

# Multinationals and the Globalization of Production

## *Exam 1 Review*

Penn State // Fall 2017

## Administrative things

- ▶ Sign in to Arkaive.com (course code: 84ST)
  - ▶ If not working, sign in up front
- ▶ Problem Set #2
  - ▶ Pick up from up front
- ▶ Exam I
  - ▶ In class, Thursday October 5
- ▶ Office hours (all take place in Kern 615)
  - ▶ Tuesday 10/3: 2:00PM–6:30PM
  - ▶ Wednesday 10/4: 9:00AM–1:00PM (Ruhl)
  - ▶ Wednesday 10/4: 6:00PM–7:00PM (Lipskiy)
  - ▶ Wednesday 10/4: 8:00PM email deadline (Ruhl)

## Exam I: Thursday 10/5

- ▶ 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!

# Roadmap

- ▶ Big picture: What have we done so far?
  1. OLI framework
  2. Basic FDI facts
  3. Horizontal FDI
  4. Export platform FDI
  5. Walmart case study
  
- ▶ Practice problems

## OLI Framework

- ▶ Multinational production is expensive
  - ▶ Language, legal, communication, shipping, ...

- ▶ What are the benefits of multinational production?

- ▶ Ownership advantage (tangible/intangible)

- ▶ Location advantage (horizontal/vertical)

- ▶ Internalization advantage (make/buy)

- ▶ Examples of each?

firm owns that allows it to earn profit

market access  
cost of production

most profitable  
for firm to control  
"internalize" foreign operation.

## Six facts about multinational production

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► Six questions to get to six facts

1. Where do MNEs operate?
2. What goods do MNEs produce?
3. How far do MNEs go from home?
4. How do MNEs compare to domestic firms?
5. What do parents do? Affiliates?
6. How do multinationals expand?

## Six facts

1. Multinationals are concentrated in developed countries Inward +  
outward
2. Multinationals are concentrated in R&D- and capital-intensive goods
3. Multinational activity falls off in the distance from the parent
4. MNE parents and affiliates, compared to domestic firms, are larger, more productive, more R&D intensive, and more likely to export
5. MNE parents specialize in R&D, affiliates in selling to foreign markets
6. Mergers and acquisitions make up a large part of MNE expansion

- ▶ Need to know the facts "broadly"
- ▶ Do not need to know specific numbers

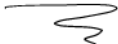
HOST COUNTRY ①  
THIRD COUNTRY ②  
HOME COUNTRY ③

## Models of horizontal FDI

### 1. Heterogeneous firm model

- ▶ Firms differ in productivity  $\varphi$
- ▶ More productive firms have lower prices, larger shares
- ▶ Better firms more likely to be MNEs

### 2. Export platform model = *HFDI model + 1 new country.*

- ▶ Foreign affiliates can sell to other countries
  - ▶ Study how geography and marginal cost matter
- 



## Horizontal FDI with heterogeneous firms

- ▶ Prices depend on firm productivity

$$p_e = \frac{w_1}{\varphi} \frac{\epsilon_2}{\epsilon_2 - 1} (1 + \tau)$$

m.c. (markup) export variable costs

$$p_m = \frac{w_2}{\varphi} \frac{\epsilon_2}{\epsilon_2 - 1}$$

m.c. [note  $w_2$ ] same markup.

- ▶ Export profit

$$\Delta\pi_1^e(\varphi) = \underbrace{\left( \frac{\epsilon_2}{\epsilon_2 - 1} \frac{1}{\varphi} w_1 (1 + \tau) \right)^{1 - \epsilon_2} \frac{E_2}{\epsilon_2}}_{\text{Variable profit}} - w_1 f^e$$

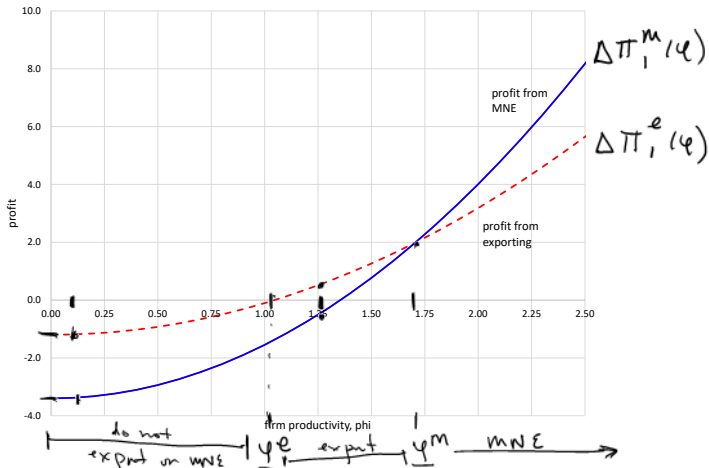
FIXED COST

- ▶ Multinational profit

$$\underline{\Delta\pi_1^m(\varphi)} = \underbrace{\left( \frac{\epsilon_2}{\epsilon_2 - 1} \frac{1}{\varphi} w_2 \right)^{1 - \epsilon_2} \frac{E_2}{\epsilon_2}}_{\text{Var. profit}} - w_2 f^p$$

FIXED COST

# Profits and productivity



- Which firms export? Which firms become MNEs?

## Proximity-concentration tradeoff

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"Fix a firm"

- For a given  $\varphi$ , a firm is more likely to use a foreign affiliate to serve the foreign market, rather than exporting, when

Firm  
perspective

1. the foreign market is larger (larger  $E_2$ )
2. variable export costs are larger (larger  $\tau$ )
3. production fixed costs are smaller (smaller  $w_2 f^p$ )

"Fix the country"

- We should observe more firms serving a foreign market as multinationals, rather than as exporters when

Country  
perspective

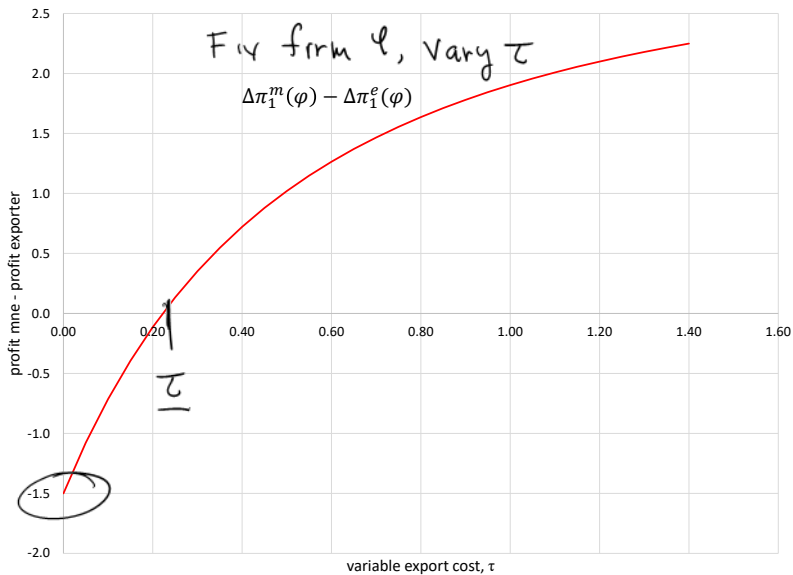
1. the foreign market is larger (larger  $E_2$ )
2. variable export costs are larger (larger  $\tau$ )
3. production fixed costs are smaller (smaller  $w_2 f^p$ )

Fix  
U.S. market...

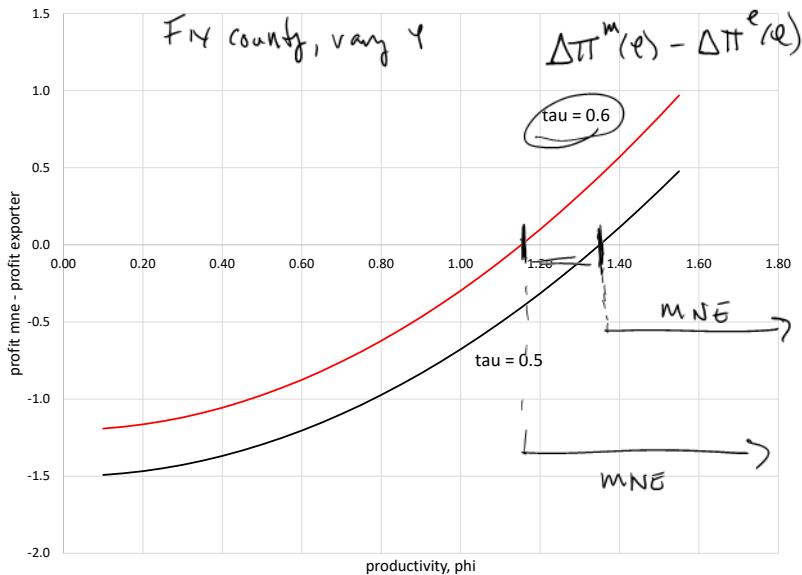
Mexico  
+ Big  
- close  
+/-

New Zealand  
- Small  
+ far  
+/-

## Variable export costs



# Decrease variable export costs



## Export platform FDI

- ▶ A US firm wants to serve Ireland and EU
- ▶ Six ways to do so
  - ~~1.~~ Export to *eu* from *us*, export to *ir* from *us*
  - ~~2.~~ Multinational affiliate in *eu*, export to *ir* from *us*
  - ~~3.~~ Export to *eu* from *us*, multinational affiliate in *ir*
  4. Multinational affiliate in *eu*, multinational affiliate in *ir* MNE
  - ~~5.~~ Multinational affiliate in *eu*, export to *ir* from *eu* XP in EU
  6. Export to *eu* from *ir*, multinational affiliate in *ir* XP in IR
- ▶ As number of countries grows, number of choices explodes

## Simplify the model

- ▶ Six ways to configure the firm
- ▶ The usual approach: compute profits from each, compare
  - ▶ Drawback: tedious
- ▶ Make some assumptions to simplify and focus our analysis
- ▶ Assumption 1:  $\tau_{us,eu}$  and  $\tau_{us,ir}$  are very large
  - ▶ US firm always wants to be MNE (proximity-concentration)
  - ▶ Rules out configurations where US firm exports: #1– #3
- ▶ Assumption 2:  $w_{ir} \ll w_{eu}$ 
  - ▶ Rules out EU as an export platform: #5

## Firm profit

- Affiliates in both countries (#4)

No  $\tau$ 's  
2x  $f^P$

$$\pi_{us}^{m,m}(\varphi) = \underbrace{\frac{E_{ir}}{\epsilon_{ir}} \left( \frac{\epsilon_{ir}}{\epsilon_{ir} - 1} \frac{w_{ir}}{\varphi} \right)^{1-\epsilon_{ir}}}_{\text{VAR PROFIT}} + \underbrace{\frac{E_{eu}}{\epsilon_{eu}} \left( \frac{\epsilon_{eu}}{\epsilon_{eu} - 1} \frac{w_{eu}}{\varphi} \right)^{1-\epsilon_{eu}}}_{\text{VAR PROFIT}} - \underbrace{w_{ir}f^P - w_{eu}f^P}_{\text{Two production fixed costs}}$$

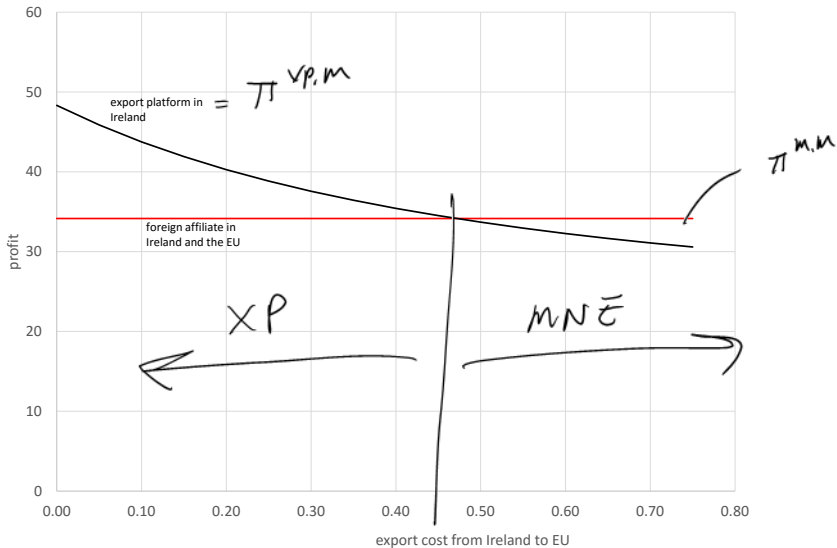
- Affiliate in Ireland, export to EU from IR (#6)

$$\pi_{us}^{xp,m}(\varphi) = \underbrace{\frac{E_{ir}}{\epsilon_{ir}} \left( \frac{\epsilon_{ir}}{\epsilon_{ir} - 1} \frac{w_{ir}}{\varphi} \right)^{1-\epsilon_{ir}}}_{\text{VAR PROFIT}} + \underbrace{\frac{E_{eu}}{\epsilon_{eu}} \left( \frac{\epsilon_{eu}}{\epsilon_{eu} - 1} \frac{w_{ir}}{\varphi} (1 + \tau_{ir,eu}) \right)^{1-\epsilon_{eu}}}_{\text{VAR PROFIT}} - w_{ir}f^P - w_{ir}f^e$$

Pay  $\tau$   
1  $f^P$  + 1  $f^e$

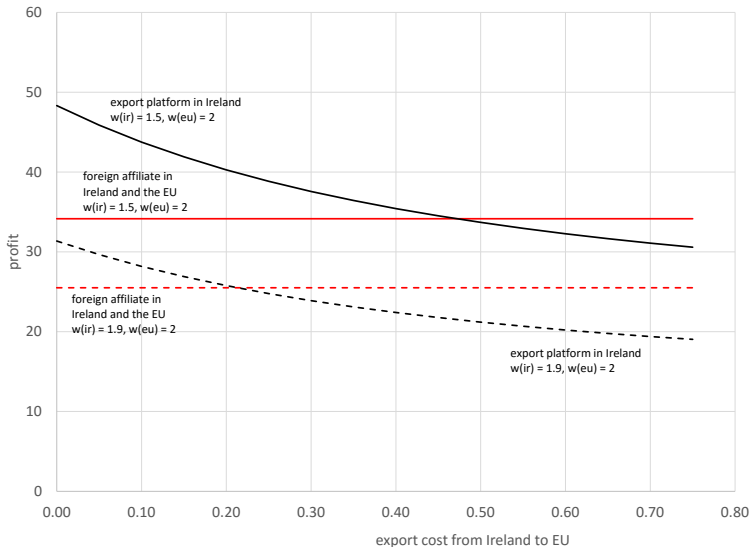


# Profit



## Profit, increasing the Irish wage

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# Practice Problems

## Heterogeneous firm model, low productivity

- ▶  $w_1 = w_2 = 2, E_2 = 50, \epsilon_2 = 3, f^p = 1.5, f^e = 0.6, \tau = 0.3$
- ▶ Let  $\varphi = 1.5$ . Compute  $p_e, p_m$ . Should the firm export to serve the foreign market or use a foreign affiliate?

$$\Delta \pi^e(1.5) = \frac{50}{3} \left( \frac{3}{2} \times \frac{2}{1.5} \times 1.3 \right)^{-2} - 2 \times 0.6 = 1.265$$

$$\Delta \pi^m(1.5) = \frac{50}{3} \left( \frac{3}{2} \times \frac{2}{1.5} \right)^{-2} - 2 \times 1.5 = 1.167$$

$\Rightarrow$  EXPORT

## Heterogeneous firm model, high productivity

- ▶  $w_1 = w_2 = 2, E_2 = 50, \epsilon_2 = 3, f^p = 1.5, f^e = 0.6, \tau = 0.3$
- ▶ Let  $\varphi = 2.0$ . Compute  $p_e, p_m$ . Should the firm export to serve the foreign market or use a foreign affiliate?

$$\Delta \pi^e(2.0) = \frac{50}{3} \left( \frac{3}{2} \times \frac{2}{2} \times 1.3 \right)^{-2} - 2 \times 0.6 = 3.193$$

$$\Delta \pi^m(2.0) = \frac{50}{3} \left( \frac{3}{2} \times \frac{2}{2} \right)^{-2} - 2 \times 1.5 = 4.407$$

$\Rightarrow$  MNE

## Heterogenous firm model

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- ▶ More practice: Redo the previous, but
  1. Change  $w_1 = 2, w_2 = 2.2$
  2. Change  $E_2 = 100$
  3. Change  $\epsilon_2 = 5$
- ▶ How does the difference in profits change? Why?
- ▶ How would the break-even  $\varphi$  for exporting and MNE change?

## Export platforms

- ▶ Assume that  $\tau_{us,ir}$  is large enough to rule out exporting from US
- ▶  $\epsilon_{ir} = \epsilon_{eu} = 3, w_{eu} = 2, f^p = 2, E_{eu} = E_{ir} = 100, \varphi = 2, f^e = 0.9,$   
 $\tau_{ir,eu} = 0.3$
- ▶ When  $w_{ir} = 1.0$ , would the US firm use an export platform in Ireland, or operate an affiliate in both countries?

$$\pi^{m,m}(z) = \frac{106}{3} \left(\frac{3 \times 1}{2 \times 2}\right)^{-2} + \frac{100}{3} \left(\frac{3 \times 2}{2 \times 2}\right)^{-2} - 2 \times 2 - 1.0 \times 2 = 69.1$$

$$\pi^{xp,m}(z) = \frac{106}{3} \left(\frac{3}{2} \times \frac{1}{2}\right)^{-2} + \frac{100}{3} \left(\frac{3}{2} \times \frac{1}{2} \times 1.3\right)^{-2} - 1 \times 2 - 1 \times 0.9 = 91.41$$

USE THE EXPORT  
PLATFORM IN IR

## Export platforms, Ireland “develops”

- ▶ Assume that  $\tau_{us,ir}$  is large enough to rule out exporting from US
- ▶  $\epsilon_{ir} = \epsilon_{eu} = 3, w_{eu} = 2, f^p = 2, E_{eu} = E_{ir} = 100, \varphi = 2, f^e = 0.9,$   
 $\tau_{ir,eu} = 0.3$
- ▶ When  $w_{ir} = 2.0$ , would the US firm use an export platform in Ireland, or operate an affiliate in both countries?

$$\pi_{us}^{M,M}(2.0) = \frac{100}{3} \left( \frac{3}{2} \times \frac{2}{2} \right)^{-2} + \frac{100}{3} \left( \frac{3}{2} \times \frac{2}{2} \right)^{-2} - 2 \times 2 - 2 \times 2 = 21.63$$

$$\pi_{us}^{XP,M}(2.0) = \frac{100}{3} \left( \frac{3}{2} \times \frac{2}{2} \right)^{-2} + \frac{100}{3} \left( \frac{3}{2} \times \frac{2}{2} (1.3) \right)^{-2} - 2 \times 2 - 2 \times 0.9 = 17.78$$

USE AN AFFILIATE  
IN EACH MARKET.



## Export platforms

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- ▶ Irish GDP per capita is about equal to the EU average. Would expect to see much new FDI in Ireland? Why or why not?
- ▶ More practice: Redo the previous (keep  $w_{ir} = 1.0$ ), but
  - ▶ Change  $\tau_{ir,eu} = 0.1$
  - ▶ Change  $E_{eu} = 200$
- ▶ If  $w_{ir}$  and  $w_{eu}$  are similar, when might the US firm want to build the export platform in the EU?

## Practice exam 5a.

Let  $E_{uk} = 1000$ ,  $\epsilon_{uk} = 4$ ,  $w_{us} = 1.5$ ,  $w_{uk} = 1.5$ ,  $f^T = 3$ ,  $f^R = 1$ ,  $f^e = 1.25$ , and  $\tau = 0.2$ . ( $f^p = f^T + f^R$ ) What is the productivity level of the smallest US firm that exports to the UK? Call this level of productivity  $\underline{\varphi}^e$ .

Solve for  $\underline{\varphi}^e$ :  $\Delta \pi^e(\underline{\varphi}^e) = 0$

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

$$\frac{1000}{4} \left( \frac{4}{3} \frac{1.5}{\underline{\varphi}^e} 1.2 \right)^{-3} - 1.5 \times 1.25 = 0$$

Pull  $\underline{\varphi}^e$  out of this expression [the exponent changes sign because  $\underline{\varphi}^e$  was in the denominator]

$$\frac{1000}{4} \left( \frac{4}{3} \times 1.5 \times 1.2 \right)^{-3} (\underline{\varphi}^e)^3 - 1.5 \times 1.25 = 0$$

$$18.08 (\underline{y}^e)^3 - 1.875 = 0$$

$$18.08 (\underline{y}^e)^3 = 1.875$$

$$(\underline{y}^e)^3 = 0.1037$$

$$\underline{y}^e = (0.1037)^{\frac{1}{3}}$$

$$\underline{y}^e = 0.4698$$