

# Multinationals and the Globalization of Production

## *Horizontal FDI: Preliminaries*

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
  - ▶ Print out copy, hand in to folder (no e-submission)
  - ▶ Can discuss with classmates, but turn in your own work
  - ▶ Read “problem set guidelines”

This week's news...

# WHOLE FOODS® MARKET

Columbus Circle CIR  
10 Columbus Circle  
New York City, NY 10023  
212-823-9600

OVF OG LG EGGS	\$6.19 F
OG HASS AVOCADO BAG	\$6.99 F
365 CRNCHY ALMD BTR	\$7.99 F
365 UNSLTD BUTTER OG	\$5.29 F
OG WTG BANANA	
1.58 lb @ \$0.99 / lb	\$1.56 F
Tare Weight 0.01lb	
Subtotal:	\$28.02
Net Sales:	\$28.02
Tax/Fee:	\$0.00
Total:	\$28.02
Sold Items:	5

Paid:  
VISA \$28.02

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CREDIT CARD

# WHOLE FOODS® MARKET

Columbus Circle CIR  
10 Columbus Circle  
New York City, NY 10023  
212-823-9600

OG HASS AVOCADO BAG	\$6.99 F
365 CRNCHY ALMD BTR	\$6.99 F
365 UNSLTD BUTTER OG	\$4.49 F
OG WTG BANANA	
1.57 lb @ \$0.69 / lb	\$1.08 F
Tare Weight 0.01lb	
OVF OG LG EGGS	\$4.49 F
Subtotal:	\$24.04
Net Sales:	\$24.04
Tax/Fee:	\$0.00
Total:	\$24.04
Sold Items:	5

Paid:  
VISA \$24.04

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CREDIT CARD

PURCHASE

Source: NYT <https://goo.gl/NNNfNb>

## Roadmap

- ▶ Past: OLI framework
  - ▶ Identify MNE advantage
  - ▶ High-level analysis
- ▶ Past/present: MNE facts
  - ▶ Lays the foundation for model features
  - ▶ Way to assess 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

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- ▶ 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

## Model: Industrial structure

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- ▶ This is a model of an industry
  - ▶ Examples: women's shoes, men's suits, cell phones, candy...
- ▶ Two countries ("markets"),  $i = 1, 2$
- ▶ Total expenditure on the industry in each country is  $E_i$ 
  - ▶ Example: German expenditure on candy
  - ▶ Assume the market size is fixed

## Model: Industrial structure

- ▶ Each firm in the industry sells a differentiated product
  - ▶ Mars (US), Barcel (MX), Nestle (CH), Hershey (US), Meiji (JP)...
- ▶ Each firm has a monopoly over its variety...
  - ▶ Only Mars can make Snickers
  - ▶ Only Barcel can make Bubu Lubu
  - ▶ Only Hershey can make Special Dark
- ▶ ...but varieties are imperfect substitutes
- ▶ Call this industrial structure *monopolistic competition*
  - ▶ Firms has some market power: can set its price
  - ▶ Pricing power limited by available substitutes



## Model: Industrial structure

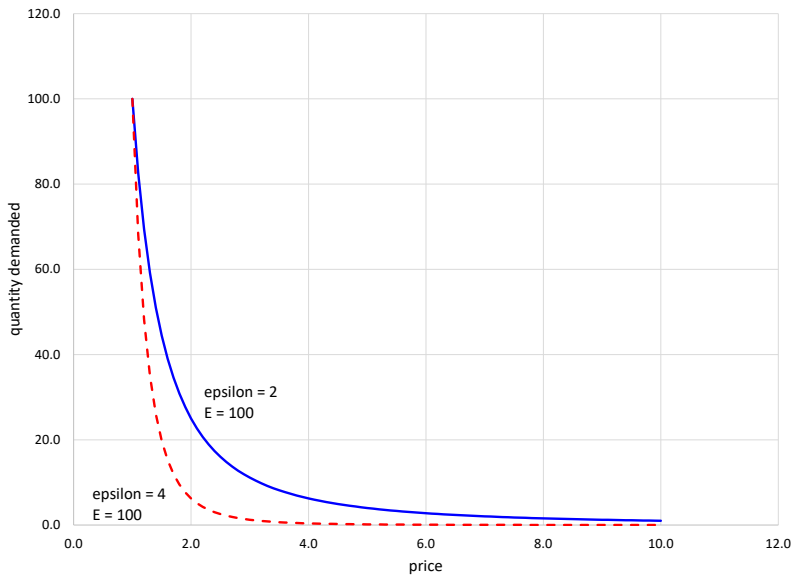
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- ▶ Formalize this in a demand function

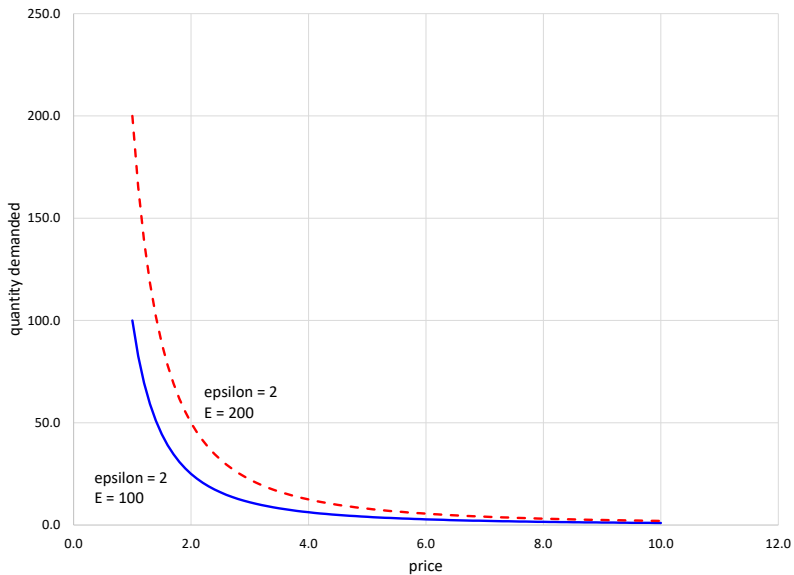
$$x(p) = E_i \times p^{-\epsilon}$$

- ▶  $x$  is the quantity demand when price is  $p$
- ▶  $p$  is the price charged by firm
- ▶  $\epsilon > 1$  is the elasticity of substitution
- ▶  $E_i$  is total market size
  
- ▶ Example:  $E_i = 100, \epsilon_i = 2, p = 2;$        $x(2) = ?$
- ▶ Example:  $E_i = 100, \epsilon_i = 2, p = 5;$        $x(5) = ?$

## Quantity demanded and elasticity



## Quantity demanded and market size



## Model: Production

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- ▶ Each firm produces its variety according to

$$x = \varphi \ell$$

- ▶  $x$  is output (number of units)
  - ▶  $\varphi$  is productivity (output per input)
  - ▶  $\ell$  is labor input (hours of work), paid wage  $w$
- ▶ The marginal cost is  $w/\varphi$ 
    - ▶ To make a unit of output requires  $1/\varphi$  units of labor
    - ▶ Example:  $\varphi = 5, w = 20$ ;       $mc = ?$
    - ▶ Example:  $\varphi = 10, w = 20$ ;       $mc = ?$
  - ▶ We will talk more about  $\varphi$  later

## Model: Production costs

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- ▶ The firm pays variable costs (wages on labor hired)
- ▶ The firm also pays a fixed cost to produce:  $f^p$ 
  - ▶ Pay  $f^p$  regardless of quantity produced
  - ▶ “Overhead” costs: plant rent, manager salaries ...
- ▶ Total cost is variable cost + fixed cost

$$\text{total cost of } x \text{ units} = x \frac{w}{\varphi} + wf^p$$

## Firm profits

- ▶ Three kinds of firms
  - ▶ Domestic firms (produce and sell only in home country)
  - ▶ Exporters (produce only in home, sell to both markets)
  - ▶ Multinationals (produce in both markets, sell in both markets)
  
- ▶ Work through country-1 firm decision problems
  
- ▶ Country-2 firm decision problem similar

## Domestic firm profit

- ▶ Only produce and sell at home
- ▶ Profit is revenues minus costs

$$\pi_1(\varphi) = px(p) - x(p)\frac{w_1}{\varphi} - w_1f^p$$

$$\pi_1(\varphi) = \left(p - \frac{w_1}{\varphi}\right)x(p) - w_1f^p$$

- ▶ Substitute the demand function

$$\pi_1(\varphi) = \left(p - \frac{w_1}{\varphi}\right)E_1p^{-\epsilon_1} - w_1f^p$$

- ▶ The only firm choice variable is  $p$

## Domestic firm profit

- ▶ The firm's maximization problem is

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

- ▶ Q: What price should the firm charge?
- ▶ A: Set marginal revenue = marginal cost

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

- ▶ Solve for  $p$

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

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



## Domestic prices

- ▶ Price is markup over marginal cost

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

- ▶ How does price change with productivity?
- ▶ How does price change with the elasticity?
  
- ▶ Example:  $\varphi = 5, w = 20, \epsilon = 2$ ;      markup =?       $p = ?$
- ▶ Example:  $\varphi = 5, w = 20, \epsilon = 5$ ;      markup =?       $p = ?$

## Domestic firm profit

- ▶ Substitute price back into profit function

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

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

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

- ▶ How do profits change with productivity?

## In class problem: productivity and profit

▶ 5-10 min, work with those around you

▶  $w_1 = 2, E_1 = 50, \epsilon_1 = 3, f^p = 1.7$

1. What price does a domestic firm with  $\varphi = 0.1$  charge in the home market? What are the firm's profits, sales, and employment? Should this firm be producing?
  
2. What price does a domestic firm with  $\varphi = 1.5$  charge in the home market? What are the firm's profits, sales, and employment? Should this firm be producing?

## In class problem: productivity and profit

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►  $w_1 = 2, E_1 = 50, \epsilon_1 = 3, f^p = 1.7$

1. What price does a domestic firm with  $\varphi = 0.1$  charge in the home market? What are the firms profits, sales, and employment? Should this firm be producing?

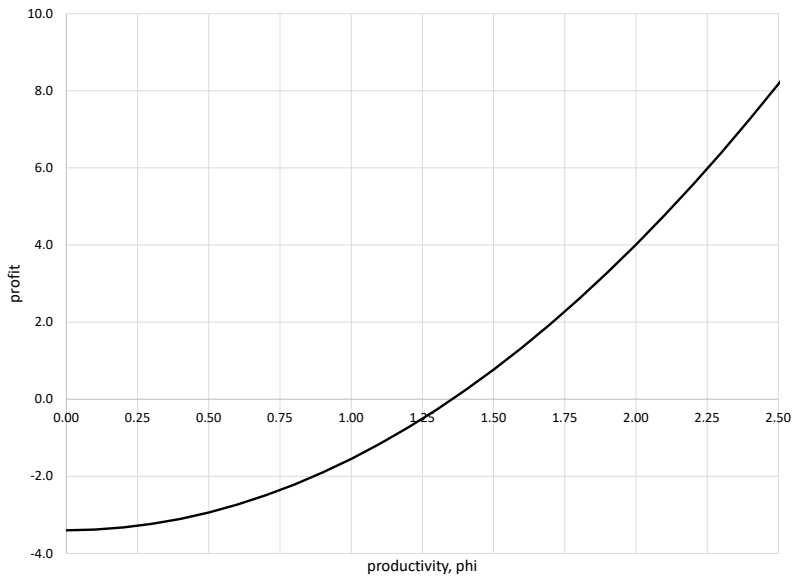
## In class problem: productivity and profit

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►  $w_1 = 2, E_1 = 50, \epsilon_1 = 3, f^p = 1.7$

1. What price does a domestic firm with  $\varphi = 1.5$  charge in the home market? What are the firms profits, sales, and employment? Should this firm be producing?

## Productivity and profits



## Firms and productivity

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- ▶ As productivity ( $\varphi$ ) increases
  - ▶ price falls
  - ▶ quantity rises
  - ▶ employment rises
  - ▶ sales rise
  - ▶ **average** cost falls

## Back to productivity

- ▶ So far, we have considered a firm with a productivity  $\varphi$
- ▶ How should we think about this?
  - ▶ Lots of potential firms in the world
  - ▶ Each potential firm has an idea about how to produce  $\varphi$
  - ▶ Some potential firms have good ideas  $\rightarrow$  high  $\varphi$
  - ▶ Some potential firms have bad ideas  $\rightarrow$  low  $\varphi$



# Potential firms



# Potential firms

