Multinationals and the Globalization of Production

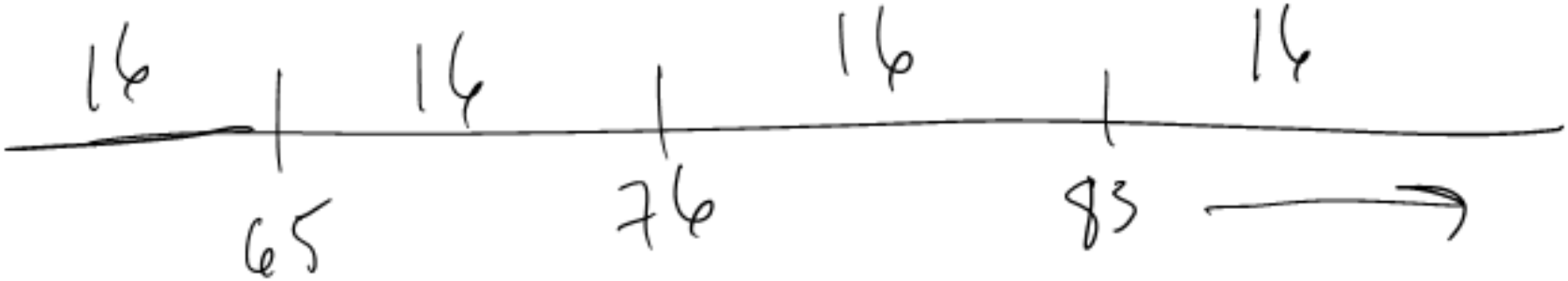
Leontief Production

Penn State // Fall 2017

Administrative things

- Sign in to Arkaive.com (course code: 84ST)
  - If not working, sign in up front

- Exam I (65 submissions)
  - Pick up from the front table
  - Mean = 71, max = 99
  - [25th, 50th, 75th] percentile = [65, 76, 83]
  - Solutions online



True/False

1. Our model of horizontal FDI predicts that Walmart should be a multinational firm.

high prod ⟶ MNE

big ⟶ prod.

True/False

2. Apple, Inc. designs iOS — the iPhone operating system — in California and the iPhone itself is assembled by Foxconn (a company unaffiliated with Apple). iOS is one of Apple's location advantages.

FALSE

iOS → ~~location~~ ownership advantage.

True/False

3. Most R&D performed by multinationals takes place in high-income countries.

#1 → MNE come from high-income ctries.

#5 → R&D done in parent

True/False

4. According to our model of horizontal FDI, the markup in the gasoline industry should be larger than the markup in the snack foods industry.

$$markup = \frac{\varepsilon}{\varepsilon - 1}$$

$$\varepsilon_{GAS} < \varepsilon_{SF}$$

$$markup_{GAS} > markup_{SF}$$

Question 5: Export or MNE?

a. How should the firm serve country 2? As a multinational or an exporter? Provide a calculation to support your answer.

$\Delta \pi^e$ vs. $\Delta \pi^m$

b. A second US firm would also like to sell its product in country 2. Again, using the model of horizontal direct investment, the relevant data are: $E_2 = 1000$, $\epsilon_2 = 4$, $w_{us} = 1.5$, $w_2 = 1.75$, $f^p = 10$, $f^e = 1.25$, $\varphi = 2.0$, and $\tau = 0.2$. How should the firm serve country 2? Provide a calculation to support your answer.

$\Delta \pi^e$ vs. $\Delta \pi^m$

Question 5: Export or MNE?

c. What is different about the two firms? Give the economic intuition why this difference leads the firms to choose different ways of serving the foreign market.

FIXED COST PRODUCTION CHANGES.

MORE EXPENSIVE TO REPLICATE PRODUCTION

VS.

"t" COSTS OF SHIPPING GOODS

Question 6: FDI and growing countries

a. In the last few decades, Chinese GDP per capita has been growing rapidly. How should we expect inward foreign direct investment to change in China?

YES → More FDI

b. State the relevant version of the proximity-concentration tradeoff that justifies your answer to part a.

More FDI To Bigger Country

c. Explain how the proximity-concentration tradeoff accounts for your answer in part a.

Question 7: Export platform in the UK or Slovakia?

a. Where will the US firm locate its plant? What is the total profit earned by the firm in these two markets?

$\Rightarrow$ SLOVAKIA

b. Where should the firm locate its plant when $\tau_{uk,sk} = \tau_{sk,uk} = 0.0$? Explain your answer.

$\Rightarrow$ SLOVAKIA

$\Delta\Pi^e$ $\Delta\Pi^m$

$\Delta\Pi^{xp,m}$ . . .

Regrading

- Points added wrong? See me after class.
- Would like a question regraded?
  - Look over the solution (on course website).
  - 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 10/17

Roadmap

- Past: Horizontal FDI/export platform
  - FDI for market access SELLING IN FOR. MARKET
- 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 $\rightarrow$ no output (car with 3 tires?)
- Too many inputs $\rightarrow$ 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 $\theta_s = 1$

"perfect complements"

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

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

    $1 = \min\left\{\frac{2}{2}, \frac{1}{1}\right\}$
  - hiring 3 hours of unskilled labor and 1 hour of skilled labor?

    $1 = \min\left\{\frac{3}{2}, \frac{1}{1}\right\} = \min\{1.5, 1\}$
  - hiring 1 hour of unskilled labor and 1 hour of skilled labor?

    $0.5 = \min\left\{\frac{1}{2}, \frac{1}{1}\right\} = \min\{0.5, 1\}$

    Per from optimal mix
  - hiring 4 hours of unskilled labor and 2 hours of skilled labor?

    $2 = \min\left\{\frac{4}{2}, \frac{2}{1}\right\} = \min\{2, 2\}$

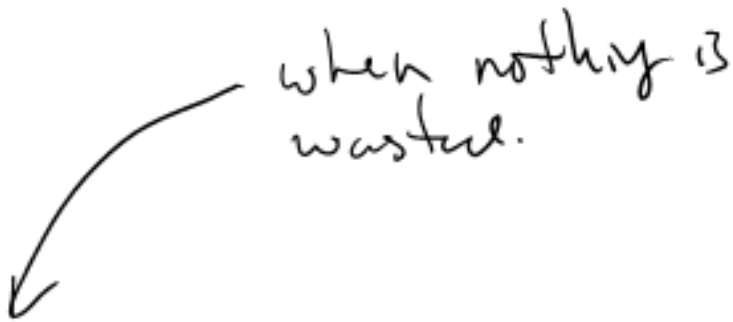
Factor intensity

- 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

unskilled-labor intensive
a unskilled-skilled ratio = 5
b = 1/10

Unit costs

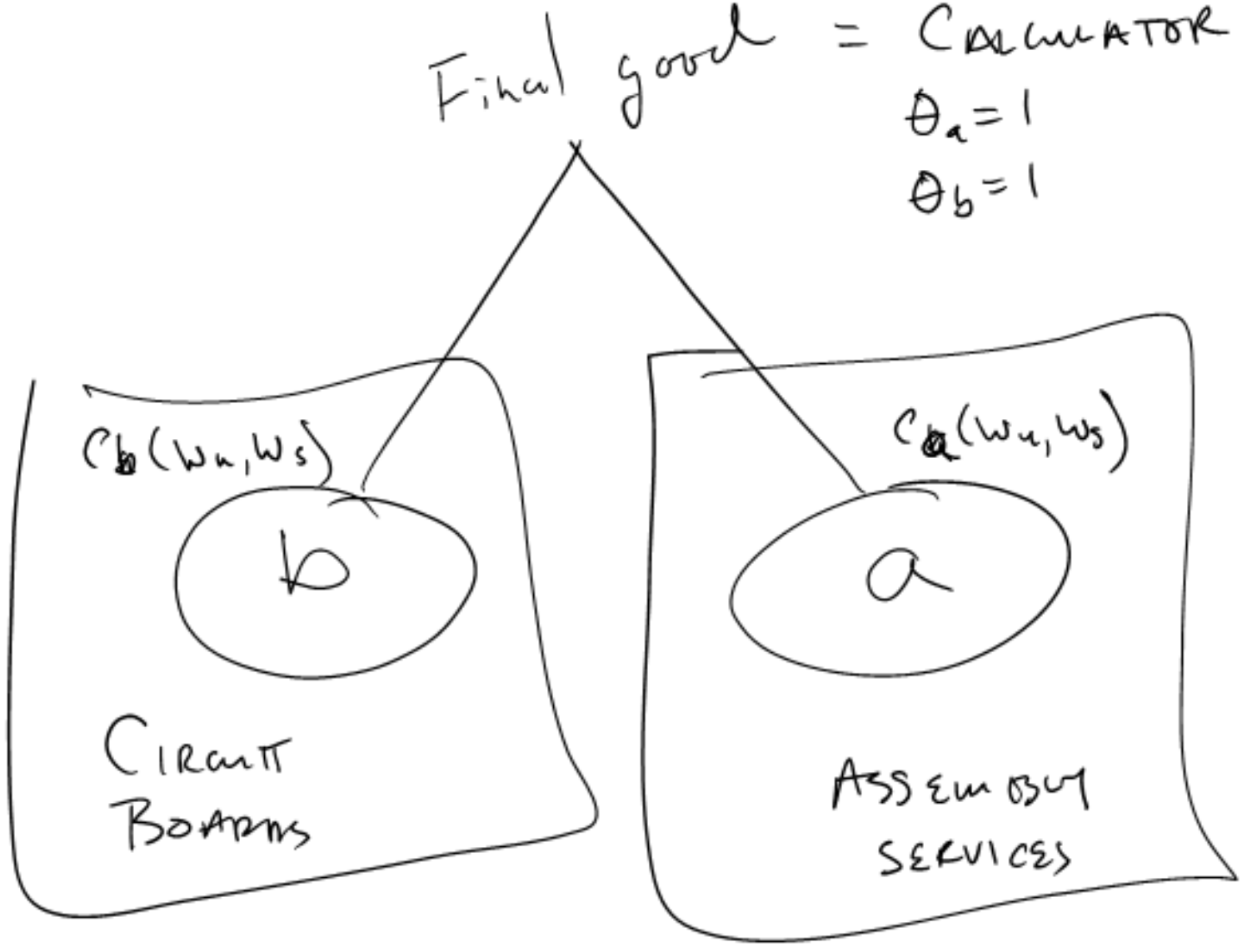
- How much does it cost to produce one unit?
- Wages w_s and w_u
- The unit cost is



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

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

$$C(w_u, w_s) = C_a(w_u, w_s) + C(w_u, w_s)$$



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