

# Multinationals and the Globalization of Production

## *Horizontal FDI 2*

Penn State // Fall 2016

## Administrative things

- ▶ Sit in the first 3 rows!
- ▶ Arkaive.com course code: 3D0Y
  - ▶ Please sign in
- ▶ Problem set #1: due Thursday September 8, end of class
  - ▶ Print out copy, hand in to folder (no e-submission)
  - ▶ Can discuss with classmates, but turn in your own work
  - ▶ Read “problem set guidelines”

## August 2016 Employment Situation

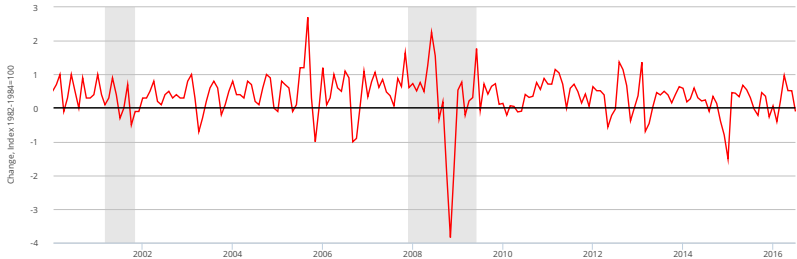
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- ▶ Released on Friday // Key data:
  - ▶ Change in payroll — net number of jobs created
  - ▶ Unemployment statistics
- ▶ What happened?
  - ▶ Net change in payroll = 151,000 (expected 180,000 or so)
  - ▶ Unemployment rate about the same = 4.9%
- ▶ FOMC meeting September 20–21
  1. “Stable prices”
  2. “Full employment”
- ▶ How will this affect FOMC decisions?

# CPI inflation

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FRED 



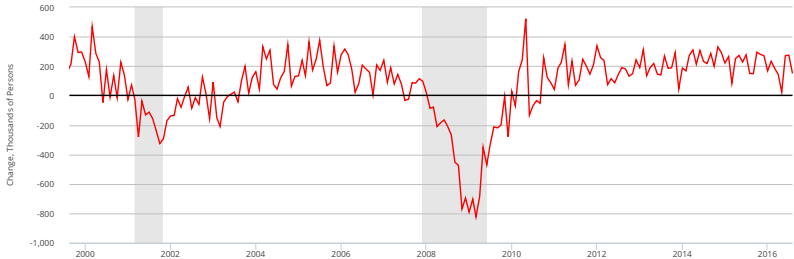
Source: US Bureau of Labor Statistics  
fred.stlouisfed.org

myf.red/g/6YKe

# Nonfarm payroll

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FRED 



Source: US Bureau of Labor Statistics  
fred.stlouisfed.org

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## Roadmap

- ▶ Past: Towards a model of horizontal FDI
  - ▶ Introduce a model of competition
  - ▶ The closed economy
- ▶ Present: Add a second country
  - ▶ Open economy with exporters
  - ▶ Introduce multinationals to the model
- ▶ Future: Formalize the proximity-concentration tradeoff

## Model overview (same as the other models)

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- ▶ Two countries (“markets”),  $i = 1, 2$
- ▶ Total expenditure in each country is  $E_i$
- ▶ Two kinds of firms
  - ▶ Domestic firms: only produce in their home country, export
  - ▶ Multinational firms: produce in both countries
- ▶ Many firms of each type
  - ▶  $n_i$  = number of domestic firms in  $i$
  - ▶  $m_i$  = number of multinational firms in  $i$

## Model overview

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- ▶ Two stages to the model
  1. Create firms and decide to be domestic or multinational
  2. Firms produce and earn profits
- ▶ Stage 1 is about determining  $n_1, m_1, n_2, m_2$
- ▶ Stage 2 takes  $n_1, m_1, n_2, m_2$  as given
- ▶ Solve the model by working backwards
  - ▶ First: given  $n_1, m_1, n_2, m_2$  compute profits
  - ▶ Second: given domestic and MNE profits, choose  $n_1, m_1, n_2, m_2$
- ▶ Today we work on stage 2 first, then stage 1



## Domestic (exporter) firm profits

- ▶ Use country 1 as an example, analogous problem in country 2
- ▶ Country-1 domestic firm profits are

$$\pi_1 = \frac{s_1 E_1}{\epsilon_1} + \frac{\rho s_2 E_2}{\epsilon_2} - w_1 f^h - w_1 f^p.$$

- ▶  $E_i, \rho, w_i, \epsilon_i, f^h, f^p$  are model parameters: take as given
- ▶ Use the adding up constraint to find  $s_1$  and  $s_2$

## Multinational-firm benefits

- ▶ Country-1 multinational serves country 2 by producing in 2
- ▶ Eliminates export costs, so market share is  $s_2$ , not  $\rho s_2$ 
  - ▶ Benefit of horizontal multinational production
  - ▶ Serve the foreign market at lower marginal cost
  - ▶ More competitive firm earns larger market share

## Multinational-firm costs

- ▶ Must pay production fixed cost in country 2
- ▶ Exporter fixed costs =  $w_1 f^h + w_1 f^p$
- ▶ Multinational fixed costs =  $w_1 f^h + w_1 f^p + w_2 f^p$ 
  - ▶ Cost of horizontal multinational production
  - ▶ Firm pays larger fixed costs

## Profits

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- ▶ Country-1 multinational's profit

$$\pi_1^m = \frac{s_1 E_1}{\epsilon_1} + \frac{s_2 E_2}{\epsilon_2} - w_1 f^h - w_1 f^p - w_2 f^p$$

- ▶ Compare to an exporter's profit

$$\pi_1 = \frac{s_1 E_1}{\epsilon_1} + \frac{\rho s_2 E_2}{\epsilon_2} - w_1 f^h - w_1 f^p$$

- ▶ Need to find shares to compute profits

## Finding shares

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- ▶ Shares sum to 1 (as always), but now with  $m_1$  and  $m_2$
- ▶ In country 1

$$1 = (n_1 + m_1 + m_2)s_1 + n_2\rho s_1$$
$$s_1 = \frac{1}{n_1 + m_1 + m_2 + n_2\rho}$$

- ▶ In country 2

$$1 = (n_2 + m_1 + m_2)s_2 + n_1\rho s_2$$
$$s_2 = \frac{1}{n_2 + m_1 + m_2 + n_1\rho}$$

## In class problem: Multinationals

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► 5-10 min, work with those around you

►  $w_1 = w_2 = 2, E_1 = E_2 = 1000, \epsilon_1 = 2, f^h = 0.5, f^p = 0.05, \rho = 0.9$

►  $n_1 = n_2 = 10$  and  $m_1 = m_2 = 2$

1. What are country-1 domestic firm's profits?
2. What are country-1 multinational firm's profits?
3. Why is  $\pi_1 < \pi_1^m$ ?

## 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



## Domestic firm with $n_1, n_2, m_1, m_2$

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$$\pi_1 = \frac{s_1 E_1}{\epsilon_1} + \frac{\rho s_2 E_2}{\epsilon_2} - w_1 f^h - w_1 f^p$$

► Shares are

$$s_1 = \frac{1}{n_1 + m_1 + m_2 + n_2 \rho} \qquad s_2 = \frac{1}{n_2 + m_1 + m_2 + n_1 \rho}$$

► Substitute the share expressions

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

## Multinational firm with $n_1 - 1, n_2, m_1 + 1, m_2$

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$$\pi_1 = \frac{s_1 E_1}{\epsilon_1} + \frac{s_2 E_2}{\epsilon_2} - w_1 f^h - w_1 f^p - w_2 f^p$$

- Shares are (note:  $s_1$  does not change)

$$s_1 = \frac{1}{n_1 - 1 + m_1 + 1 + m_2 + n_2 \rho} \quad s_2 = \frac{1}{n_2 + m_1 + 1 + m_2 + (n_1 - 1) \rho}$$

- Substitute the share expressions

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

## Comparing ways to serve the foreign market

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► 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

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

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

## In class problem: Become a multinational?

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► 5-10 min, work with those around you

►  $w_1 = w_2 = 2, E_1 = E_2 = 100, \epsilon_1 = 2, f^h = 0.5, f^p = 0.05, \rho = 0.9$

1000

0.75

►  $n_1 = n_2 = 10$  and  $m_1 = m_2 = 2$

1. How much extra profit would a country-1 domestic firm earn if it became a multinational?

2. Why is this different than the  $\pi_1^m - \pi_1 = 0.118$  in the earlier problem?

5.71

## The gain from multinational production

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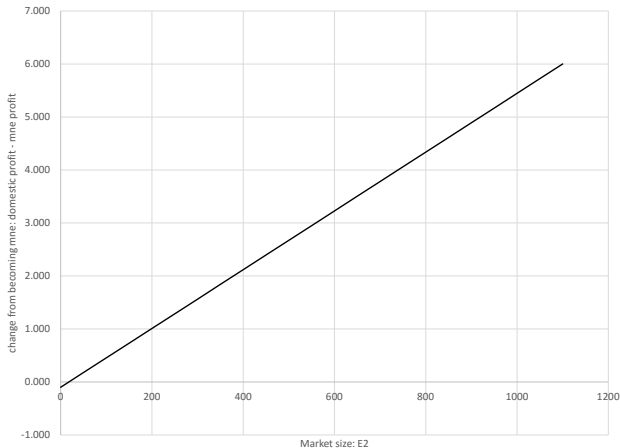
$$\Delta \pi_1^{d \rightarrow m} = \left[ \frac{1}{n_2 + (m_1 + 1) + m_2 + (n_1 - 1)\rho} - \frac{\rho}{n_2 + m_1 + m_2 + n_1\rho} \right] \frac{E_2}{\epsilon_2} - w_2 f^p$$

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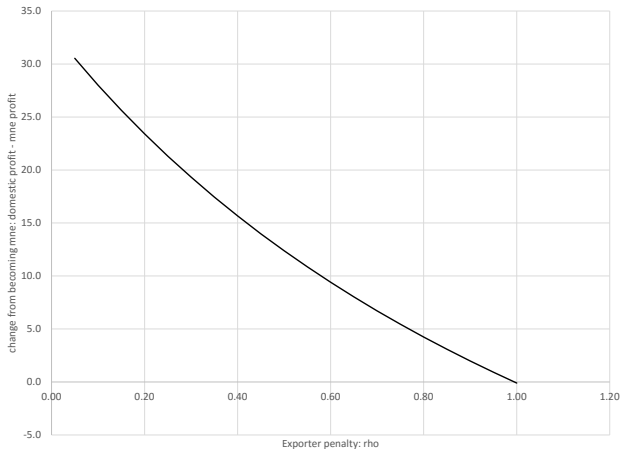
$$\Delta \pi_1^{d \rightarrow m} = \left[ \frac{1}{n_2 + (m_1 + 1) + m_2 + (n_1 - 1)\rho} - \frac{\rho}{n_2 + m_1 + m_2 + n_1 \rho} \right] \frac{E_2}{\epsilon_2} - w_2 f^p$$



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

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

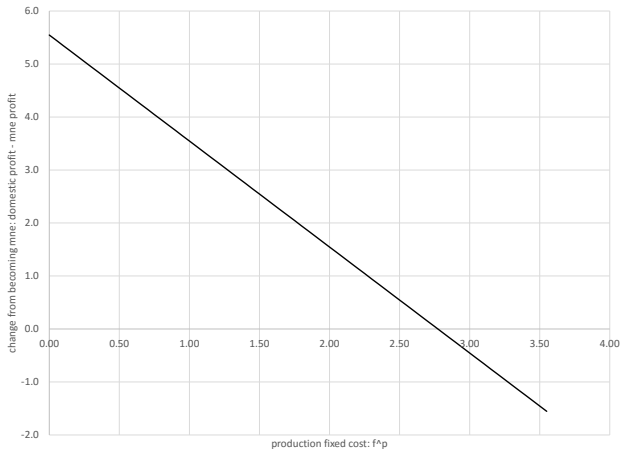




## MNE gain vs. production fixed cost ( $\rho$ )

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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  $w_j f^p$ )

## 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