国际经济学

规模经济与国际贸易：新贸易理论

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提纲

Motivation: a Surprising Kind of Trade

- We will look at trade in **golf clubs**, a good that the U.S. **imports and exports in large quantities**.
- Many countries that sell to the U.S. are also buying from the U.S.
  - The total value of imports is close to the total value of exports.
- Why does the U.S. export and import golf clubs to and from the same countries?
  - We observe **intra-industry trade**. 产业内贸易
  - A new explanation for trade will be discussed here.

The data:

图: U.S. Imports and Export of Golf Clubs, 2005

	IMPORTS				EXPORTS			
Rank	Country	Value of Imports ($ millions)	Quantity of Golf Clubs (thousands)	Average Price ($/club)	Rank	Country	Value of Imports ($ millions)	Quantity of Golf Clubs (thousands)	Average Price ($/club)
1	China	$278.2	15,520	$18	1	United Kingdom	$83.9	1,266	$66
2	Japan	11.0	100	109	2	Japan	47.1	482	98
3	Taiwan	6.7	504	13	3	Canada	44.2	598	74
4	Hong Kong	5.3	258	21	4	South Korea	41.8	477	88
5	Thailand	1.4	57	25	5	Netherlands	21.7	265	82
6	South Korea	1.0	121	9	6	Australia	21.3	294	73
7	Canada	1.0	28	37	7	Singapore	12.2	147	83
8	British Virgin Islands	0.4	72	5	8	South Africa	11.7	121	96
9	United Kingdom	0.3	7	36	9	Hong Kong	6.9	83	82
10	Vietnam	0.2	8	25	10	New Zealand	4.7	59	80
11	Australia	0.1	3	30	11	Taiwan	3.1	32	99
12	Mauritius	0.05	3	16	12	Thailand	2.2	20	110
13–30	Various countries	0.1	3	41	13–83	Various countries	17.9	201	89
	All 30 countries	$305.8	16,683	$18		All 83 countries	$318.7	4,046	$79

- Very hard to explain this with models we have used so far
- As we will later see, **increasing returns to scale** are fundamental force behind this phenomenon

Broader Motivation

- The models we have developed so far emphasize **cross -country differences** in autarky prices as sources of trade
- These autarky price differences may stem from technology differences (Ricardian model) or from factor endowment differences (Heckscher-Ohlin model)
- Regardless, countries trade because they are different
- However, **the majority of world trade is between similar countries**
  - Similar technologies, similar endowments
- How do we explain this?

Interindustry vs. Intraindustry Trade

- Similarly, the models so far emphasize an intersectoral nature of trade flows (cloth for food)
- In reality, a large fraction of world trade is intraindustry trade
- Measuring intra-industry trade: the Grubel-Lloyd (GL) index

$$IIT_i = GL_i = 1 - \frac{|Ex_i - Im_i|}{Ex_i + Im_i}$$

TABLE 6-3 Indexes of Intraindustry 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

"New" Trade Theory 新贸易理论

- Trade theory since the late 1970s has pushed the view that **imperfect competition and increasing returns to scale** 不完全竞争和规模报酬递增 may be key in explaining the actual features of trade flows
  - Krugman received the 2008 Nobel Prize for these developments
- Broadly speaking, imperfect competition will imply that **two- way trade flows** within the same industry will become possible
- Increasing returns to scale will imply that **country size** will become a determinant of comparative advantage 如何理解此处的比较优势?
- 这是否让你想起了之前讨论的 Orphan——引力方程，它们之间有什么关联吗?

Increasing Returns to Scale

- Previous models assumed **constant returns to scale**:
  - If all factors of production are doubled then output will also double
- But a firm or industry may feature **increasing returns to scale** (or economies of scale)
- A production technology exhibits IRS if an $x\%$ increase in all factors leads to more than $x\%$ increase in output
  - This implies that Average Cost (AC) decreases as output increases
  - Production is more efficient if it takes place on a larger scale
- Economies of Scale comes in two varieties 规模经济的两种类型
  - **Internal:** AC of firm falls with firm output 内部规模经济
  - **External:** AC of firm falls with industry output 外部规模经济

An Example

- Assume labor is the only input required
- Note that the average amount of inputs needed to produce output declines as the volume of output (at the firm or industry level) increases
- **Example**: internal IRS may arise because there is an overhead cost of 5 units of labor (regardless of output)

Output	Total Labor Input	Average Labor Input
5	10	2
10	15	1.5
15	20	1.33
20	25	1.25
25	30	1.2
30	35	1.167
35	40	1.143
40	45	1.125
45	50	1.111

Benefits from Trade: Preview

- Imagine that there are two goods A and B with the production technique described above
- If a country assigns 15 workers to each good, then they get 10 units of each good (so world produces 20 units of each good)
- Instead, suppose a country assigns its 30 workers to the production of only one good 怎样多找 15 个人来生产这种产品?
- Then production is 25 units of that good

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- Then production is 25 units of that good
- Suppose another country does the same and specializes in the other good
- World is now producing 25 units of each variety (before 20)

Possible Losses from Trade: Preview

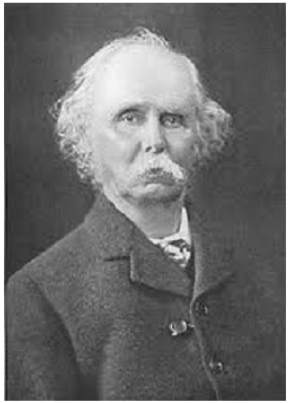
- Imagine that there is an IRS good A with technology described above, and a second good B produced one-to-one from labor
- Suppose one country (Home) has 50 workers and the other country (Foreign) has 20 workers
- If in autarky each country has half of its workforce in each sector:
  - Home produces 20 units of A and 25 units of B
  - Foreign produces 5 units of A and 10 units of B
- Suppose now that Home specializes in B and Foreign in A
  - Then world produces 15 units of A and 50 units of B
- World output of good B is higher, but that of good A is lower
  - If consumers value good A sufficiently, world welfare is reduced

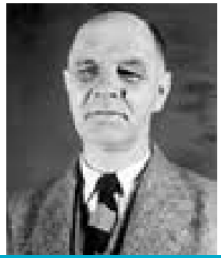
IRS and Market Structure

- Modeling increasing returns to scale poses difficulties for how to treat market structure 规模报酬递增下对应着怎样的市场结构?
- Is it still sensible to work with perfectly competitive markets?
- The nature of the external economies has important implications for the structure of industries:
  - An industry where economies of scale are purely external will typically consist of many small firms and be perfectly competitive 外部规模经济可能对应完全竞争市场
  - Internal economies of scale result when large firms have a cost advantage over small firms, causing the industry to become imperfectly competitive 内部规模经济意味着某些企业的规模大于行业平均规模，从而获得了一定的垄断力量
- Hence, external economies of scale are a natural starting point 因此，我们从外部规模经济说起

Intellectual History

- **External economies of scale** were first defined by Alfred Marshall (1842 -1924)
- Their implications for trade patterns and welfare were studied by Frank Graham (1890 - 1949)





External Economies of Scale

- Remember that external economies of scale arise when average costs are decreasing in the output of other firms in the industry or in the economy
- If external economies exist, a country or region that has a large industry will have low costs of producing that industry′ s good or service
- Marshall thought that the source of external economies of scale are:
  - Specialized Suppliers
  - Labor Market Pooling
  - Knowledge Spillovers

Examples

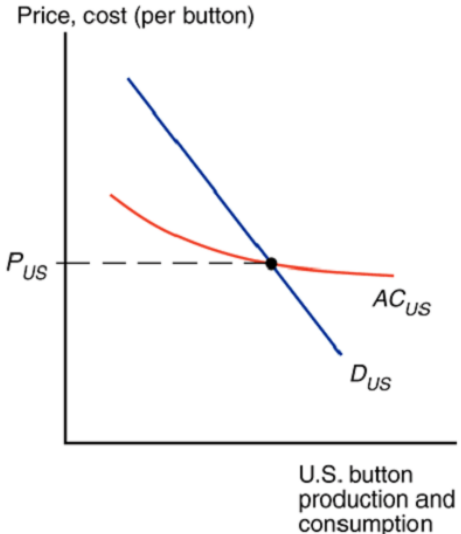
- In the US, the semiconductor industry is concentrated in Silicon Valley, investment banking in New York, and the entertainment industry in Hollywood
- In developing countries, external economies are pervasive in manufacturing
  - One town in China produces most of the world' s underwear, another nearly all cigarette lighters
  - One town in Pakistan (Sialkot) produces 70% of world soccer balls
  - Indian information services companies are still clustered in Bangalore

External Economies of Scale

- External economies may exist for several reasons:
  1. Specialized equipment or services may be needed for the industry, but are only supplied by other firms if the industry is large and concentrated (e.g., Silicon Valley firms serviced by machine producers)
  2. Labor pooling: a large and concentrated industry may attract a pool of workers, reducing labor search and hiring costs for all firms in the industry
  3. Knowledge spillovers: a large and concentrated industry may facilitate the sharing of productive ideas between workers in different firms

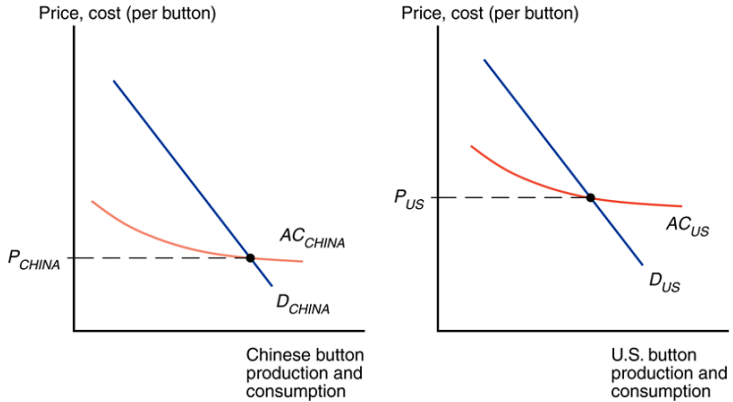
Implications for Industry Equilibrium

- There is a **forward-falling supply curve**: the larger the industry′ s output, the lower the price at which firms are willing to sell
- Without international trade, the unusual slope of the supply curve might not matter much 为什么外部规模经济在国际贸易的情况下更容易发生?



Differences in Autarky Prices

- As an example, consider the button industry

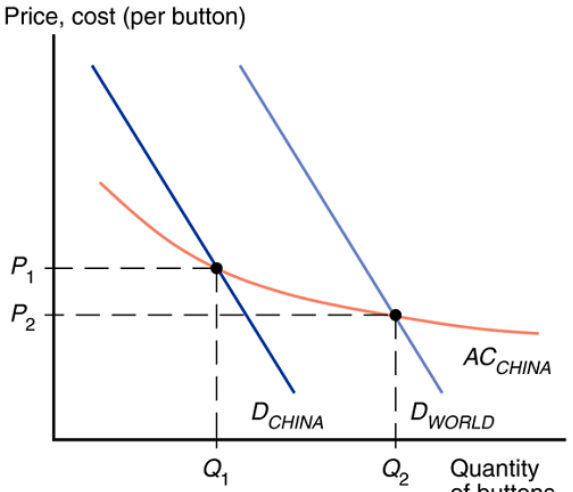


External Scale Economies and Trade

- What will happen when the countries open up the potential for trade in buttons?
- The Chinese button industry will expand, while the U.S. button industry will contract
- As the Chinese industry′ s output rises, its costs will fall further; as the U.S. industry′ s output falls, its costs will rise
- In the end, all button production will be in China

Trade and Prices

- Because supply curve is forward-falling, increased production as a result of trade leads to a button price that is lower than the price before trade
- Trade leads to prices that are **lower** than the prices **in either country** before trade!

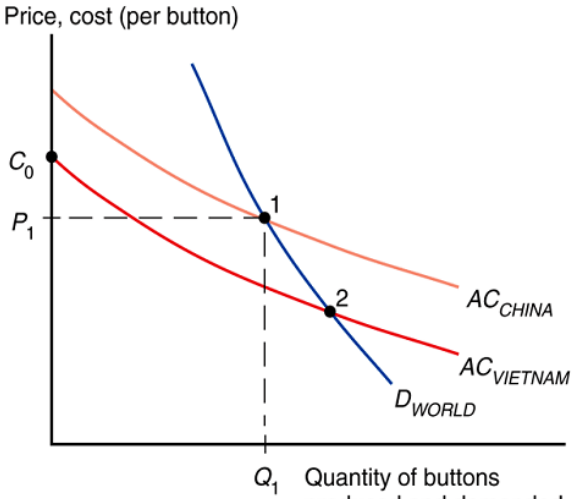


Trade and Prices (cont.)

- Note the very different implications relative to models without increasing returns. 与以前贸易模型的显著差异是：价格的变化趋势
- In the standard trade model relative prices converge as a result of trade
  - They go up for goods that were abundant under autarky and down for goods that were scarce 在自给自足情况下生产规模大的产品的相对价格会上升，反则反之
- With external economies, by contrast, the effect of trade is to reduce prices **everywhere 而在外部经济的情况下，都会下降!**

Determinants of Comparative Advantage

- If external economies exist, the pattern of trade may be due to **historical accidents** 贸易模式由历史的偶然因素决定的
- In the graph, Vietnam could manufacture buttons more cheaply than China at any given level of production
- But with zero production in Vietnam, the average cost is higher than the initial price, which is P_1

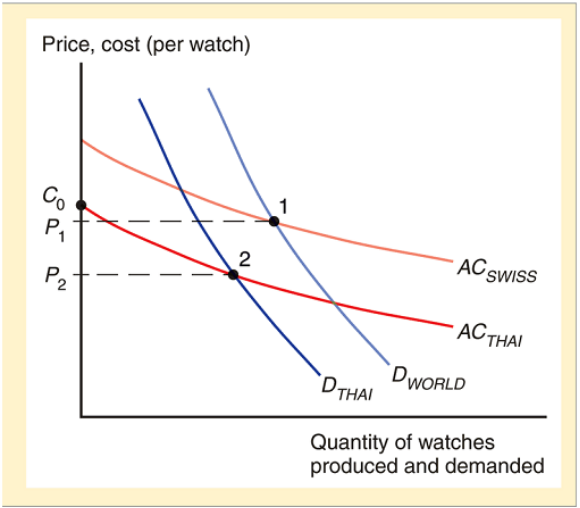


Welfare Effects of Trade

- Trade based on external economies has an **ambiguous effect** on national welfare 对国家福利的影响是含混的
- There may be gains to the world economy of concentrating production of industries with external economies
- But where does production concentrate? It may seem optimal to concentrate it in the most efficient countries 生产区位理论
- But as the example above illustrated, there is no guarantee this will happen
- As a result, in some cases some countries might be worse off with international trade than without it (Graham, 1928) 某些国家会因国际贸易而受损，为什么?

A Graphical Example

- Suppose Thailand can produce watches more cheaply than Switzerland, but only the latter produces them (for historical reasons)
- Thailand cannot profitably enter
- But if Thailand restricts trade in watches...限制性贸易政策有了存在的意义
- ...they will end up consuming them at a lower price $P_2 < P_1$

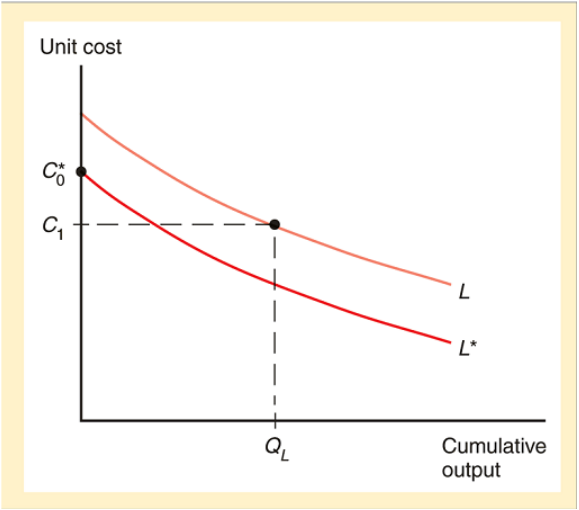


Dynamic External Economies of Scale

- We have considered cases where external economies depend on the amount of **current output** at a point in time 关键看你现在是否已经生产，已经生产的规模
- **Dynamic external economies of scale** (dynamic IRS) exist if average costs fall as **cumulative output** increases over time 动态收益递增
- Think about a process of accumulation of knowledge or experience 知识和经验的积累
- A graphical representation of dynamic increasing returns to scale is called a **learning curve 学习曲线以及干中学理论**
- Especially important in some high-tech industries, such as aeronautics

Dynamic External Economies of Scale

- Dynamic external IRS have the same implications as static external IRS
  - History may matter
  - Protectionism may be justified
- The latter is related to the so - called "**infant-industry**" argument for protection 幼稚工业理论的缘起和发展
- **Key issue**: which industries should be protected and for how long? 幼稚工业理论的阿克琉斯之踵
- 对我们的启示：有些事情可以先做起来



Implications for Policy: Preview

- Governments may want to actively encourage investment in technology when externalities in new technologies create a high marginal social benefit
- When considering whether a government should subsidize high-technology industries, should consider:
  1. The ability of government to subsidize the right activity
  2. Instead of subsidizing specific industries, it may be better to subsidize research and development through the tax code
  3. The economic importance of externalities (measurable?)
  4. Externalities may occur across countries as well (free-riding)

Internal Economies of Scale

- When economies of scale are internal, large firms may be more efficient than small firms, and the industry may consist of a monopoly or a few large firms 市场结构发生变化
- This creates a tension with the notion of perfect competition:
  - many buyers and sellers, all price takers
  - sellers can sell/supply as much as they want at the current price without worrying about driving the price down
- Not a good assumption when only a few firms produce a good
  - Ex: in the aircraft industry, both Boeing and Airbus know that if they produce more, they will have a significant effect on total aircraft supply, thus driving the price down

Imperfect Competition

- More natural to assume that the industry is **imperfectly competitive**
- In imperfectly competitive markets, the quantity they produce will influence the price it sells for, i.e. $P(Q_i)$ with $P\prime(Q_i) < 0$
- How the price is influenced generally depends on industry demand and market structure
- Note also that, under perfect competition, firms would operate at the point in which Price $=$ Marginal Cost, but then with IRS the firm would not be able to cover the higher costs incurred from producing the initial units of output 难以越过刚刚开始生产时的高成本，为什么？成本函数怎么写？

The Monopolist Problem

- In such a case, $P(Q)$ is simply the inverse of the market demand curve (determined by consumer preferences, not the industrial structure 与产业结构无关)
- Demand is downward-sloping, with an elasticity that depends on the degree to which the monopolist′ s output is substitutable with other different products 需求曲线的倾斜程度
- Marginal revenue slopes down also, and always lies below the demand curve 为什么?
- Total Revenue $= P(Q) \cdot Q$
- Marginal Revenue $= P(Q) + P\prime(Q) \cdot Q < P(Q)$

Cost Structure

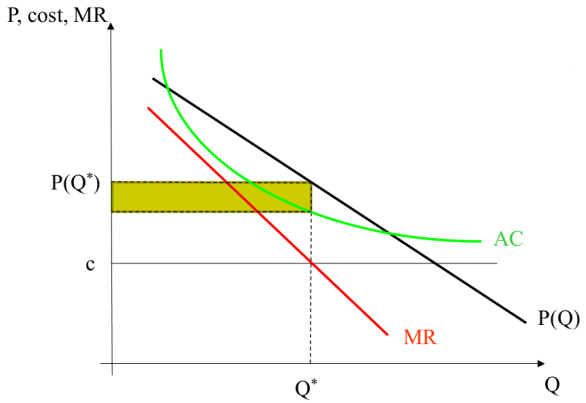
- Suppose that the total costs of the monopolist are $TC = F + cQ$,
- F represents a fixed or overhead cost (and is independent of the level of output)
- c represents a constant marginal cost: the constant cost of producing an additional unit of output Q
- Average cost is then: $AC = F/Q + c$
- A larger firm is more efficient because average cost decreases as output Q increases: **internal economies of scale**

Optimal Scale of Operation

- The monopolist will choose the scale of operation that maximizes profits
- Namely a Q s.t. that $[P(Q) \cdot Q - F - cQ]$ is maximized
- This implies $MR(Q^*) = MC(Q^*) = c$
- Note that the optimal price satisfies $P^* = P(Q^*) > c$
- And optimal profits equal $P(Q^*) \cdot Q^* - F - cQ^*$

Graphical Analysis

- Suppose the demand curve the firm faces is a straight line $Q = A - BP$, where A and B are constants.
- **Marginal revenue** equals $MR = P - Q/B$.



Oligopolistic Competition

- One rarely sees only one producer per good (e.g. a natural resource that only one firm has access to) 完全垄断
- If there are a small number of very large producers (**oligopoly**), we can use game -theoretic tools to model their interactions, as their pricing decisions are interdependent
- But this can get very complicated, as we have to take into account how firms second-guess the behavior of their competitors 寡头分析从技术上讲比较困难
- Alternatively, we can model multi-firm imperfect competition via "**monopolistic competition**", which gets around the interdependence issue 只分析垄断竞争的情况

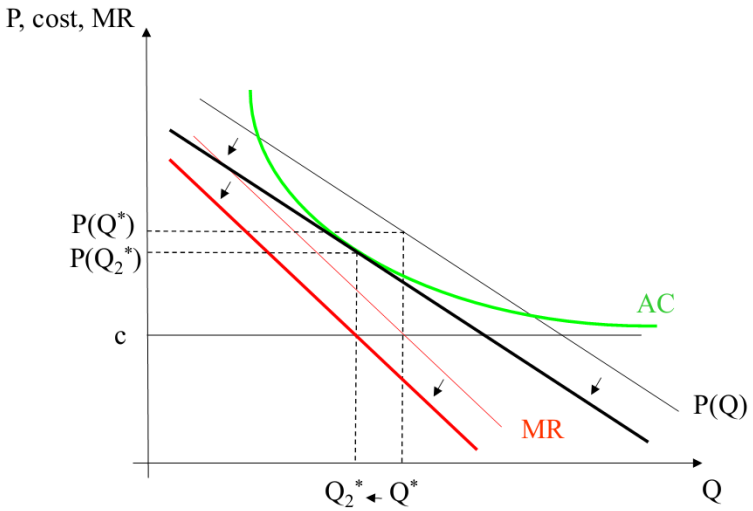
Intellectual History

- Developed by Paul Krugman (1953-) using a model of industry equilibrium first suggested by Edward Chamberlin (1899 - 1967)

Monopolistic Competition

- Due to Chamberlin (1933), its distinctive features are:
  1. Each firm has some market power in the sense that it faces a downward- sloping demand curve 每个厂商都有一定的垄断力
  2. There are a large number of firms so that a price change by a single firm has no effect on the level of demand faced by the rest of the firms 行业内有大量企业
  3. There is free entry so that firm profits are driven down to zero 行业自由进出，且利润为 0

Free Entry at Work



Product Differentiation 差异产品

- Where does the downward sloping demand function come from?
- There can be many firms within an industry, but each firm can differentiate its product (e.g. Samsung Galaxy vs. Apple iPhone)
- It is important that consumers value that the economy provides **a variety of differentiated products**
  - Perhaps consumers themselves value variety (Dixit- Stiglitz, 1977) 多样化偏好
  - Or different consumers value different varieties (Lancaster, 1979) 差异品的理想多样化，每个人都有一个 "ideal variety"
- In sum, each individual producer behaves like a monopolist but free entry drives profits down to zero

Example

- Suppose we represent the demand faced by a differentiated-good producer by

$$Q = S \cdot [1/n - b(P - P_{avg})]$$

- Q is the quantity sold by the firm
- S are total sales (in quantity terms) of the industry 常数
- n is the number of firms in the industry
- b captures the responsiveness of a firm' s sales to its price 常数，表示公司的销量对价格变化的反应程度
- P is the price charged by the firm itself
- $P_{avg}$is the average price charged by its competitors
- 考虑：如果厂商都制定相同价格；如果价格高于平均水平；如果价格低于平均水平

Example (cted.)

- Assume that firms are **symmetric** (representive firm, leave room for the heterogenous firm trade theory: all firms face the same demand function and have the same cost function, so in equilibrium $P = P_{avg}$
- Then $Q = S/n$, and firms get the same market share
- If instead, we had $P > P_{avg}$, then the firm would still have a positive market share, but it would be lower than $1/n$
- Hence demand is downward sloping (not perfectly elastic), unless $b \to \infty$
- 求解：行业中厂商的数量 n 和代表性价格 P_{avg}

Optimal Pricing

- Remember that each firm acts like a monopolist, and hence Q (or P) is chosen such that $MR = MC = c$
- We first invert the demand function:

$$P = P_{avg} + 1/(nb) - Q/(Sb)$$

- Then we compute

$$MR = P(Q) + P^{'}(Q) \cdot Q = P - Q/(Sb)$$

- Now note that in equilibrium, $Q = S/n$
- So we have 由零利润条件推导出

$$P = c + 1/(nb) \qquad (PP)$$

- 反应了产品价格和厂商数量之间的关系

Average Costs

- In a symmetric equilibrium, we must have

$$Q = S/n$$

- But then, average cost is equal to 由成本函数推出

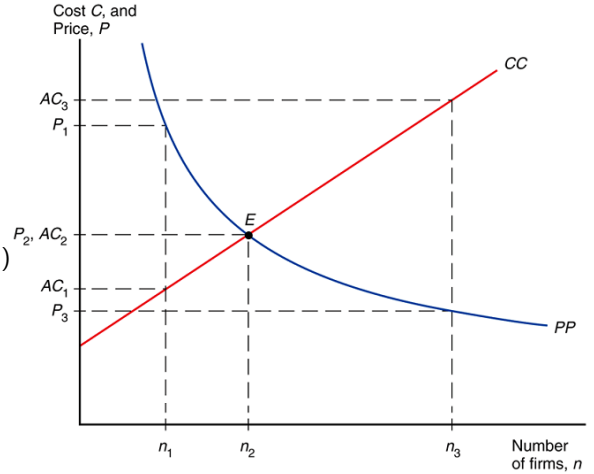
$$AC = TC/Q = F/Q + c = F{\cdot}n/S + c \qquad (CC)$$

反应了生产成本和厂商数量的关系

- The larger the number of firms n , the higher AC for each firm because each firm produces less
- The larger total industry sales S , the lower AC for each firm because each firm produces more

Equilibrium

- Graphically, we can pin down P and n as the intersection of (**CC**) and (**PP**)
- At n_1 , $P > AC$ and there is an incentive for entry
  - An increase in n, reduces prices (competition) and increases AC
- In some case, this model was named **PP-ZZ model**



Monopolistic Competition and Trade: an Application of PP-ZZ Model

- Remember the key equations of the monopolistic competition model

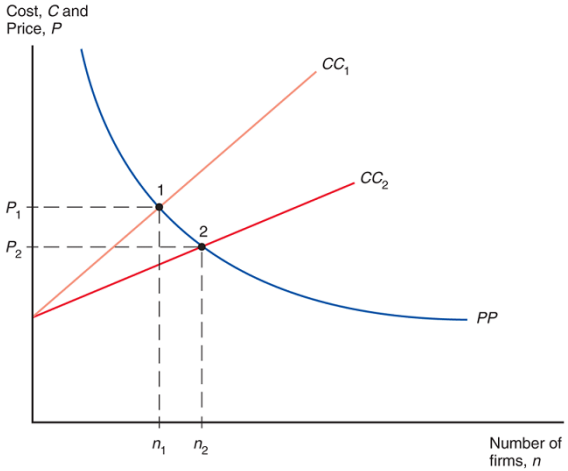
$$AC = TC/Q = F/Q + c = F \cdot n/S + c \qquad (CC)$$

$$P = c + 1/(nb) \qquad (PP)$$

- These two equations yield a solution for P and n
- What is the effect of trade?
- Suppose trade increases market size, so S goes up
- No effect on (**PP**) curve, while (**CC**) curve shifts down
  - No direct effect on optimal pricing, but AC will tend to go down

Graphical Analysis

- The shift in the CC curve will lead to a larger number of firms in the industry and to lower equilibrium prices
- Hence, there is a pro-competitive effect and a variety - enhancing effect
- Note that consumers (or society) value variety, so both effects are welfare-enhancing



Numerical Example

- Now let us apply this to the automobile industry by assuming:
  - $b = 1/30,000$
  - $F = \$750,000,000$
  - $c = \$5,000$
  - $S = \$900,000$
  - $S^* = \$1,600,000$
- Combining (CC) and (PP) we find $n = [S/(bF)]^{1/2}$
- In our numerical example:
  - $n = (36)^{1/2} = 6$
  - $n^* = (64)^{1/2} = 8$
  - $n_{INT} = (100)^{1/2} = 10$

Summary

- The effect of trade on the remaining equilibrium values is described in the table below (make sure you can derive them)
- Note: total number of varieties increases, but some firms in the world economy will need to shut down as a result of trade

TABLE 6-2 Hypothetical Example of Gains from Market Integration

	Home Market, Before Trade	Foreign Market, Before Trade	Integrated Market, After Trade
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

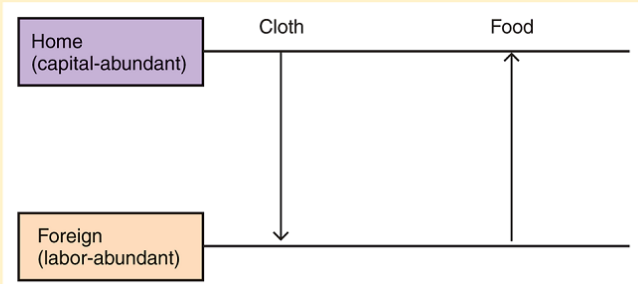
Implications for the Structure of Trade

In neoclassical trade models (Ricardian, Heckscher-Ohlin) countries specialize in certain industries and hence trade is inter-industry trade
Example: Cloth is capital- intensive relative to Food

Figure 6-6

Trade in a World Without Increasing Returns

In a world without economies of scale, there would be a simple exchange of cloth for food.

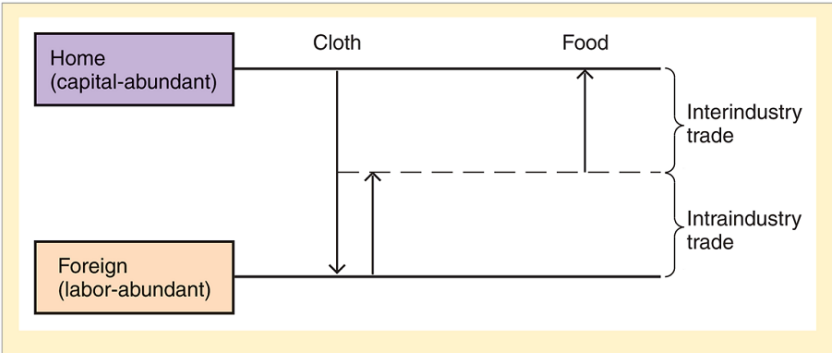


Intra -Industry Trade

- Now suppose that **cloth is not a homogenous good**, and the global cloth industry is better described by the monopolistic competition model
- In equilibrium, Home and Foreign will produce different varieties of clothes (as in our example)
- So Home will not only export cloth, it will now import it as well!
- Hence, **with IRS** and imperfect competition, trade also occurs within the cloth industry: **intra-industry trade**

Inter and Intra -Industry Trade

- Still, Home is capital- abundant, and hence we expect it to be a net exporter of cloth and net importer of food (as in H - O model)



Recap on Pattern of Trade

- Gains from inter-industry trade reflect traditional comparative advantage.
- Gains from intra-industry trade reflect economies of scale and wider consumer choices.
- What determines the relative size of inter-industry vs. intra-industry trade?
  - Countries with similar relative amounts of factors of production are predicted to have little inter-industry trade, so most trade is intra-industry trade
  - Less trivially, larger and more similar countries will also feature a larger volume of intra- industry trade
    - gains from economies of scale are larger

Evidence: Intra-Industry Trade

- Some industries have more intra-industry trade than others:
  - Larger in skill-, technology-, and capital-intensive industries
  - These tend to be the industries where economies of scale, imperfect competition and product differentiation are more relevant
- Also, share of intra-industry trade with U.S. is larger for countries with similar relative amounts of skilled labor, technology and physical capital
- Problem: "pseudo- intraindustry trade" (vertical fragmentation)

Some Examples

TABLE 8-2 Indexes of Intra-Industry Trade for U.S. Industries, 2009

Metalworking Machinery	0.97
Inorganic Chemicals	0.97
Power-Generating Machines	0.86
Medical and Pharmaceutical Products	0.85
Scientific Equipment	0.84
Organic Chemicals	0.79
Iron and Steel	0.76
Road Vehicles	0.70
Office Machines	0.58
Telecommunications Equipment	0.46
Furniture	0.30
Clothing and Apparel	0.11
Footwear	0.10

Implications for Income Distribution

- Remember that in the H-O model, inter-industry trade generated winners and losers
- In the model above, all consumers benefit from trade (perhaps some more than others depending on their "love-for-variety")
- So whenever the share of intra- industry trade is large, we may expect welfare gains to be more evenly distributed
- Two caveats:
  - Some models with IRS and imperfect competition generate wasteful two-way trade flows (see Brander and Krugman, 1983)
  - Trade integration may reduce the number of "local varieties"