# Multinationals and the Globalization of Production

## *Horizontal FDI: I*

Penn State // Fall 2017

# Administrative things

- Arkaive.com course code: 84ST
  - Please sign in
- Problem set #1: due Thursday September 7, end of class
  - Available ~~this afternoon~~ now
  - 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 2017 Employment Situation

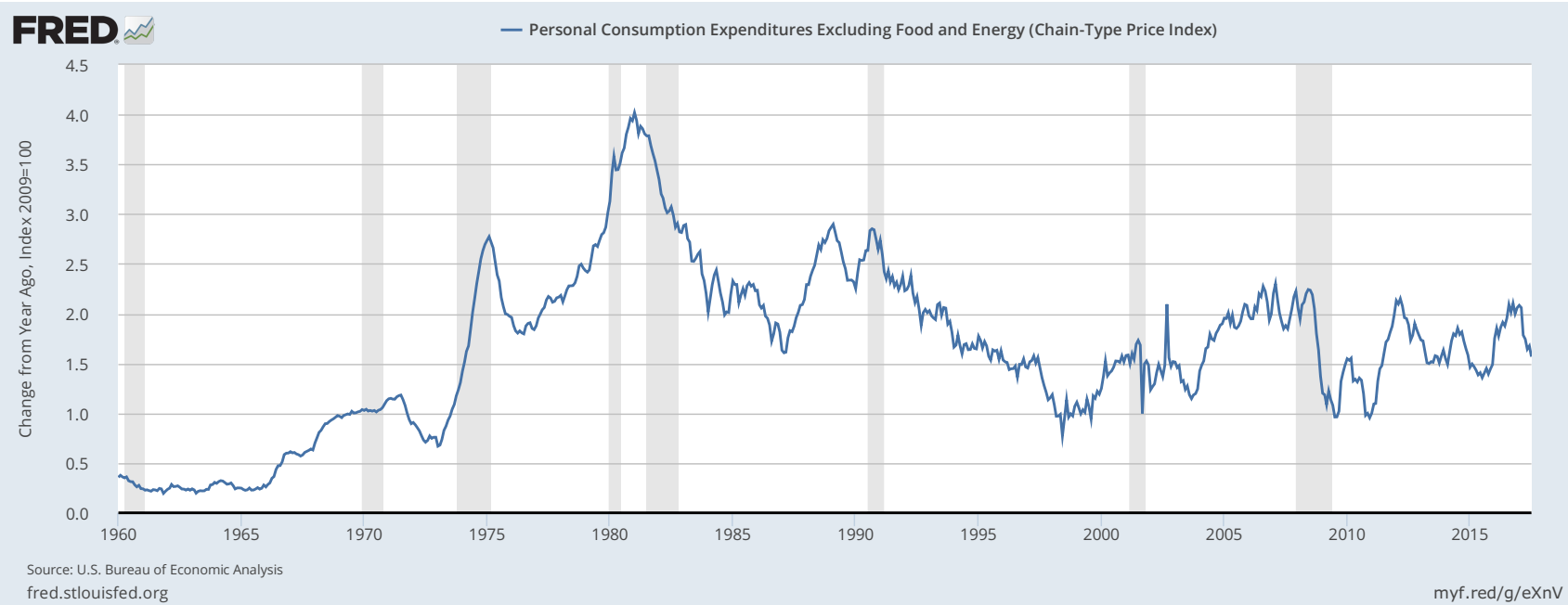
- Released on Friday // Key data:
  - Change in payroll — net number of jobs created
  - Unemployment statistics
- What happened?
  - Net change in payroll = 156,000 (expected 180,000 or so)
  - Unemployment rate about the same = 4.4%
  - Data collected pre-hurricane

$$= \frac{\#u}{\#u + \#e}$$

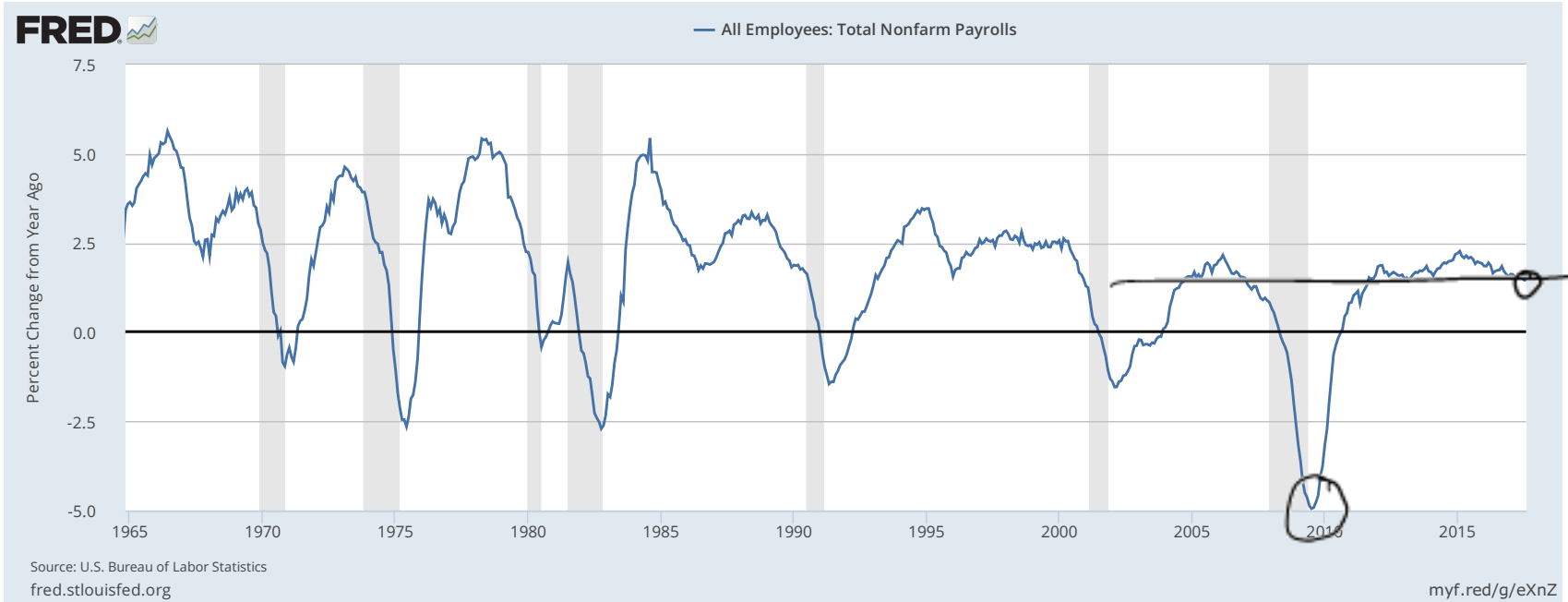
- FOMC meeting September 19–20
  1. "Stable prices"
  2. "Full employment"

- How will this affect FOMC decisions?

# CPI inflation



# Nonfarm payroll



# Roadmap

- Past: OLI framework
  - Identify MNE advantage
  - High-level analysis
- Past/present: MNE facts
  - Lays the foundation for model features
  - Way to asses model successes
- Present: Towards a model of horizontal FDI
  - Introduce a model of competition ✓
  - The closed economy ✓
  - Open economy with exporters and MNEs

# Horizontal FDI

- Horizontal FDI: Use affiliates to serve foreign market
- Relevant facts
  - More multinational activity in bigger markets
  - More multinational activity (compared to exports) with distance
- Important model ingredients
  - Exporting requires additional costs
  - Building a foreign affiliate requires a fixed cost
- Key tradeoff in the model
  - Saving on transport costs vs. saving on production fixed costs
  - Called the "proximity-concentration tradeoff"

# Model overview

- A firm would like to serve a foreign market. How?
  - Should it produce at home and export? (an exporter)
  - Should it produce abroad? (an MNE)
- The firm makes an either-or decision
  - We call these *discrete choice models*
- To solve a discrete choice model
  - Compute the profit from each choice (exporter, MNE)
  - Choose the one with the highest profit

Let $w = \$20$ $\varphi = 5$ $\tau = 0.1$

$\varepsilon_2 = \varepsilon_1 = 2$

$$p = \frac{w}{\varphi}\frac{\varepsilon}{\varepsilon-1} = \frac{20}{5}\frac{2}{2-1} = \$8$$

$\$4 \times 2$

$$p_e = \frac{w}{\varphi}\frac{\varepsilon_2}{\varepsilon_2-1}(1+\tau) = \frac{20}{5}\frac{2}{2-1}(1.1) = \$8.80$$

# Exporters

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

$$\pi_1^e(\varphi) = \left(p - \frac{w_1}{\varphi}\right) E_1 p^{-\epsilon_1} + \left(p_e - \frac{w_1}{\varphi}(1+\tau)\right) E_2 p_e^{-\epsilon_2} - w_1 f^e - w_1 f^p$$

- The solution is a mark-up over marginal cost

$$p = \frac{w_1}{\varphi}\frac{\epsilon_1}{\epsilon_1 - 1} \qquad p_e = \frac{w_1}{\varphi}\frac{\epsilon_2}{\epsilon_2 - 1}(1+\tau)$$

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

# Exporting firms

- Substitute prices back into profit function

$$\pi_1^e(\varphi) = \frac{1}{\epsilon_1}\left(\frac{\epsilon_1}{\epsilon_1 - 1}\frac{w_1}{\varphi}\right)^{1-\epsilon_1} E_1 + \frac{1}{\epsilon_2}\left(\frac{\epsilon_2}{\epsilon_2 - 1}\frac{w_1}{\varphi}(1+\tau)\right)^{1-\epsilon_2} E_2 - w_1 f^p - w_1 f^e$$

domestic profit

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

$\uparrow \tau \longrightarrow p_e \uparrow \longrightarrow$ sales $\downarrow \longrightarrow \pi \downarrow$

# Multinational firms

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

$$\pi_1^m(\varphi) = \left(p - \frac{w_1}{\varphi}\right) E_1 p_m^{-\epsilon_1} + \left(p_m - \frac{w_2}{\varphi}\right) E_2 p_m^{-\epsilon_2} - w_1 f^p - w_2 f^p$$

- The solution is a mark-up over marginal cost

$$p = \frac{w_1}{\varphi} \frac{\epsilon_1}{\epsilon_1 - 1} \qquad p_m = \frac{w_2}{\varphi} \frac{\epsilon_2}{\epsilon_2 - 1}$$

- Marginal cost now $w_2/\varphi$ "ownership advantage"

Firm transfers its technology, $\varphi$, to other plant

# Multinational firms

- Substitute price back into profit function

$$\pi_1^m(\varphi) = \frac{1}{\epsilon_1}\left(\frac{\epsilon_1}{\epsilon_1 - 1}\frac{w_1}{\varphi}\right)^{1-\epsilon_1} E_1 + \frac{1}{\epsilon_2}\left(\frac{\epsilon_2}{\epsilon_2 - 1}\frac{w_2}{\varphi}\right)^{1-\epsilon_2} E_2 - w_1 f^p - w_2 f^p$$

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

$f^p$ rather than $f^e$

no $(1+\tau)$

marginal cost is $\frac{w_2}{\varphi}$ rather than $\frac{w_1}{\varphi}$

# Exporting vs. multinational production

- Exporter

$$\pi_1^e(\varphi) = \frac{1}{\epsilon_1}\left(\frac{\epsilon_1}{\epsilon_1 - 1}\frac{w_1}{\varphi}\right)^{1-\epsilon_1} E_1 + \frac{1}{\epsilon_2}\left(\frac{\epsilon_2}{\epsilon_2 - 1}\frac{w_1}{\varphi}(1+\tau)\right)^{1-\epsilon_2} E_2 - w_1 f^p - w_1 f^e$$

- MNE

$$\pi_1^m(\varphi) = \frac{1}{\epsilon_1}\left(\frac{\epsilon_1}{\epsilon_1 - 1}\frac{w_1}{\varphi}\right)^{1-\epsilon_1} E_1 + \frac{1}{\epsilon_2}\left(\frac{\epsilon_2}{\epsilon_2 - 1}\frac{w_2}{\varphi}\right)^{1-\epsilon_2} E_2 - w_1 f^p - w_2 f^p$$

is $\pi_1^m(\varphi) \gtrless \pi_1^e(\varphi)$

- Which method delivers the greatest profit?
- Domestic profits are the same in each case, so we can ignore them

# Exporting vs. multinational production

$\varphi = 1.5$

$\varphi = 2.0$

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

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

↑ extra profit if exporter

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

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

extra profit if MNE

# In class problem: exporting vs. MNE

- 5-10 min, work with those around you
- $w_1 = w_2 = 2$, $E_2 = 50$, $\epsilon_2 = 3$, $f^p = 1.7$, $f^e = 0.6$, $\tau = 0.3$

**1.** Should a firm with $\varphi = 1.5$ export to serve the foreign market or use a foreign affiliate?

**2.** Should a firm with $\varphi = 2.0$ export to serve the foreign market or use a foreign affiliate?

# In class problem: exporting vs. MNE

- $w_1 = w_2 = 2, E_2 = 50, \epsilon_2 = 3, f^p = 1.7, f^e = 0.6, \tau = 0.3$

**1.** Should a firm with $\varphi = 1.5$ export to serve the foreign market or use a foreign affiliate?

$$\Delta \pi_i^e(1.5) = \frac{1}{3}\left(\frac{3}{3-1}\frac{2}{1.5}1.3\right)^{-2} 50 - \underbrace{2 \times 0.6}_{1.2} = 1.27$$

$2.47$

$P_e = 2.6$

$$\Delta \pi_i^m(1.5) = \frac{1}{3}\left(\frac{3}{3-1}\frac{2}{1.5}\right)^{-2} 50 - \underbrace{2 \times 1.7}_{3.4} = 0.767$$

$4.17$

$P_m = 2.0$

# In class problem: exporting vs. MNE

- $w_1 = w_2 = 2, E_2 = 50, \epsilon_2 = 3, f^p = 1.7, f^e = 0.6, \tau = 0.3$

**2.** Should a firm with $\varphi = 2.0$ export to serve the foreign market or use a foreign affiliate?

$$\Delta \pi_1^e(2.0) = \underbrace{\frac{1}{3}\left(\frac{3}{3-1}\frac{2}{2.0}1.3\right)^{-2} 50}_{4.38} - \underbrace{2 \times 0.6}_{1.2} = 3.183$$

[vs. 2.47 if $\varphi = 1.5$]

$$\Delta \pi_1^m(2.0) = \underbrace{\frac{1}{3}\left(\frac{3}{3-1}\frac{2}{2.0}\right)^{-2} 50}_{7.41} - \underbrace{2 \times 1.7}_{3.4} = 4.01$$

[vs. 4.17 if $\varphi = 1.5$]

Large sales, the more hurtful is $\tau$

# $\Delta\pi_1^m(\varphi)$ vs. $\Delta\pi_1^e(\varphi)$