

# Multinationals and the Globalization of Production

## *Horizontal FDI 3*

Penn State // Fall 2016

## Administrative things

- ▶ Arkaive.com course code: 3D0Y
  - ▶ Please sign in
  
- ▶ Problem Set #2
  - ▶ Available online
  - ▶ Due, end of class, Thursday September 22
  
- ▶ Exam I
  - ▶ In class, Thursday September 29
  - ▶ Review session, in class Tuesday September 27
  - ▶ Practice exam to be posted soon...

## Roadmap

- ▶ A model of horizontal FDI
  - ▶ Introduce a model of competition
  - ▶ The closed economy
  - ▶ Open economy: exporting and MNE
- ▶ Present: Formalize the proximity-concentration tradeoff
  - ▶ Where do multinationals occur?
- ▶ Future: Firm-level heterogeneity (MNE fact #4)
  - ▶ MNEs are larger and more productive than domestic firms.

## Domestic or multinational?

- ▶ Second stage: given  $n_i, m_i$  we can find profits ✓
- ▶ First stage: choose to be domestic or multinational
  
- ▶ Suppose there are  $n_1, n_2, m_1, m_2$  firms in the economy
- ▶ Would a domestic firm want to become a multinational?
  - ▶ Compare profits from each type of firm, choose largest

## One more multinational

- ▶ If a country-1 domestic firm becomes a multinational
  - ▶ One less country-1 domestic firm:  $n_1 \rightarrow n_1 - 1$
  - ▶ One more country-1 multinational firm:  $m_1 \rightarrow m_1 + 1$
- ▶ Compute domestic profit with  $n_1, n_2, m_1, m_2$
- ▶ Compute multinational profit with  $n_1 - 1, n_2, m_1 + 1, m_2$
- ▶ Compare the two

## Comparing ways to serve the foreign market

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► Subtract

$$\begin{aligned}\pi_1(n_1, n_2, m_1, m_2) &= \left( \frac{1}{n_1 + m_1 + m_2 + n_2\rho} \right) \times \frac{E_1}{\epsilon_1} \\ &+ \left( \frac{\rho}{n_2 + m_1 + m_2 + n_1\rho} \right) \times \frac{E_2}{\epsilon_2} \\ &- w_1 f^h - w_1 f^p\end{aligned}$$

from

$$\begin{aligned}\pi_1^m(n_1 - 1, n_2, m_1 + 1, m_2) &= \left( \frac{1}{(n_1 - 1) + (m_1 + 1) + m_2 + n_2\rho} \right) \times \frac{E_1}{\epsilon_1} \\ &+ \left( \frac{1}{n_2 + (m_1 + 1) + m_2 + (n_1 - 1)\rho} \right) \times \frac{E_2}{\epsilon_2} \\ &- w_1 f^h - w_1 f^p - w_2 f^p\end{aligned}$$

## Comparing ways to serve the foreign market

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- ▶ The difference in profits from switching to multinational

$$\Delta\pi_1^{d\rightarrow m} = \left[ \frac{1}{n_2 + (m_1 + 1) + m_2 + (n_1 - 1)\rho} - \frac{\rho}{n_2 + m_1 + m_2 + n_1\rho} \right] \frac{E_2}{\epsilon_2} - w_2 f^p$$

- ▶ First term is positive: gain from better market access
- ▶ Second term is negative: cost of replicating production

## The gain from multinational production

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$$\Delta \pi_1^{d \rightarrow m} = \left[ \frac{1}{n_2 + (m_1 + 1) + m_2 + (n_1 - 1)\rho} - \frac{\rho}{n_2 + m_1 + m_2 + n_1\rho} \right] \frac{E_2}{\epsilon_2} - w_2 f^p$$

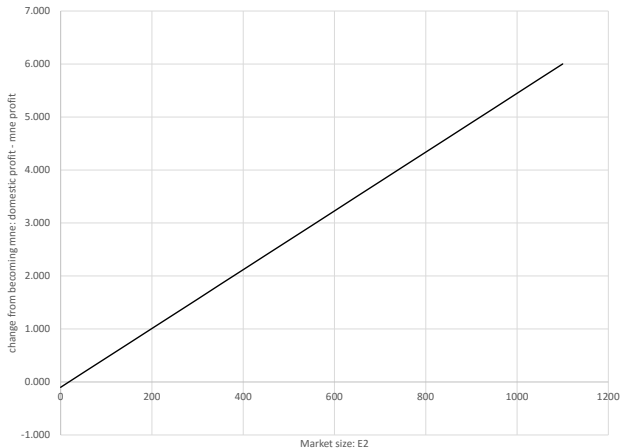
- ▶ Next three slides
  - ▶ Hold fixed  $n_i, m_i$
  - ▶ Change  $E_2$ : foreign market size
  - ▶ Change  $\rho$ : exporter penalty
  - ▶ Change  $f^p$ : production fixed cost
- ▶ How does the gain from being a MNE change?



## MNE gain vs. foreign market size ( $E_2$ )

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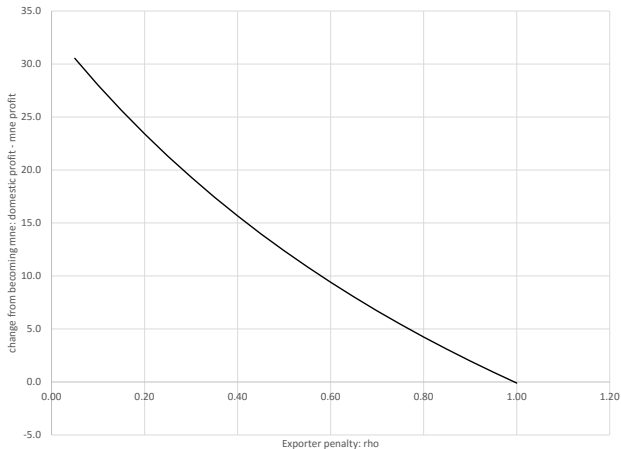
$$\Delta \pi_1^{d \rightarrow m} = \left[ \frac{1}{n_2 + (m_1 + 1) + m_2 + (n_1 - 1)\rho} - \frac{\rho}{n_2 + m_1 + m_2 + n_1 \rho} \right] \frac{E_2}{\epsilon_2} - w_2 f^p$$



## MNE gain vs. exporter penalty ( $\rho$ )

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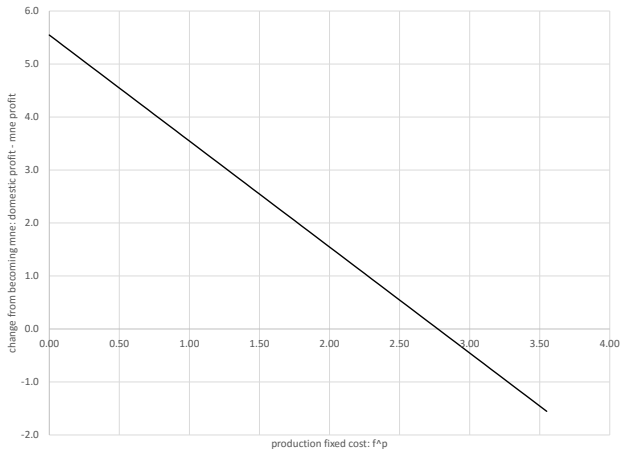
$$\Delta \pi_1^{d \rightarrow m} = \left[ \frac{1}{n_2 + (m_1 + 1) + m_2 + (n_1 - 1)\rho} - \frac{\rho}{n_2 + m_1 + m_2 + n_1 \rho} \right] \frac{E_2}{\epsilon_2} - w_2 f^p$$



## MNE gain vs. production fixed cost ( $\rho$ )

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$$\Delta \pi_1^{d \rightarrow m} = \left[ \frac{1}{n_2 + (m_1 + 1) + m_2 + (n_1 - 1)\rho} - \frac{\rho}{n_2 + m_1 + m_2 + n_1\rho} \right] \frac{E_2}{\epsilon_2} - w_2 f^p$$



## The proximity-concentration tradeoff

The number of multinational firms, relative to domestic firms is larger

1. the larger is the foreign market (larger  $E_j$ )
2. the larger are export costs (smaller  $\rho$ )
3. the smaller are production fixed costs (smaller  $w_j f^p$ )

### **Multinational facts**

- #1. Multinationals are concentrated in developed countries
- #3. Multinational activity falls off in the distance from the parent, *but exports fall off faster* [we have the second part, not the first]

## Takeaways

- ▶ How number and type of firms affects profits
  - ▶ Exporters are disadvantage because they pay higher costs
  - ▶ Multinationals skip higher export costs, but pay more fixed costs
- ▶ Proximity-concentration tradeoff
  - ▶ More multinationals relative to domestic firms when
    - ▶ larger foreign market
    - ▶ more expensive exporting
    - ▶ smaller fixed production costs

## A model in which firms are different

- ▶ Our model has identical firms
- ▶ Fact #4 says that MNEs are productive, and large
- ▶ Modify model to make firm heterogenous in productivity
- ▶ Study how firm differences affect export/MNE decision
- ▶ Much of the model stays the same
- ▶ Need to add a few new elements

## Change #1: market structure

- ▶ Each firm sells a differentiated product (shoes, fast food, beer)
- ▶ Consumers like to consume many varieties
- ▶ Each firm has a monopoly over its variety
- ▶ But imperfect substitutes mean only some price power
- ▶ Call this *monopolistic competition*
- ▶ Formalize this as a demand function

$$x(p) = E_i \times p^{-\epsilon}$$

## Change #2: heterogeneous productivity

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- ▶ Firms have different productivity,  $\varphi$
- ▶ Take differences in productivity as given

- ▶ Production function

$$x = \varphi l$$

- ▶ Marginal cost of production is  $1/\varphi \times w$ 
  - ▶ How does this differ from our earlier model?



## Change #3: export fixed costs

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- ▶ Still have “old” fixed costs:  $f^p, f^h$
- ▶ Add export fixed cost:  $f^e$
- ▶ What fixed costs might be associated with exporting?
- ▶ Setting up export operation cheaper than a new factory:  $f^e < f^p$

## Firm profits

- ▶ Three kinds of firms
- ▶ Non-exporting (domestic only) firms; exporters; multinationals
- ▶ Two countries,  $i = 1, 2$
- ▶ Work through country-1 firm decision problems...

## Non-exporting firms

- ▶ Only sell at home
- ▶ Choose price  $p$  to maximize profit

$$\pi_1(\varphi) = \left( p - \frac{1}{\varphi} w_1 \right) E_1 p^{-\epsilon_1} - w_1 f^h - w_1 f^p$$

- ▶ The solution is a mark-up over marginal cost

$$p = \frac{1}{\varphi} w_1 \frac{\epsilon_1}{\epsilon_1 - 1}$$

- ▶ How does price change with productivity?

## Non-exporting firms

- ▶ Substitute price back into profit function

$$\pi_1(\varphi) = \frac{1}{\epsilon_1 - 1} \frac{1}{\epsilon_1} \left( \frac{\epsilon_1}{\epsilon_1 - 1} \frac{1}{\varphi} w_1 \right)^{1 - \epsilon_1} E_1 - w_1 f^h - w_1 f^p$$

- ▶ How do profits change with productivity?

## In class problem: productivity and profit

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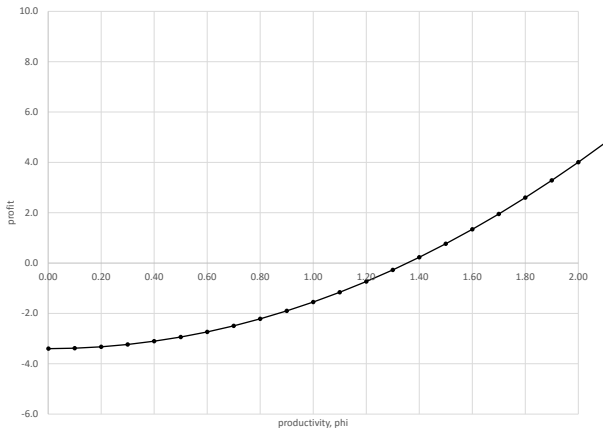
► 5-10 min, work with those around you

►  $w_1 = 2, E_1 = 50, \epsilon_1 = 3, f^h = 0.2, f^p = 1.5$

1. What price does a non-exporter with  $\varphi = 0.001$  charge in the home market? What are the firms profits? Should this firm be producing?
  
2. What price does a non-exporter with  $\varphi = \del{1.2} 1.5$  charge in the home market? What are the firms profits? Should this firm be producing?

## Profits and productivity

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► What firms can profitably operate?

## Exporting firms

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- ▶ Pay export fixed costs, pay trade cost  $\tau$
- ▶ How much profit does the firm earn from exporting?
- ▶ Choose price  $p_e$  to maximize profit

$$\pi_1^e(\varphi) = \left( p_e - \frac{1}{\varphi} w_1 (1 + \tau) \right) E_2 p_e^{-\epsilon_2} - w_1 f^e$$

- ▶ The solution is a mark-up over marginal cost

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

- ▶ Price rises to offset export costs (similar to having smaller  $\varphi$ )

## Exporting firms

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- ▶ Substitute price back into profit function

$$\pi_1^e(\varphi) = \frac{1}{\epsilon_2 - 1} \frac{1}{\epsilon_2} \left( \frac{\epsilon_2}{\epsilon_2 - 1} \frac{1}{\varphi} w_1 (1 + \tau) \right)^{1 - \epsilon_2} E_2 - w_1 f^e$$

- ▶ How do profits change with productivity?
- ▶ How does  $\tau$  impact profit?



## Multinational firms

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- ▶ Pay export production fixed cost abroad; avoid  $\tau$  and  $f^e$
- ▶ How much profit does the firm earn from affiliate sales?
- ▶ Choose price  $p_m$  to maximize profit

$$\pi_1^m(\varphi) = \left( p_m - \frac{1}{\varphi} w_2 \right) E_2 p_m^{-\epsilon_2} - w_2 f^p$$

- ▶ The solution is a mark-up over marginal cost

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

- ▶ Marginal cost now  $w_2$

## Multinational firms

- ▶ Substitute price back into profit function

$$\pi_1^m(\varphi) = \frac{1}{\epsilon_2 - 1} \frac{1}{\epsilon_2} \left( \frac{\epsilon_2}{\epsilon_2 - 1} \frac{1}{\varphi} w_2 \right)^{1 - \epsilon_2} E_2 - w_2 f^m.$$

- ▶ How do profits change with productivity?
- ▶ How does this compare to export profit?

## Exporting vs. multinational production

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

$$\pi_1^e(\varphi) = \frac{1}{\epsilon_2 - 1} \frac{1}{\epsilon_2} \left( \frac{\epsilon_2}{\epsilon_2 - 1} \frac{1}{\varphi} w_1 (1 + \tau) \right)^{1 - \epsilon_2} E_2 - w_1 f^e$$

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

$$\pi_1^m(\varphi) = \frac{1}{\epsilon_2 - 1} \frac{1}{\epsilon_2} \left( \frac{\epsilon_2}{\epsilon_2 - 1} \frac{1}{\varphi} w_2 \right)^{1 - \epsilon_2} E_2 - w_2 f^m$$

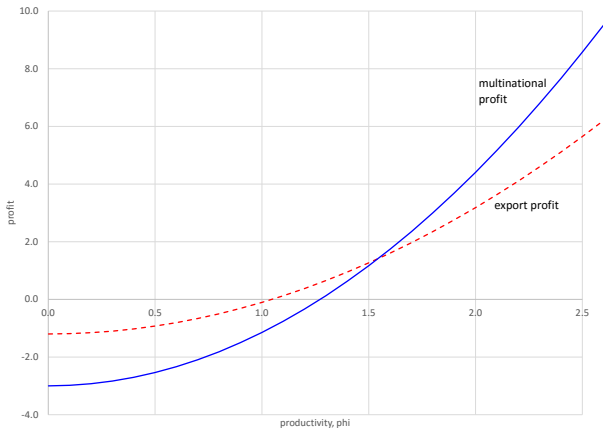
## In class problem: exporting vs. MNE

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- ▶ 5-10 min, work with those around you
  - ▶  $w_1 = w_2 = 2, E_2 = 50, \epsilon_2 = 3, f^p = 1.5, f^e = 0.6, \tau = 0.3$
1. Should a firm with  $\varphi = \cancel{1.20}$  1.5 export to serve the foreign market or use a foreign affiliate?
  2. Should a firm with  $\varphi = \cancel{1.50}$  2.0 export to serve the foreign market or use a foreign affiliate?

## Profits and productivity

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- Which firms export? Which firms become MNEs?

## Takeaways

- ▶ With heterogeneity, we get selection
  - ▶ low productivity firms do not export or have affiliates (in the example,  $\varphi < 1.1$ )
  - ▶ medium productivity firms export, but no affiliates (in the example,  $1.1 \leq \varphi < 1.55$ )
  - ▶ high productivity firms do not export, but use affiliates (in the example,  $1.55 \leq \varphi$ )
- ▶ MNEs are more productive than non-multinationals or exporters
- ▶ More productive firms are larger (have more sales)

## Intuition for selection

- ▶ Higher productivity means lower prices
  - ▶ Lower prices means larger operating profits
  - ▶ Fixed costs are constant
- ⇒ More productive firms earn enough profit to pay fixed costs
- ⇒ Larger fixed costs require more productive firms