



# International Economics

## Fall 2011

### Trade Model with Imperfect Competition

Paul Deng  
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# Today's Plan

- Why imperfect competition model?
- (Internal) economies of scale
  - Monopolistic competition
  - Impact on international trade
- External economies of scale
  - Why do firms cluster together?
  - Impact on international trade



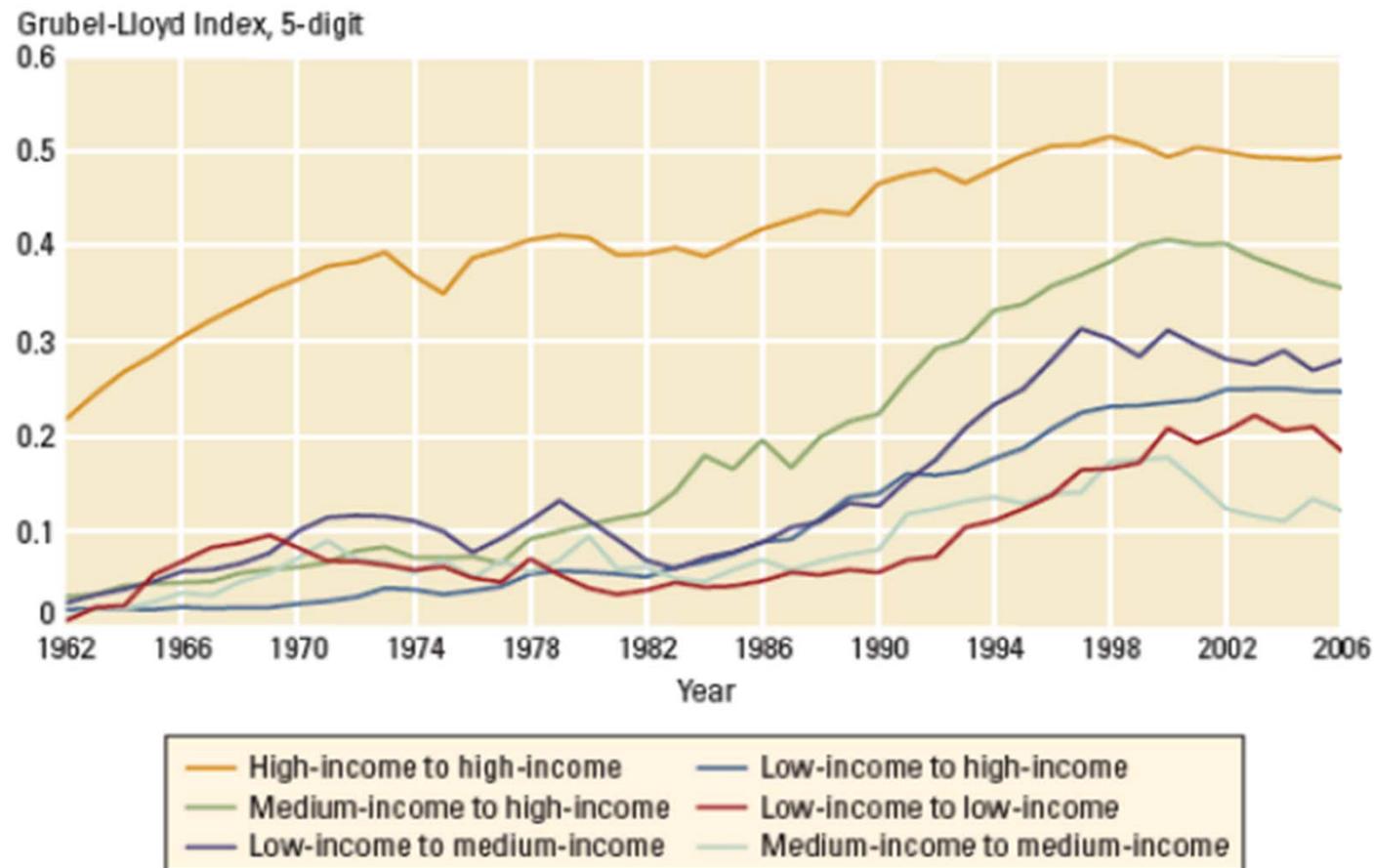
# Why do we need an imperfect competition model?

## Indexes of Intra-industry Trade for U.S. Industries, 1993

Inorganic chemicals	0.99
Power-generating machinery	0.97
Electrical machinery	0.96
Organic chemicals	0.91
Medical and pharmaceutical	0.86
Office machinery	0.81
Telecommunications equipment	0.69
Road vehicles	0.65
Iron and steel	0.43
Clothing and apparel	0.27
Footwear	0.00

Note: an index of 1 means that all trade is intra-industry trade.  
An index of 0 means that all trade is inter-industry trade.

# How important is intra-industry trade?



Source: Brühlhart 2008 for this Report.

Note: The Grubel-Lloyd index is the fraction of total trade that is accounted for by intraindustry trade.



## Why do we need an imperfect competition model?

- Intraindustry trade accounts for about  $\frac{1}{4}$  of world trade
- Mostly in manufacturing goods among advanced industrial economies. Not between developed and developing countries as Ricardian and HO models would predict.
- And mostly within the **same** industry with no difference in their comparative advantage
- We need a theory to explain such trade pattern

# Paul Krugman won 2008 Nobel prize

- **Increasing Returns, Monopolistic Competition, and International Trade**, P. Krugman, *Journal of International Economics* 9: 469–479, 1979
- **Scale Economies, Product Differentiation, and the Pattern of Trade**, P. Krugman, *American Economic Review* 70: 950–959, 1980



Krugman, Princeton University



# What's the core idea?

- Essentially, we are looking for a theory that can explain why countries (and firms) have incentives to trade with each other, even though there is no comparative advantage involved.
- Like Ricardian and HO theory, there have to be gains from international trade to motivate trading activities. So where do these gains come from?
- In Krugman's theory, the extra gains come from *economies of scale*, where each firm produces less varieties of goods, but at much larger scale, driving down the average cost of production.
- Thus, firms in each country can produce similar goods but with different characteristics (or product differentiation) at much larger scale (with lower cost). These goods are similar but not direct substitutes. Because consumers have taste for varieties, intra-industry trade rises.



# Where do extra gains come from?

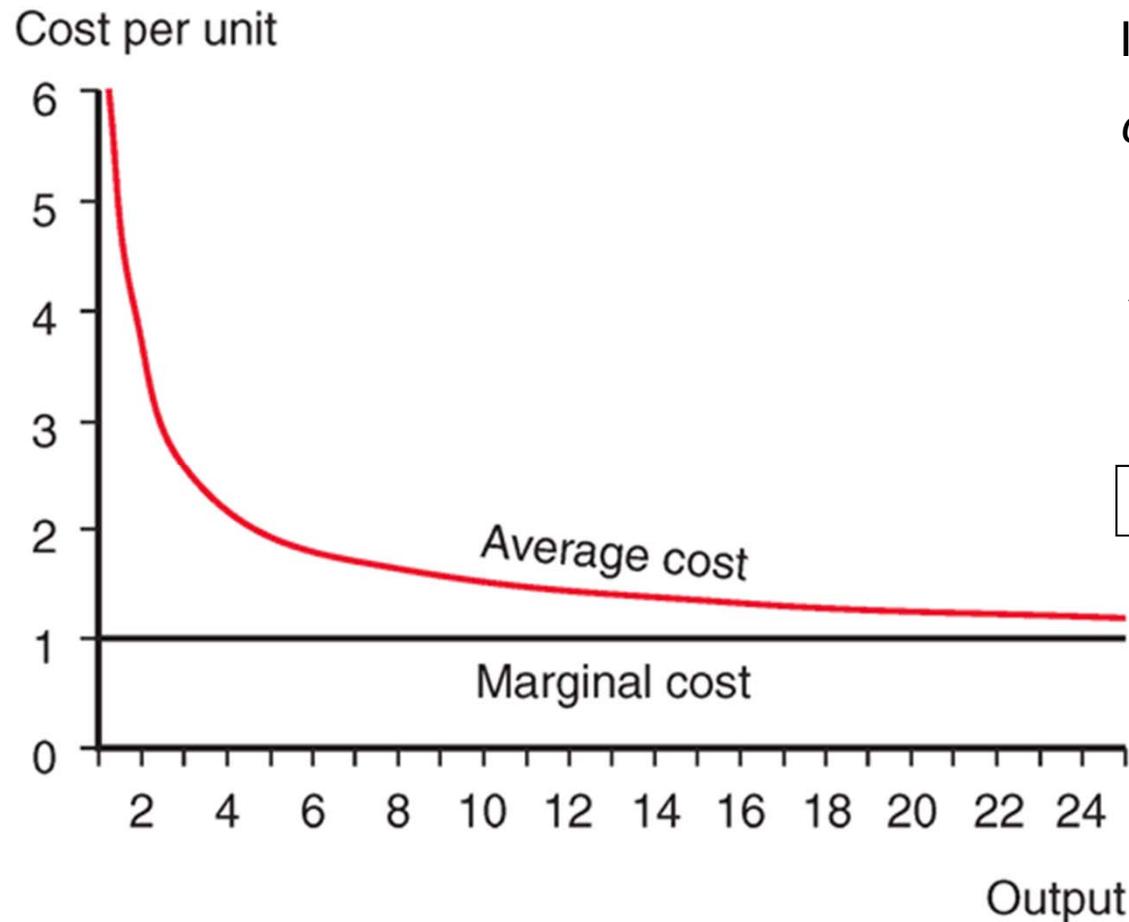
## Relationship of Input to Output for a Hypothetical Industry

Output	Total Labor Input	Average Labor Input
5	10	2
10	15	1.5
15	20	1.333333
20	25	1.25
25	30	1.2
30	35	1.166667

➔ Increasing return to scale, lower average cost

# Economies of scale bring down average cost (AC)

## Average versus Marginal Cost



In mathematical terms:

cost function:

$$C = F + cQ$$

→

$$AC = F/Q + c$$

average cost

fixed cost

marginal cost



# A model of monopolistic competition

## ■ Key assumptions

- First, each firm is assumed to be able to differentiate its product from that of its rivals. This product differentiation assures that each firm has a monopoly in its own product within the same industry.
- Second, each firm is assumed to take the prices charged by its rivals as given, i.e., it ignores the impact of its own price on the prices of other firms and vice versa.



# A model of monopolistic competition

How number of firms,  $n$  and price are determined:

A typical demand function looks like this:

$$Q = S * [1/n - b * (P - \bar{P})] \quad (1)$$

Which says firm's demand depends positively with market size,  $S$ , negatively with its own price  $P$ , and positively with the average price charged by other firms,  $\bar{P}$ .

$S$ : total sales of the industry, measuring the size of the market

$n$ : the number of firms in the industry

$\bar{P}$ : the average price charged by competitors

If all firms charge the same price, i.e.,  $P = \bar{P}$ , then we have  **$Q = S/n$**

Since we have  $AC = F/Q + c$ , plug in  $Q = S/n$

$$\rightarrow \mathbf{AC = n * F/S + c} \quad (F, S, c \text{ are all constant}) \quad (2)$$

→ This is the relationship between number of firms and average cost

# A model of monopolistic competition

- How number of firms,  $n$  and price are determined:

$$Q = S^* [1/n - b^* (P - \bar{P})] \quad (1)$$

$$\rightarrow Q = (S/n + S^*b^* \bar{P}) - S^*b^*P$$

$$\rightarrow \text{let } A = S/n + S^*b^* \bar{P} \text{ and } B = S^*b$$

$$\rightarrow Q = A - B^*P$$

$$\rightarrow P = A/B - Q/B$$

$$\rightarrow TR = P^*Q = Q^*A/B - Q^*Q/B$$

$$\rightarrow MR = A/B - 2^*Q/B = (A/B - Q/B) - Q/B$$

$$\rightarrow MR = P - Q/B = P - Q/(S^*b) \text{ (using } B = S^*b)$$

*Profit maximizing firms set  $MR = MC = c$*

$$\rightarrow P - Q/(S^*b) = c$$

$$\rightarrow P = c + Q/(S^*b) \text{ since } Q = S/n$$

$$\rightarrow \mathbf{P = c + 1/(b^*n)} \quad (3)$$

# A model of monopolistic competition

## Equilibrium in a Monopolistically Competitive Market

Combining eq (2):

$$AC = n \cdot F/S + c$$

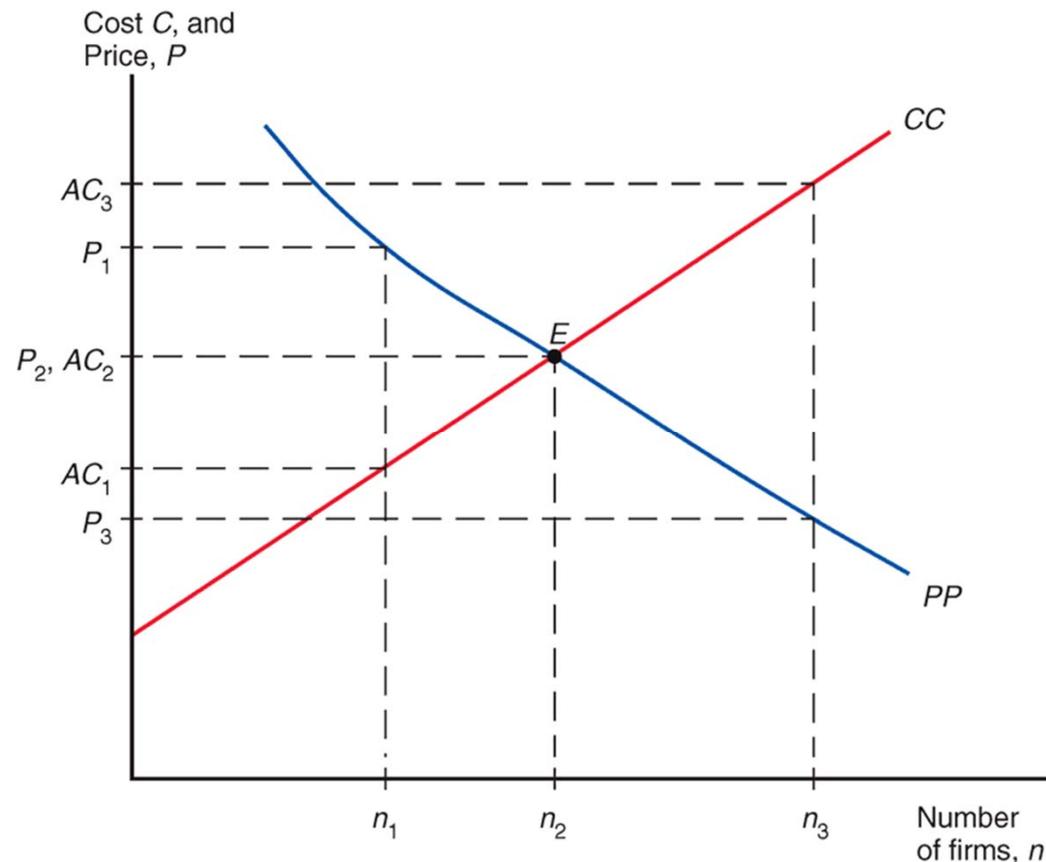
(in red line)

and eq (3):

$$P = c + 1/(b \cdot n) \rightarrow$$

(in blue line)

@ equilibrium  
point E,  $P = AC$



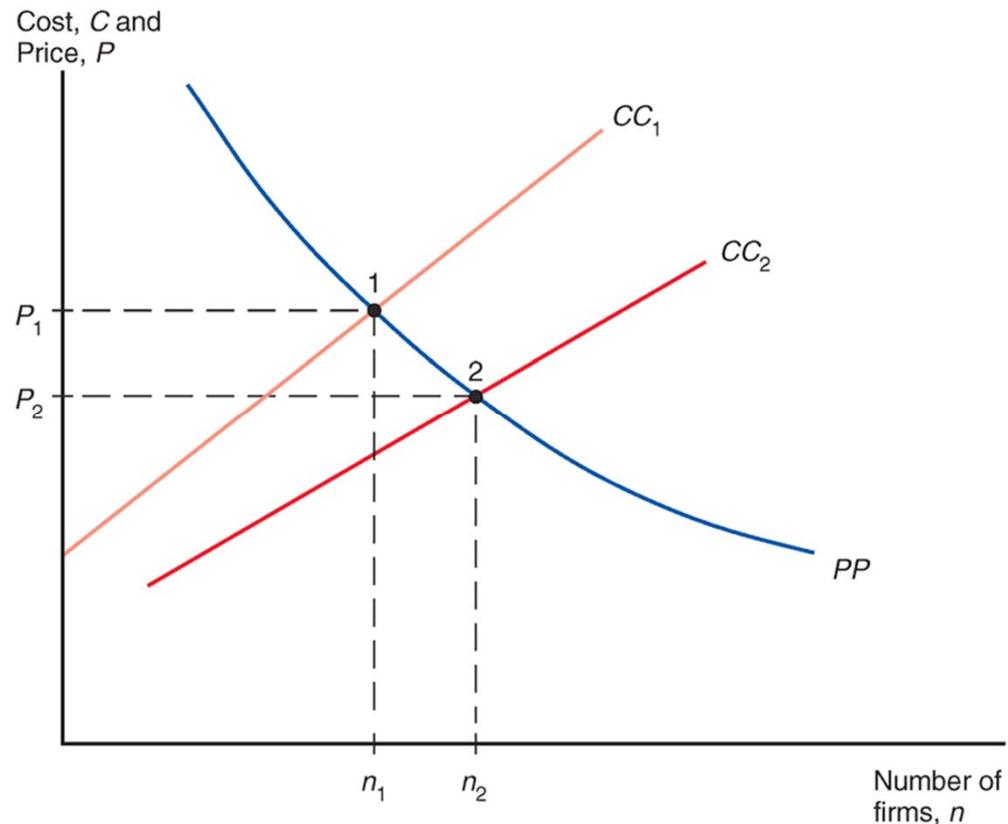
# A model of monopolistic competition

With international trade, firms gain access to larger market, i.e,  $S$  increases

Since  $AC = n \cdot F/S + c$ , as  $S \uparrow$ ,  $AC \downarrow$ , resulting in a downward shift of CC curve, from  $CC_1$  to  $CC_2$ .

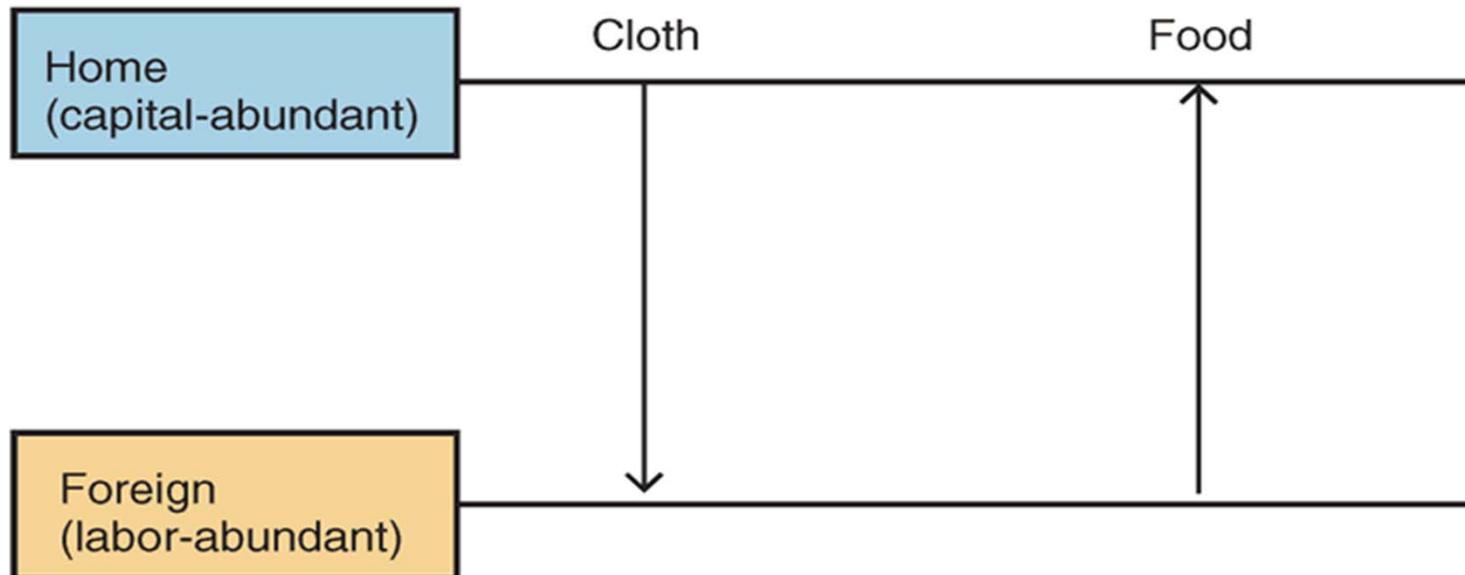
@ new equilibrium point 2, firm produces at lower cost, and consumers enjoys lower prices

## Effects of a Larger Market



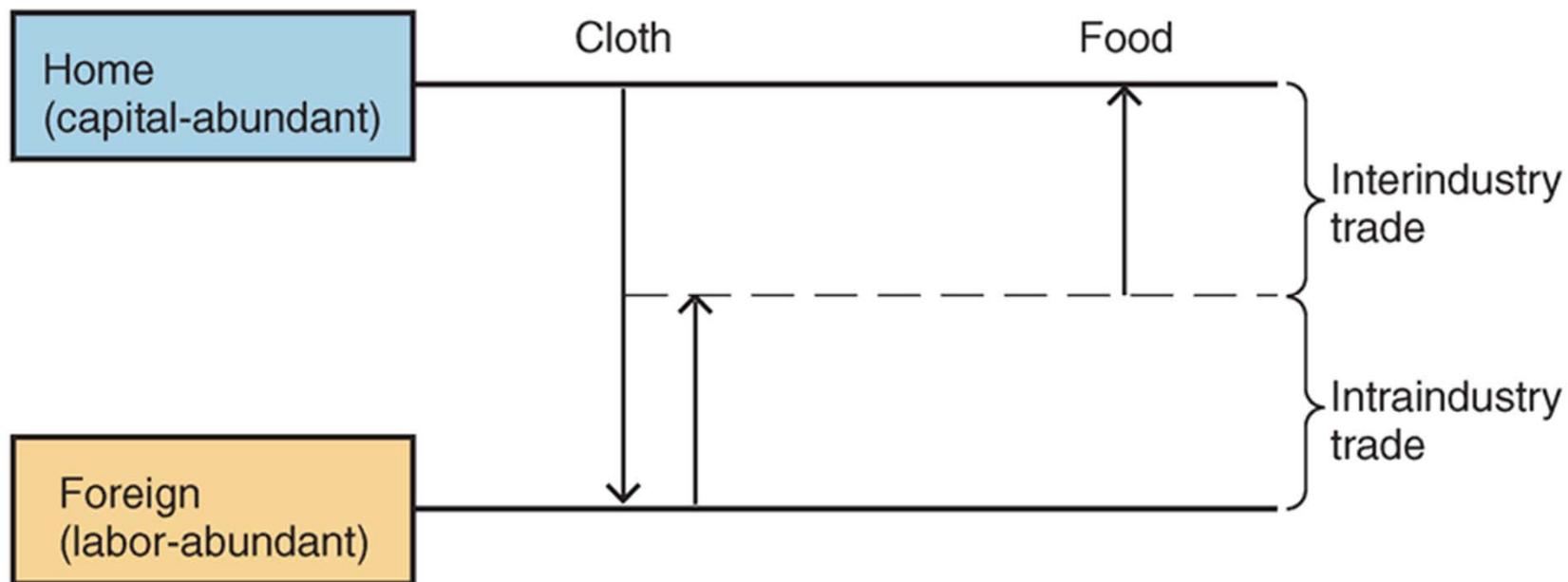
# How economies of scale change pattern of trade

## Trade in a World Without Increasing Returns



# How economies of scale change pattern of trade

Trade with Increasing Returns and Monopolistic Competition





# Gains from Economies of Scale and Trade

## Hypothetical Example of Gains from Market Integration

	<b>Home Market, Before Trade</b>	<b>Foreign Market, Before Trade</b>	<b>Integrated Market, After Trade</b>
Total sales of autos	900,000	1,600,000	2,500,000
Number of firms	6	8	10
Sales per firm	150,000	200,000	250,000
Average cost	\$10,000	\$8,750	\$8,000
Price	\$10,000	\$8,750	\$8,000



## Summary: Economies of Scale and Trade

- Firms take advantage of increasing return to scale by producing goods with less varieties, but gaining access to much larger market
- Intra-industry trade tends to be prevalent between countries with similar capital-labor ratios, skill levels, or in general, at similar level of development
- Example: European Union -- compare each country's relatively small market before integration vs. much larger integrated market post-integration, consumers in integrated market enjoy more choices and cheaper prices.



# External Economies of Scale

- Firms clustering together in certain location → subject of *Economics of Geography*
- Examples:
  - NYC as the center of finance and creative arts
  - Hollywood as film/entertainment center
  - Silicon Valley as technology center
- Why do firms (or individuals) behave in such way?  
What are the benefits from such location choice?



# External Economies of Scale

- Sources of gains
  - Specialized suppliers
  - Labor market pooling
  - Knowledge spillovers
  
- What are the key differences between ***internal*** and ***external*** economies of scale?
  - Internal gains come from larger market scale because there is a initial fixed cost, implying that the larger the scale, the more efficient (or less costly) they can produce.
  - External gains are not from within the firm; rather, they are from the externalities generated from firms clustering together.



# Impact of External Economies of Scale

- It could have similar effects as internal economies of scale:
  - The clustering of firms will bring down the cost of production: easy access to suppliers and labor pool
  - Technology spillovers could spur innovation, another way of bringing down cost
  
- In addition, firm clustering tends to reinforce specialization choices at the beginning, which may have some unintended consequences:
  - A special case study: Swiss watch industry

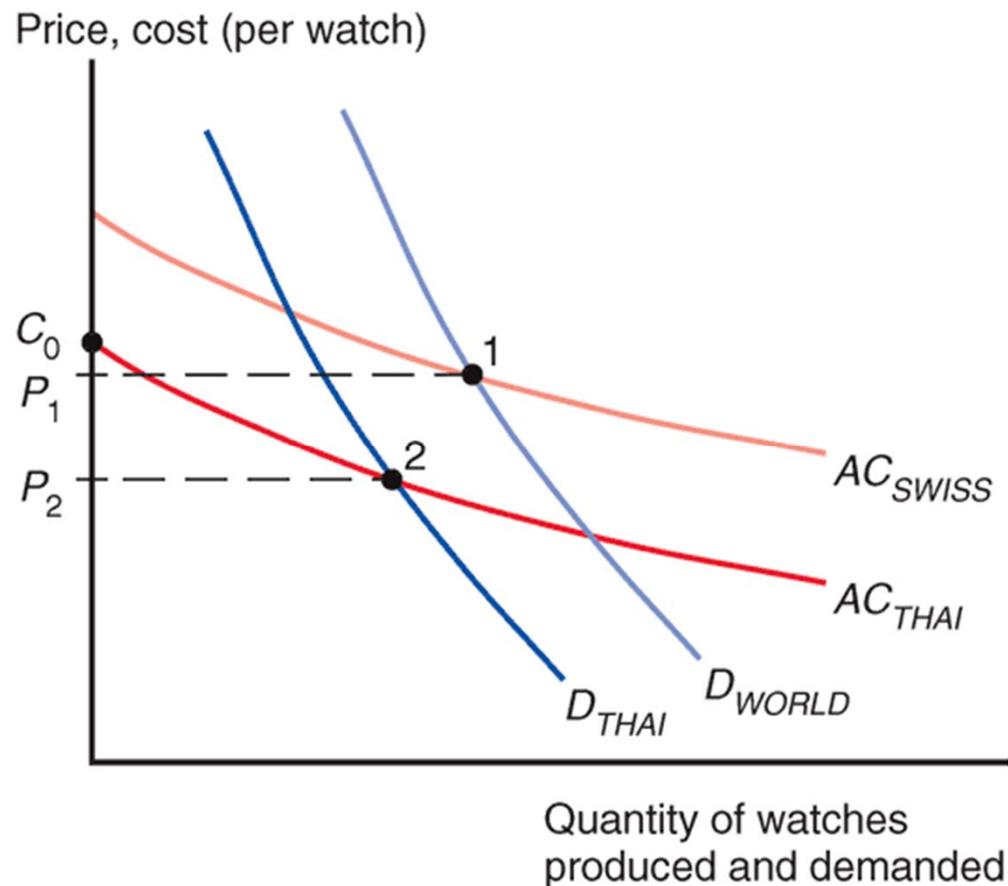


## Special Case Study: Swiss watch industry

- Switzerland specializes in watch making due to mysterious unknown historical/cultural reasons. But in short, they are good at making watches.
- Over time, as income of Switzerland rises, their cost of watch making is also rising.
- But because of their early specialization in watch industry and the external scale of economies generated from this long-time watch making (learning curve), it makes new competitor's entry into the market very difficult.
- And the world may face a welfare loss as a result of trade

# Special Case Study: Swiss watch industry

## External Economies and Specialization



- Thailand has a lower AC than Switzerland (even after quality adjustment).
- But since Swiss watch producers specialized early, and their AC is at point 1, which is lower than the initial AC of Thai producers, at  $C_0$ . Thailand needs larger market to drive down its AC, but the existence of Swiss watches deters their new entry of Thai producers.
- Without trade (i.e., when Swiss watches are not available), Thailand consumers could buy domestic watches at  $P_2$ , which is lower than  $P_1$ , the equilibrium price with trade. Thus, with trade, Thai consumers suffer a welfare loss.



## For the next class...

- Read chapters on Balance of Payments and FX market (or Chapter 13 & 14 in the 9<sup>th</sup> ed. textbook; quick scan is enough)
- A short article on FAQs of trade deficits (on course website)