

# Multinationals and the Globalization of Production

## *Exam 2 Review*

Penn State // Fall 2017

## Administrative things

- ▶ Sign in to Arkaive.com (course code: 84ST)
  - ▶ If not working, sign in up front
- ▶ Problem set #4
  - ▶ Ready for pickup
- ▶ Exam II
  - ▶ Thursday, 11/9
  - ▶ Covers material from 10/10–11/7
  - ▶ Same format as exam I

Today 4-5  
Tom 11-noon

By APT  
By email

## Exam II: Thursday 11/~~3~~9

- ▶ Exam duration is 75 minutes
- ▶ We will start on time; arrive early
- ▶ Bring
  - ▶ Calculator
  - ▶ One page of notes (8.5"x11")
  - ▶ No wireless devices or other materials
- ▶ Show your work!

## Grading

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<b>Deliverable</b>	<b>Contribution</b>
5 Problem Sets	5%
Exam 1	25%
Exam 2	25%
Final Exam	40%
Participation	5%

- ▶ Course score is “curved” at the end of the semester
- ▶ Your relative position in class is what matters

# Roadmap

## ► Big picture

1. Leontief production function/cost function
2. Vertical FDI model
3. Host country effects of FDI
4. Evaluating foreign investments
5. Competing for FDI

FIRM'S  
MOTIVES FOR  
FDI

Host  
Country

## ► Practice problems

## Leontief production

- ▶ Inputs are used in fixed proportions

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

- ▶  $\theta_u$  = unit requirement of  $\ell_u$  (paid wage  $w_u$ )
- ▶  $\theta_s$  = unit requirement of  $\ell_s$  (paid wage  $w_s$ )
- ▶ Associated cost function

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

## Vertical FDI model

- ▶ Factor price differences encourage VFDI — fragment
- ▶ Costs of trading goods limits VFDI — concentrate
- ▶ 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
- ▶ The unit cost of the final good is

$$f = \left\{ \frac{b}{1}, \frac{a}{1} \right\}$$

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

## Vertical FDI model

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- ▶  $\theta_{ua} = 5$  and  $\theta_{sa} = 1$ ;  $\theta_{ub} = 1$  and  $\theta_{sb} = 10$  [ $b$  is skill-intensive]
- ▶ Two countries that differ by wages
  - ▶ Country 1:  $w_u^1 = 10$  (\$/h) and  $w_s^1 = 20$  (\$/h) *← unskill expens.*
  - ▶ Country 2:  $w_u^2 = 2$  (\$/h) and  $w_s^2 = 30$  (\$/h) *← skill expens.*
- ▶ Two trade costs
  - ▶  $\tau_b$  = cost of shipping good  $b$
  - ▶  $\tau$  = cost of shipping final good
- ▶ What firm structure delivers the lowest cost final good in each country?



## Structure 1 (HFDI)

country 1



$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

no trade

country 2



$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2)$$

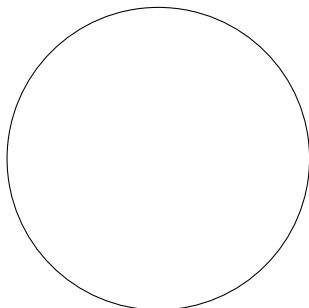
## Structure 2 (Export)

country 1



—————→  
final good exports

country 2



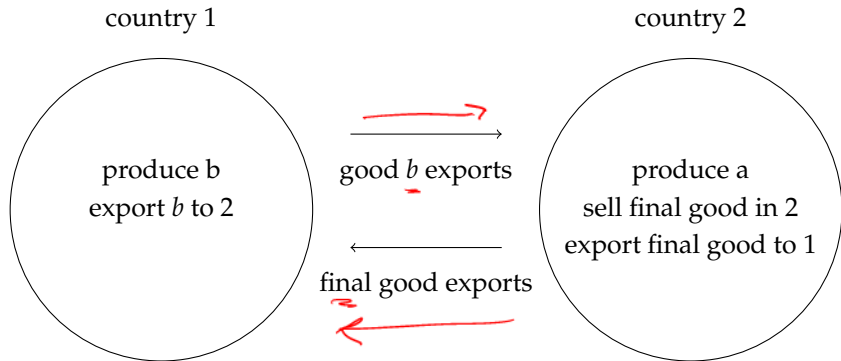
$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = \underbrace{[c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)]}_{c^1} (1 + \tau)$$



## Structure 4 (Complete fragmentation)

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$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)$$

$$c^1 = [c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)] (1 + \tau)$$

$c^2$

## Possible firm structures

look for lowest cost in each country

1. Do  $a$  and  $b$  in each country (HFDI)

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2)$$

2. Do  $a$  and  $b$  in country 1, export to country 2

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = [c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)] (1 + \tau)$$

3. Do  $b$  in country 1, both countries do  $a$

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

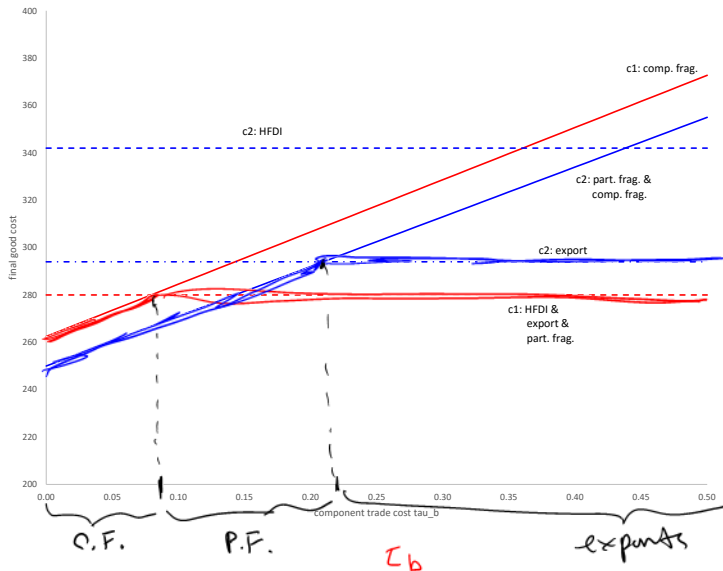
$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)$$

4. Do  $b$  in country 1, do  $a$  in country 2 and ship final good to 1

$$c^1 = [c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)] (1 + \tau)$$

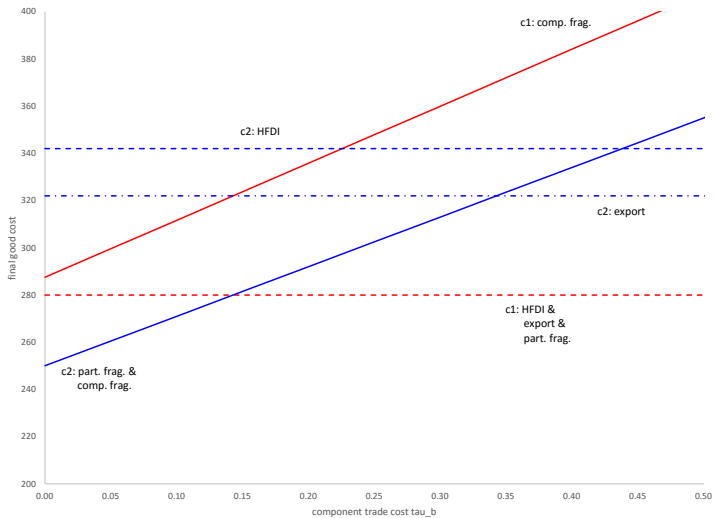
$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)$$

# Determining firm structure ( $\tau = 0.05$ )



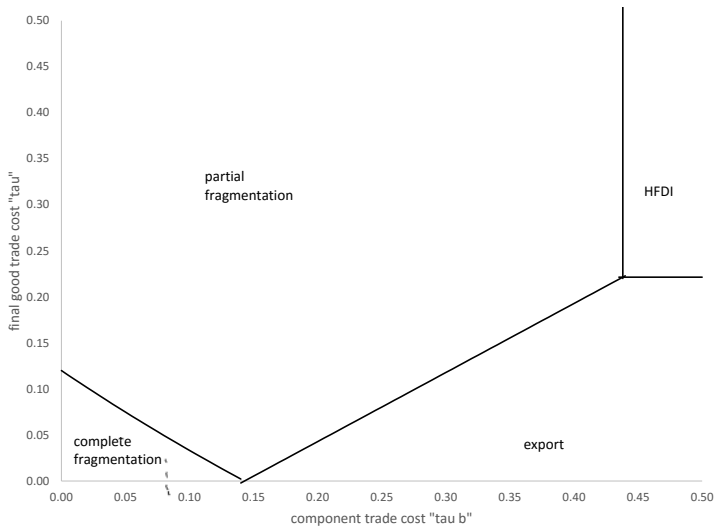
## Determining firm structure ( $\tau = 0.15$ )

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# How trade costs shape firm structure

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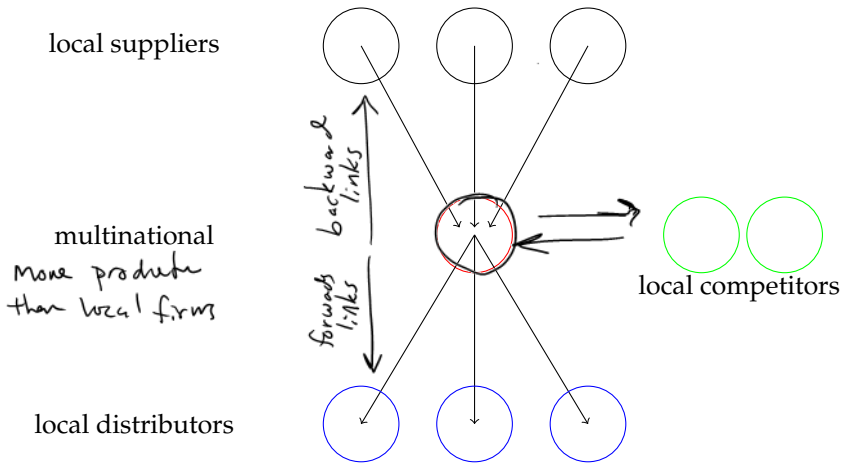


## Host country effects of FDI

- ▶ Host country productivity effects of MNEs
- ▶ Factor market effects price of factor inputs
- ▶ Competition effects

## MNE interactions with other firms

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## Two kinds of productivity effects

### 1. Composition effects (changes in $f$ )

- ▶ MNEs more productive than local firms
- ▶ Increase competition
- ▶ Change in types of firms in production
- ▶ Aggregate productivity increases


# of high- $\varphi$   
vs.

low- $\varphi$  firms  
in market

### 2. Spillover effects (changes in $\varphi$ )

- ▶ MNEs make local firms more productive
- ▶ Backward linkages with local input suppliers [Walmart]
- ▶ Forward linkages with local distributors

## Factor market effects and FDI

- ▶ How will MNEs affect factor market prices?  

- ▶ Factor markets: labor markets, capital markets, natural resource markets, utilities
- ▶ Key issue: factor demand by MNEs vs. factor supply in the country
  - ▶ If MNEs need inelastic factors → likely negative effects
  - ▶ If MNEs need elastic factors → likely small effects

## Competition effects of FDI

- ▶ If local firms have market power
  - ▶ MNE provides competition
  - ▶ Decreases markups, lowers prices
  - ▶ Good for consumers, downstream firms
  
- ▶ Can it go too far?
  - ▶ If MNE drives local firms out of business
  - ▶ Potentially less competition in the market
  - ▶ Higher markups and prices
  - ▶ Bad for consumers, downstream firms

WALMART

- MANY LOCAL FIRMS
- provides competition

GM in Brazil

- no local firms

## Evaluating potential FDI

▶ Policy makers faced with potential FDI projects

▶ Who are the winners and the losers?

▶ A framework of questions

1. Is the investment likely to raise production costs for local firms?

2. Are there local firms that compete directly with the MNE?

3. Are there local firms that will likely benefit from the MNE?

*elasticity  
of factor supply*

*spillovers.*

▶ Often this a local (region/state/city) analysis

▶ Depends on how “big” markets are

## Competing for FDI

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- ▶ Countries  $i = 1, \dots, N$
- ▶ Multinational has project with profit  $\pi_i = v_i - f_i^p$
- ▶ If project is located in  $i$ , country benefit is  $b_i$
- ▶ Not privately profitable:  $\pi_i = v_i - f_i^p < 0$
- ▶ Jointly beneficial:  $\pi + b_i = v_i - f_i^p + b_i > 0$
- ▶ Country can offer a take-it-or-leave-it subsidy,  $s_i$

joint surplus

## The equilibrium with one country

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- ▶ The optimal subsidy is  $s_i = \underbrace{f_i^p - v_i}_{\text{firm loss}} + \eta$
- ▶  $\eta$  is a very small positive number — just enough to make the project profitable for the multinational

### SPLITTING JOINT SURPLUS

- ▶ The multinational's profit is  $\pi_i + s_i = \underbrace{v_i - f_i^p}_{\pi_i} + \underbrace{f_i^p - v_i + \eta}_{s_i} = \eta$
- ▶ The country's after-subsidy benefit is  $\beta_i = b_i - \underbrace{f_i^p + v_i - \eta}_{s_i} = b_i + \pi_i - \eta$
- ▶ The country extracts all but  $\eta$  of the joint surplus



## Two identical countries compete

Country 1

	Country 2 subsidize	Country 2 do not subsidize
Country 1 subsidize	$(0, 0)$	$(\beta_1, 0)$
Country 1 do not subsidize	$(0, \beta_2)$	$(0, 0)$

Country 2

Handwritten notes:

- Randomly go to a country (arrow pointing to the top row)
- Country 1 project (arrow pointing to the top-right cell)
- Country 2 Project (arrow pointing to the bottom-left cell)
- no project (arrow pointing to the bottom-right cell)

► Why does subsidize, subsidize yield  $(0, 0)$ ?

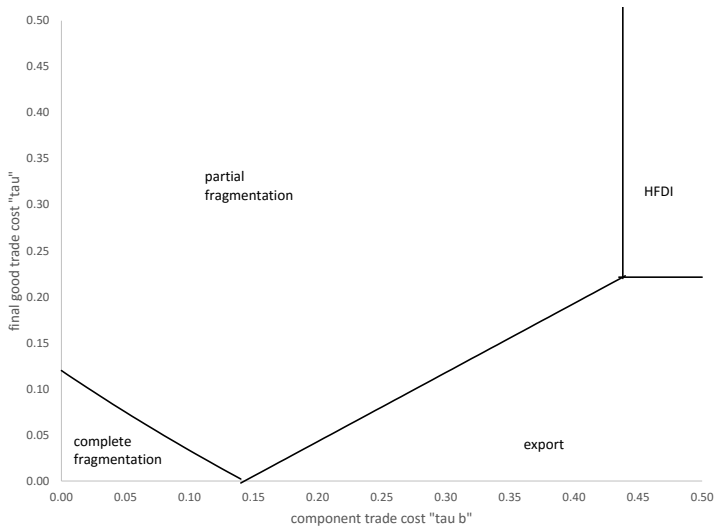
► What is the Nash equilibrium?

BERTRAND  
TRICKING

## *Practice problems*

# How trade costs shape firm structure

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## Trade liberalization

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- ▶ Suppose (in our previous model)  $\tau_b = 0.25$  and  $\tau = 0.05$
- ▶ If a trade agreement lowers  $\tau_b = 0.15$ , what happens to
  - ▶ FDI in country 2?
  - ▶ Exports from country 1?
  - ▶ Exports from country 2?
- ▶ If a trade agreement lowers  $\tau_b = 0.0$ , what happens to
  - ▶ FDI in country 2?
  - ▶ Exports from country 1?
  - ▶ Exports from country 2?

## Where to produce?

- ▶  $\theta_{ua} = 4$  and  $\theta_{sa} = 1$ ;  $\theta_{ub} = 1$  and  $\theta_{sb} = 6$
- ▶  $w_u^1 = 5, w_s^1 = 20, w_u^2 = 2, w_s^2 = 30, \tau_b = 0.15, \tau = 0.10$
- ▶ How should the firm structure itself?

## Possible firm structures

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1. Do  $a$  and  $b$  in each country (HFDI)

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^2, w_u^2)$$

2. Do  $a$  and  $b$  in country 1, export to country 2

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = [c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)] (1 + \tau)$$

3. Do  $b$  in country 1, both countries do  $a$

$$c^1 = c_a(w_s^1, w_u^1) + c_b(w_s^1, w_u^1)$$

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)$$

4. Do  $b$  in country 1, do  $a$  in country 2 and ship final good to 1

$$c^1 = [c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)] (1 + \tau)$$

$$c^2 = c_a(w_s^2, w_u^2) + c_b(w_s^1, w_u^1)(1 + \tau_b)$$

## Where to produce?

- ▶  $\theta_{ua} = 4$  and  $\theta_{sa} = 1$ ;  $\theta_{ub} = 1$  and  $\theta_{sb} = 6$
- ▶  $w_u^1 = 5, w_s^1 = 20, w_u^2 = 2, w_s^2 = 30$
- ▶ Suppose  $\tau_b = 0.0, \tau = 0.0$
  
- ▶ How should the firm structure itself? [Don't compute anything!]

## Asymmetric countries

JS

$$CTY1: 20 + 65 - 70 = 15$$

$$CTY2: 15 + 65 - 70 = 10$$

- The payoff to the firm is identical in each country, but the benefit to each country is different:  $b_1 = 20, b_2 = 15, v = 65, f^p = 70, \eta = 0.01$

1. Now both countries compete. Write out the payoff matrix.

2. Where is the project located?

3. In equilibrium, what are  $s_1, s_2, \beta_1, \beta_2$ , and  $\pi$ ?

$$\pi_i = 65 - 70 = -5$$

$$s_3 = 15$$

$$s_1 = 15.01$$

$$\pi = -5 + 15.01 = 10.01$$

$$s_2 = 5.01$$

CTY 2

	S	ns
S	(4.99, 0)	(14.99, 0)
ns	(0, 9.99)	(0, 0) no project

$$s_1 = 5.01$$

CTY1 → subsidize

CTY2 → subsidize