

Multinationals and the Globalization of Production

Leontief Production

Penn State // Fall 2016

Administrative things

- ▶ Arkaive.com course code: 3D0Y
 - ▶ Please sign in

- ▶ Exam I
 - ▶ Pick up from the front table
 - ▶ Mean = 64, max = 100
 - ▶ [25th, 50th, 75th] percentile = [53, 64, 74]
 - ▶ Solutions online

True/False

1. Multinational firms, which make up less than one percent of US manufacturing firms, account for almost 75 percent of R&D spending. This fact suggests that multinational firms tend to have strong ownership advantages.

True/False

2. Consider the model in which firms are heterogeneous in productivity. Firms in country one can serve two foreign countries by exporting or multinational production.

The only difference between the two foreign countries is that one has a large GDP and one has a small GDP.

The model predicts that the smallest country-one exporter to the large-GDP country will be more productive than the smallest country-one exporter to the small-GDP country.

True/False

3. A country is a good candidate for export platform FDI if it is close to the parent firm, close to other markets, and has low production costs.

True/False

4. Deloitte Touche Tohmatsu Limited, a multinational management and tax consultancy, employs more than 240,000 professionals across the world. Deloitte's network of global offices, which provide on-site consulting to thousands of customers, is consistent with the proximity-concentration tradeoff.

Question 5: T-TIP

- a. What is the productivity level of the smallest US firm that exports to the UK? Call this level of productivity $\underline{\varphi}^e$.

$$\pi_{us}^e(\underline{\varphi}^e) = \frac{E_{uk}}{\epsilon_{uk}} \left(\frac{\epsilon_{uk}}{\epsilon_{uk} - 1} \frac{1}{\underline{\varphi}^e} w_{us}(1 + \tau) \right)^{1 - \epsilon_{uk}} - w_{us} f^e = 0$$

Question 5: T-TIP

- b. What is the productivity level, $\underline{\varphi}^m$, for which a firm in the US is indifferent between exporting to the UK and operating a foreign affiliate in the UK?

$$\pi_1^e(\underline{\varphi}^m) = \pi_1^m(\underline{\varphi}^m)$$

Question 5: T-TIP

- c. Suppose implementing T-TIP eliminates the regulatory costs of foreign production, $f^R = 0$, but everything else stays the same. What are the new values of $\underline{\varphi}^e$ and $\underline{\varphi}^m$?

Question 5: T-TIP

- d. As a result of T-TIP, the influx of new investment into the UK has caused an increase in the demand for UK workers, driving up their wages, w_{uk} . Does the higher wage dampen or amplify the impact of T-TIP on FDI from the US into the UK? Explain your answer.

Question 6: Export platform in Germany or Hungary?

- a. Where will the US firm locate its plant? Show the calculations that support your answer.

If the export platform is in Germany,

$$\pi = \frac{E_g}{\epsilon_g} \left(\frac{\epsilon_g}{\epsilon_g - 1} \frac{w_g}{\varphi} \right)^{1-\epsilon_g} + \frac{E_h}{\epsilon_h} \left(\frac{\epsilon_h}{\epsilon_h - 1} \frac{w_g}{\varphi} (1 + \tau) \right)^{1-\epsilon_h} - w_g f^p - w_g f^e$$

If the export platform is in Hungary,

$$\pi = \frac{E_g}{\epsilon_g} \left(\frac{\epsilon_g}{\epsilon_g - 1} \frac{w_h}{\varphi} (1 + \tau) \right)^{1-\epsilon_g} + \frac{E_h}{\epsilon_h} \left(\frac{\epsilon_h}{\epsilon_h - 1} \frac{w_h}{\varphi} \right)^{1-\epsilon_h} - w_h f^p - w_h f^e$$

Question 6: Export platform in Germany or Hungary?

- b. Explain the economic intuition behind your choice of Germany or Hungary as an export platform.

Question 7: Modeling the P-C Tradeoff

- a. From the perspective of a firm in country one, which parameter(s) are *most important* for generating a desire for proximity to country two?

Question 7: Modeling the P-C Tradeoff

- b. From the perspective of a firm in country one, which parameter(s) are *most important* for generating a desire concentrate production?

Regrading

- ▶ Points added wrong? See me after class.
- ▶ Would like a question regraded?
 - ▶ Look over the solution.
 - ▶ Complete exam regrade request form (on course website).
 - ▶ On the form, explain why your answer is correct.
 - ▶ Turn in regrade form and your exam to me.
 - ▶ Entire exam is regraded. Score could decrease.
- ▶ Deadline for regrade request: end of class Tuesday 10/11

Roadmap

- ▶ Past: Horizontal FDI/export platform
 - ▶ FDI for market access
- ▶ Present: Vertical FDI: break up production across countries
 - ▶ FDI to save on factor costs (factors = inputs)
 - ▶ Need a model with multi-stage production
- ▶ Today: work through the production function
- ▶ Thursday: start on vertical FDI

Fixed-proportions production function

- ▶ Often called the *Leontief production function*
- ▶ Big idea: Inputs are used in fixed proportions
 - ▶ No ability to substitute inputs
- ▶ Examples (simplified)
 - ▶ 4 tires + 1 motor + 2 windshield wipers = 1 car
 - ▶ 2 sq. yds. denim + 1 zipper + 3 ft. thread = 1 pair jeans
 - ▶ 1 screen + 1 keyboard + 1 case = 1 laptop
- ▶ Too few inputs → no output (car with 3 tires?)
- ▶ Too many inputs → inputs go unused (jeans with two zippers?)

Fixed-proportions production function

- ▶ Output = x
- ▶ Two inputs
 - ▶ ℓ_s = skilled labor
 - ▶ ℓ_u = unskilled labor
- ▶ Unit input requirements
 - ▶ θ_s = hours of skilled labor needed to make one unit output
 - ▶ θ_u = hours of unskilled labor needed to make one unit output

$$x = \min \left\{ \frac{\ell_u}{\theta_u}, \frac{\ell_s}{\theta_s} \right\}$$

Fixed-proportions production function

- ▶ $\theta_u = 2$ and $\theta_s = 1$

$$x = \min \left\{ \frac{\ell_u}{2}, \frac{\ell_s}{1} \right\}$$

- ▶ How much output is produced from
 - ▶ hiring 2 hours of unskilled labor and 1 hour of skilled labor?
 - ▶ hiring 3 hours of unskilled labor and 1 hour of skilled labor?
 - ▶ hiring 1 hour of unskilled labor and 1 hour of skilled labor?
 - ▶ hiring 4 hours of unskilled labor and 2 hours of skilled labor?

Factor intensity

- ▶ Two goods, a and b
- ▶ Good a : $\theta_{ua} = 5$ and $\theta_{sa} = 1$
- ▶ Good b : $\theta_{ub} = 1$ and $\theta_{sb} = 10$
- ▶ Good b is *skilled-labor* intensive
 - ▶ Good a skilled to unskilled labor ratio = $1/5$
 - ▶ Good b skilled to unskilled labor ratio = $10/1$
- ▶ Factor intensity is a relative concept

Unit costs

- ▶ How much does it cost to produce one unit?
- ▶ Wages w_s and w_u
- ▶ The unit cost is

$$c(w_u, w_s) = \theta_u w_u + \theta_s w_s$$

- ▶ Note: the unit cost is a function of the wages

Two stage production

- ▶ The final good is made up of two parts
 1. Component parts b (b for circuit *boards*)
 2. Assembly services a
- ▶ 1 unit of parts and 1 unit of assembly combine to make the final good

$$x = \min \{x_a, x_b\}$$

- ▶ The unit cost of the final good is

$$c(w_u, w_s) = c_a(w_u, w_s) + c_b(w_u, w_s)$$

In class problem: Where to produce?

- ▶ $\theta_{ua} = 5$ and $\theta_{sa} = 1$; $\theta_{ub} = 1$ and $\theta_{sb} = 10$
- ▶ Two locations that differ by wages
 - ▶ Location 1: $w_u = 7$ (\$/h) and $w_s = 25$ (\$/h)
 - ▶ Location 2: $w_u = 2$ (\$/h) and $w_s = 30$ (\$/h)
- ▶ What is the unit cost of the final good in location 1?
- ▶ What is the unit cost of the final good in location 2?
- ▶ What is the unit cost of the final good when components and assembly are carried out in the cheapest locations?

Takeaways

- ▶ Leontief production = fixed input proportions
- ▶ Leontief production functions have easy to compute unit costs
- ▶ Looking ahead to vertical FDI
 - ▶ Factor intensity differences and factor cost differences generate desire to move parts of the production process across locations