\right]$$

- For given capital returns, trade costs and wage rate in country 1, this expression defines the maximum wage level in 2 consistent with firms wanting to invest.
- The higher the level of trade costs, the lower this maximum level of the wage rate.

VFDI: Fragmentation 5



Iso-cost lines. $p = c(w_1, r_1) + a(w_1, r_1)$,BB: $p = c(w, r) + a(w, r)$;AA: $p = c(w_1, r_1) + a(w, r)$;CC:$p = c(w, r) + a(w_1, r_1)$;C'C':$p = c(w, r) + a(w_2, r_2)$

VFDI: Fragmentation 6

- If no trade costs ($\tau = 1$) then all other countries' factor prices must lie on or above line BB, otherwise it would be profitable to start-up production in a low cost country.
- Now assume that fragmentation is possible but there is no disintegration costs. Where will assembly take place?
- Fragmentation will occur if some country has factor prices below AA but above BB.

VFDI: Fragmentation 7

- What will happen with factor prices and profitability in the industry? Three possibilities:

1) Movement of assembly bids up factor prices in country 2, if p and w_1, r_1 are unchanged. Who gains?
2) Along C'C' component production breaks even at initial price p and with unit cost of assembly equal to $a\{w2, r2\}$.Factor prices can change to lie on C'C' as indicated by arrow 2. Who gains?
3) Output price falls given the factor prices in each country. The new price $p\prime = a(w_2, r_2) + c(w_1, r_1), p\prime < p$. The dashed line B' pararell to BB is the locus of factor prices at which integrated production could compete with fragmented production at these factor prices. Who gains?

VFDI: Fragmentation 8

- The exact outcome depends on the full general equilibrium
- Imagine a country 3 that initially has costs above BB but they are lowered to K. Where will the production take place with frgamentation? Without fragmentation?

VFDI: Fragmentation 9

- A common feature of VFDI is that tends to locate close to large centres of economic activity, e.g. Mexico and Eastern European countries, close to the US and and the large markets of EU.
- Depends on trade costs but also wages, 'Wage gradient' from central to periphery captures this.

VFDI: Fragmentation 10

- Thought experiment: Suppose North is a large central region surrounded by regions located at different distances.
- The distance to the North determines trade costs.
  - Perfectly mobile capital$\longrightarrow$ r equalized across regions.
- How low must wages be in a particular peripheral region in order to attract VFDI in assembly activities?
- Answer: Small trade costs must be compensated by steep wage gradients (because the immobile factor squeezed from two sides).
- Remoteness affect equilibrium wage levels.

VFDI: Fragmentation 11

- Country 2 will import components and assemble products if:

$$\left[c\left(w_1, r_1\right)\tau^c + a\left(w_2, r_2\right)\right]\tau^a = \left[c\left(w_1, r_1\right) + a\left(w_1, r_1\right)\right]$$

- If trade costs and factor prices w_1, r_1,and r_2 are exogeneous then the relationship implicitly defines w_2 as a function of these factor prices and trade costs.
- Differenting wrt trade costs and country 2 wages, we can derive a "wage gradient":

$$\tau^a c\left(w_1, r_1\right) d\tau^c + \frac{\partial a\left(w_2, r_2\right)}{\partial w_2}\tau^a dw_2 + \left[c\left(w_1, r_1\right)\tau^c + a\left(w_1, r_1\right)\right] d\tau^a = 0$$

denote $C = a + c\tau^c$

$$\tau^a c\tau^c \frac{d\tau^c}{\tau^c} + \frac{\partial a}{\partial w_2} w_2 \tau^a \frac{dw_2}{w_2} + C\tau^a \frac{d\tau^a}{\tau^a} = 0$$

VFDI: Fragmentation 12

Solve for $\frac{dw_2}{w_2}$:

$$\begin{aligned} \frac{\partial a}{\partial w_2}\frac{w_2}{a}a\tau^a\frac{dw_2}{w_2} &= -C\tau^a\frac{d\tau^a}{\tau^a} - \tau^a c\tau^c\frac{d\tau^c}{\tau^c} \longleftrightarrow \\ \frac{dw_2}{w_2} &= -\frac{1}{\lambda\alpha}\left[\frac{d\tau^a}{\tau^a} + (1-\alpha)\frac{d\tau^c}{\tau^c}\right] \end{aligned}$$

where $\alpha = a/C$ is the share of assembly in the total costs of production, and $\lambda = \frac{\partial a}{\partial w_2}\frac{w_2}{a}$ is the share of labour in the value added of assembly.

VFDI: Fragmentation 13

- Negative relationship with trade costs. Quite small trade costs have to be compensated for by steep wage gradients. For $\alpha = \lambda = 0.5$, a 10% increase in both trade costs is associated with a 60% reduction in the wage rate.
- Intuition?

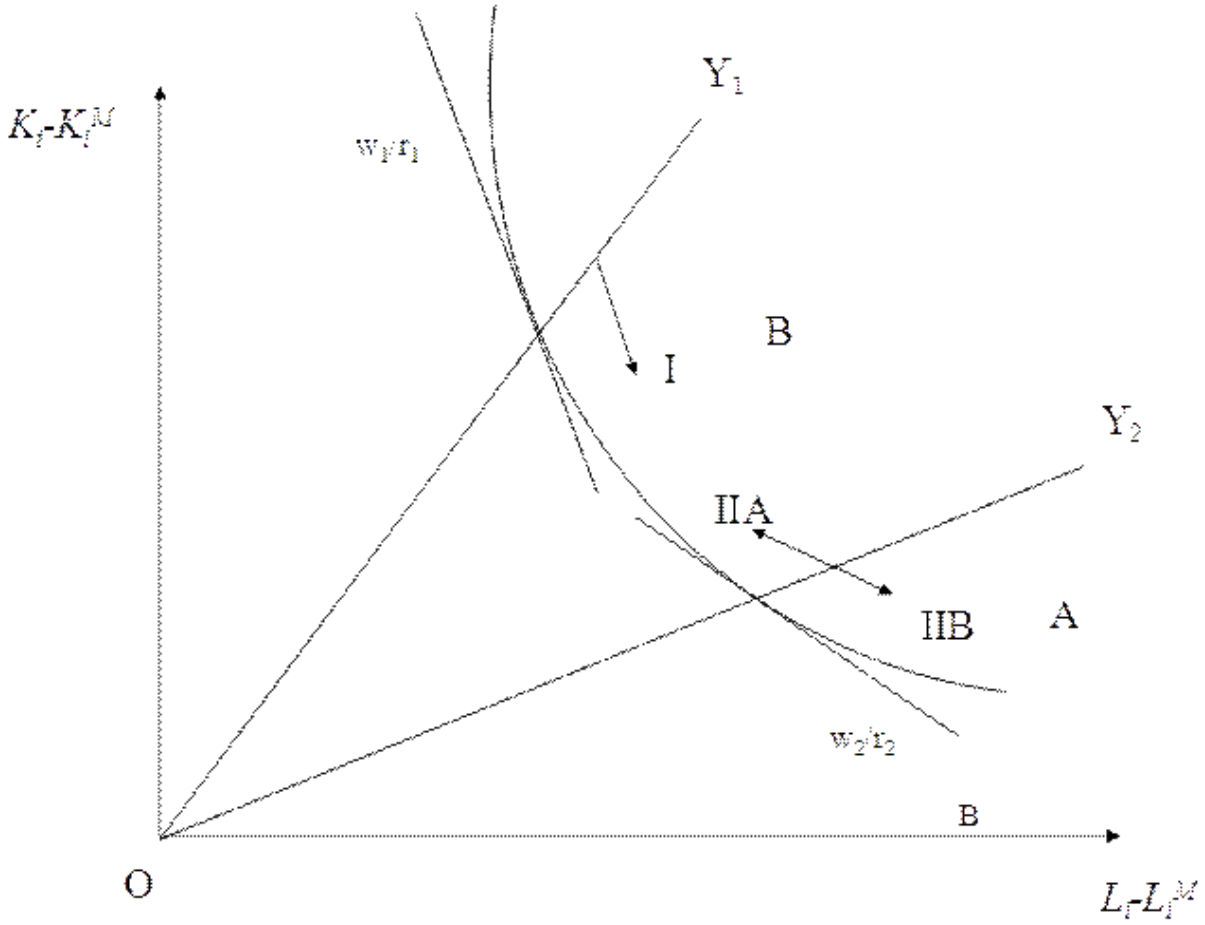
VFDI: Fragmentation 14

- Not full equilibrium, merely describe wages at which VFDI is possible. Remote countries may have higher wages but then they not host VFDI. If wages are lower than in equations, then it is strictly profitable to do VFDI there and this tending to bid up wages there.
- General eq in chapter 4.3

Fragmentation and Skill Premium

- Since 1980's, already before NAFTA 1994, there was a substantial increase of VFDI to Mexico
- At the same time there was a marked increase in the skill premium in BOTH the US and Mexico
- According to theory, we would expect that VFDI brings factor price convergence with factor price ratios moving into opposite directions
- What explains the increasing skill premiums in Mexico?
- Feenstra and Hanson (1996) provide an answer.

Fragmentation and Skill Premium



The isoquant represents the tehnology of the rest of the economy, the Y sector. M-sector is manufacturing, where VFDI may occur.
Slope of line OY_1 is country 1 capital-labor endowment net of factor usage in the M-sector, so it is $(K_1 - K_1^M)/(L_1 - L_1^M)$.

Fragmentation and Skill Premium

- Suppose some stage of manufacturing relocates from country 1 to country 2. Assume this stage of production is highly labor intensive, i.e. in interval A below OY_1 and OY_2.

New Theory on Fragmentation

- Extensions: Put structure on demand and firm behavior.
  - E.g. Dixit-Stiglitz specification for demand for differentiated products
- Allow for firm heterogeneity w r t technology (Helpman, Melitz and Yeaple).