

External Economies of Scale and the International Location of Production

Krugman Ch.7
Namun Cho

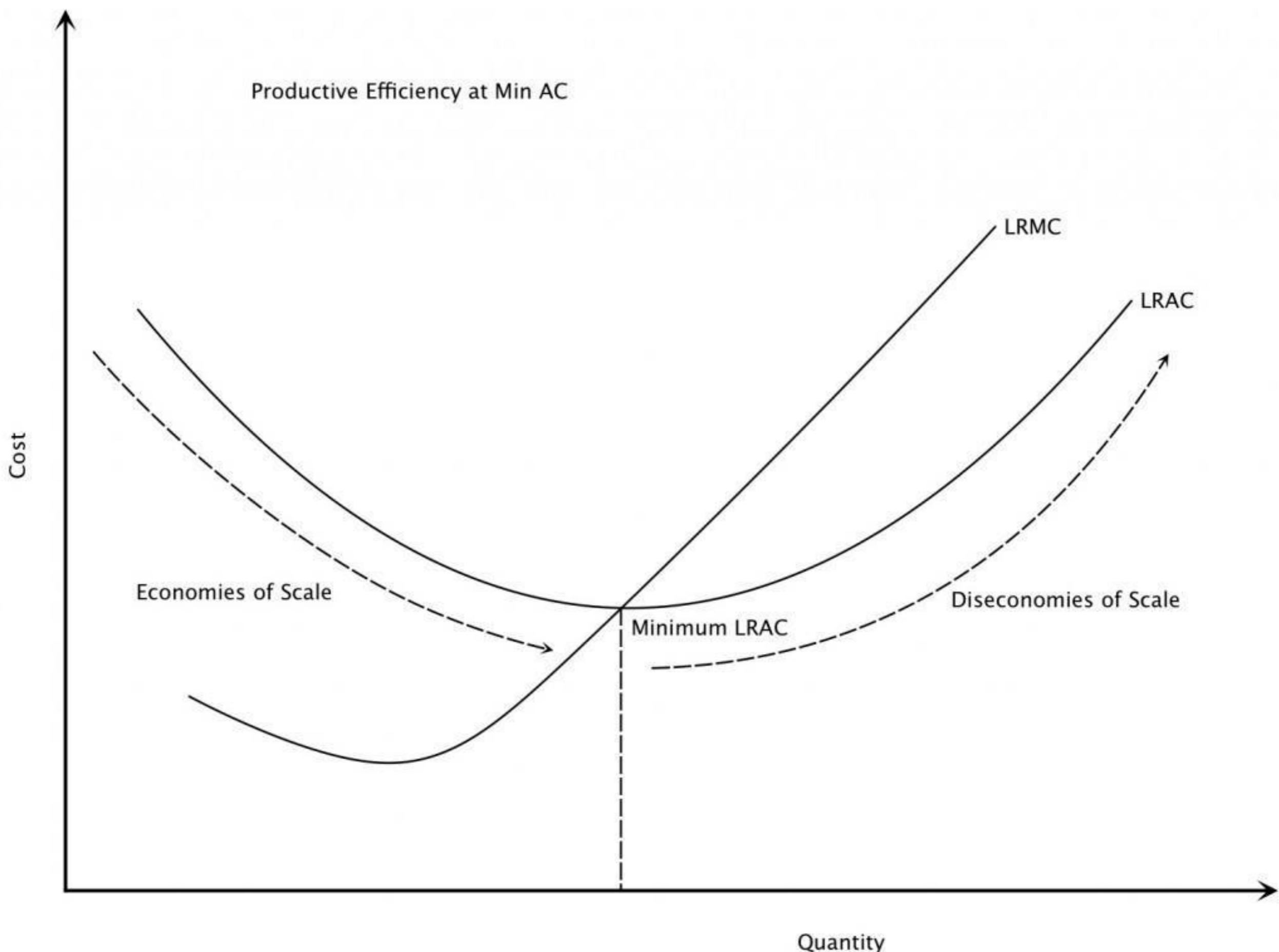
Topics

- Economies of Scale and International Trade
- Economies of Scale and Market Structure
- The Theory of External Economies
- Specialized Supplies
- Labor Market Pooling
- Knowledge Spillovers
- External Economies and International Trade
- Interregional Trade and Economic Geography

Economies of Scale and International Trade: An Overview

Economies of Scale

- $bY = F(aX)$
- Three types of returns to scale
 - Increasing Returns to Scale (IRS): $a < b$
 - Concentration (S/W, car, banks, etc)
 - This is called as "Economies of scale"
 - Constant Returns to Scale (CRS): $a = b$
 - Decreasing Returns to Scale (DRS): $a > b$
 - Decentralization (ordinary products)
 - "Diseconomies of scale"



Example: Hypothetical Industry

TABLE 7-1

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

Y X X/Y

Example: Hypothetical Industry

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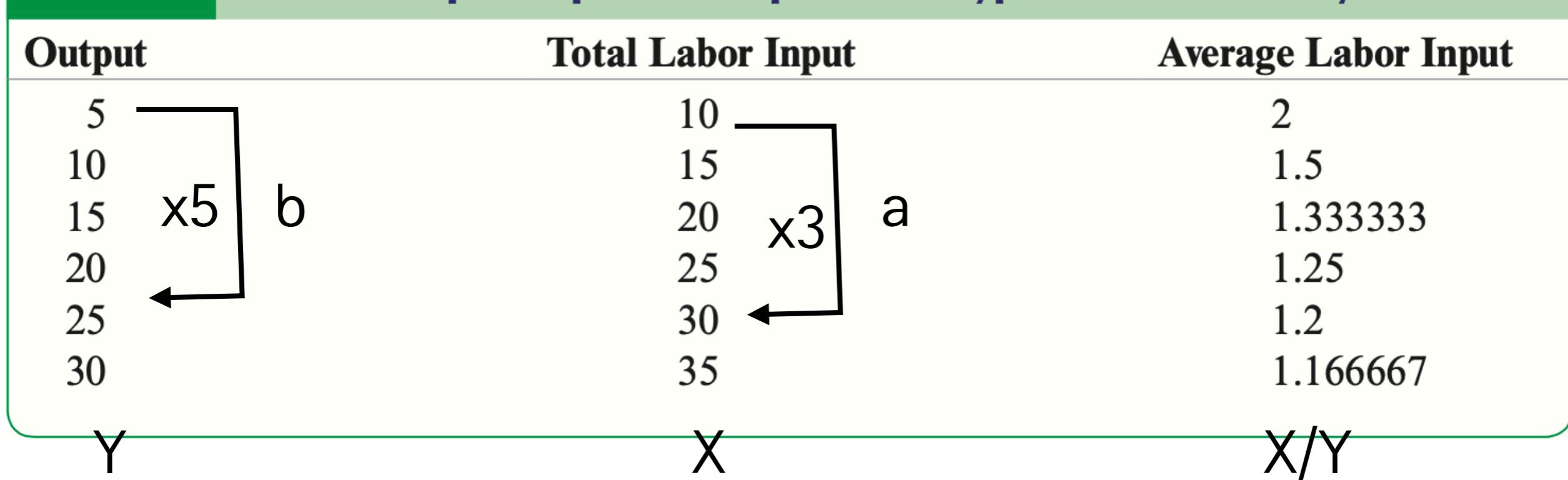
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The graph illustrates the relationship between Output (Y-axis) and Total Labor Input (X-axis). The X-axis is labeled 'X' and the Y-axis is labeled 'Y'. A series of points are plotted at (10, 5), (15, 10), (20, 15), (25, 20), (30, 25), and (35, 30). A vertical line segment connects the point (20, 15) to the point (30, 25). An arrow labeled 'x3' points from the value 20 on the X-axis to the value 30 on the X-axis. The label 'a' is placed near the middle of the vertical segment.

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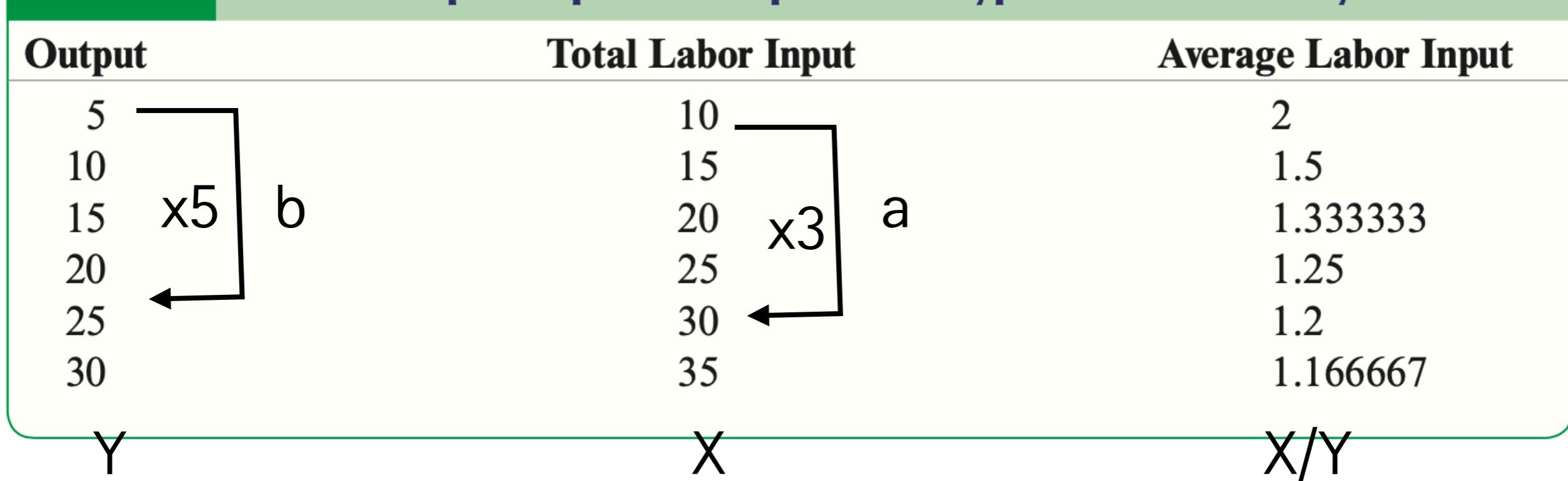
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Example: Hypothetical Industry

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$$a < b \Rightarrow IRS$$

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- Suppose:

- Korea and Japan have same technology (Table 7-1)
- Each country produces 10 units of output
 - KR and JP utilize 15 units of labor each
 - World total: 20 output using 30 labors
- However, One country can produce 20 products using 25 (<30) labors: more efficient
 - Or, One country can utilize 30 labors to make 25 (>20) products: more efficient
 - This can only possible in IRS sectors

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International Division of Production

- As a result of economies of scale, trade can be mutually beneficial.
- International Division of Production:
Concentrating factors on specific products
- Bad news: economies of scale can lead to imperfectly competitive market structure
 - Oligopoly, Monopoly..
 - Topic of Chapter 8

Economies of Scale and Market Structure

External/Internal Economies of Scale

- External economies of scale (Chapter 7)
 - It occur when the cost per unit depends on the size of **the industry**.
- Internal economies of scale (Chapter 8)
 - It occur when the cost per unit depends on the size of **an individual firm**.
 - It can lead to imperfectly competitive market structure: oligopoly, monopoly..
- Both external and internal economies of scale can occur simultaneously

Market Structure

Market structure	External economies of scale	NOT external economies of scale
Internal economies of scale	Imperfectly competitive market	Imperfectly competitive market
NOT internal economies of scale	Competitive market	Competitive market

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Internal economies of scale	Imperfectly competitive market	Imperfectly competitive market
NOT internal economies of scale	Competitive market	Competitive market

The Theory of External Economies

External Economies

- Not all scale economies apply at the level of the individual firm.
- External economies: Economies of scale applied **at the level of the industry** rather than at the level of the individual firm
- Example: clusters of firms
 - Geographically concentrated industry
 - Silicon Valley (semiconductor industry, California), Hollywood (entertainment industry, LA), Manhattan (financial firms, NY)

China's Industry Clusters

Industry	City or Town
Button	Qiaotou
Toothbrush	Hang Ji
Tie	Sheng Zhou
Cigarette Lighter	Zhang Qi
Shoes	Wen Ling
Socks	Yiwu

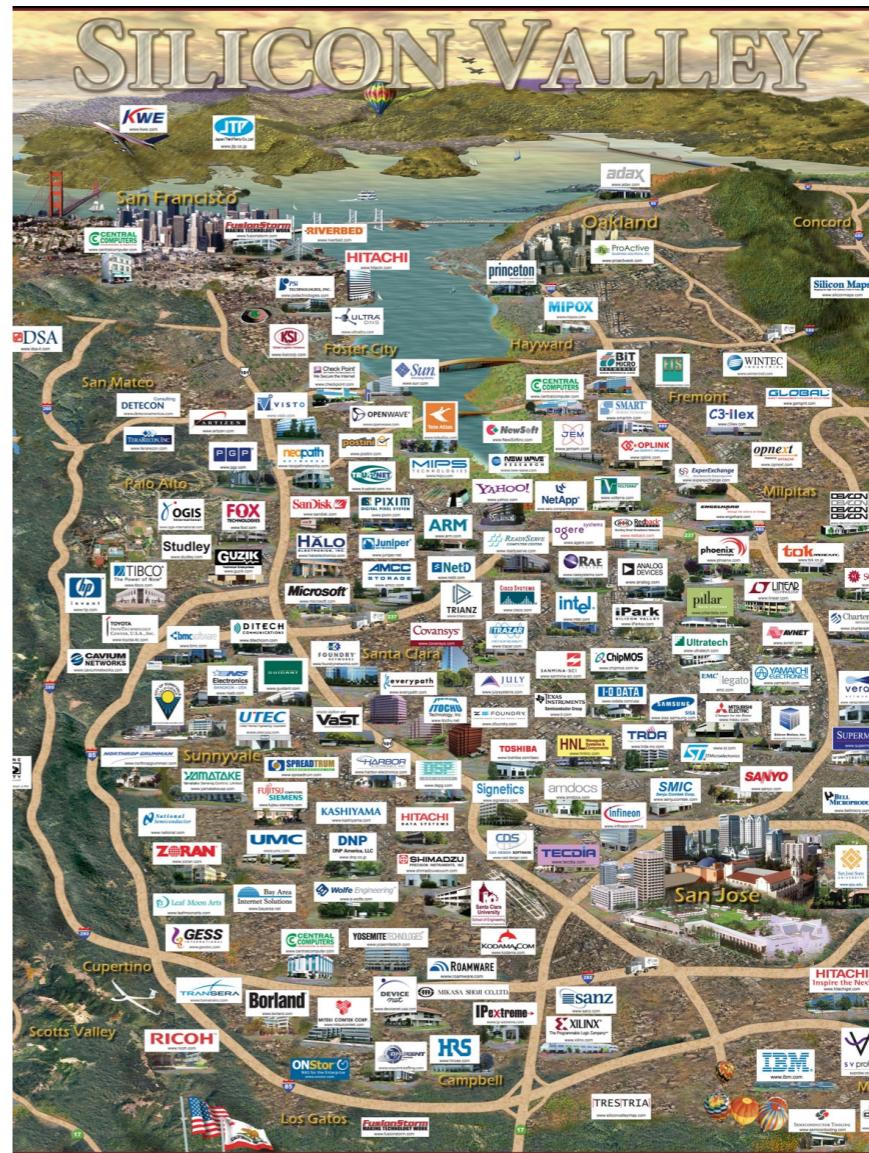
Cluster of firms: Reasons

- Specialized suppliers
- Labor market pooling
- Knowledge spillovers

Specialized Suppliers

- Each industry needs its own specialized equipment or support
 - An individual company can not afford to pay the cost.
- A localized cluster can solve this problem:
 - By bringing together many firms

Firms in Silicon Valley



<https://digimarconsiliconvalley.com/silicon-valley-regions/>

Case study: Silicon Valley

- Dense network of specialized suppliers has given high-technology firms in Silicon Valley considerable advantages over firms elsewhere
- In this cluster, some firms can concentrate on very specialized part of product
 - Fabless company: a company which designs microchips but not make them.

2013 Top 25 Fabless IC Suppliers

2013 Rank	2012 Rank	Company	Headquarters	2012 (\$M)	2013 (\$M)	% Change
1	1	Qualcomm	U.S.	13,177	17,211	31%
2	2	Broadcom	U.S.	7,793	8,219	5%
3	3	AMD	U.S.	5,422	5,299	-2%
4	5	MediaTek	Taiwan	3,366	4,587	36%
5	4	Nvidia	U.S.	3,965	3,898	-2%
6	6	Marvell	U.S.	3,144	3,352	7%
7	7	LSI	U.S.	2,506	2,370	-5%
8	8	Xilinx	U.S.	2,196	2,297	5%
9	9	Altera	U.S.	1,783	1,732	-3%
10	10	Avago	Singapore	1,479	1,619	9%
11	12	Novatek	Taiwan	1,256	1,398	11%
12	13	HiSilicon	China	1,178	1,355	15%
13	11	MStar	Taiwan	1,271	1,136	-11%
14	18	Spreadtrum	China	725	1,070	48%
15	14	CSR	Europe	1,025	961	-6%
16	15	Realtek	Taiwan	836	951	14%
17	16	Dialog	Europe	774	903	17%
18	19	Cirrus Logic	U.S.	714	772	8%
19	17	Himax	Taiwan	737	771	5%
20	21	Silicon Labs	U.S.	563	580	3%
21	22	MegaChips	Japan	553	577	4%
22	24	Semtech	U.S.	518	555	7%
23	23	PMC-Sierra	U.S.	531	508	-4%
24	25	IDT	U.S.	497	475	-4%
25	26	Microsemi	U.S.	450	433	-4%
Top 25 Total			—	56,459	63,029	12%
Other Total			—	15,650	14,882	-5%
Total Fabless			—	72,109	77,911	8%

Source: Company reports, IC Insights' *Strategic Reviews* database

Labor Market Pooling

- A cluster of firms can create a pooled market for workers with highly specialized skills.
- Mutually beneficial to workers and firms:
 - workers: unemployment ↓
 - firms: labor shortage ↓

“it wasn’t that big a catastrophe to quit your job on Friday and have another job on Monday. . . . You didn’t even necessarily have to tell your wife. You just drove off in another direction on Monday morning.”

Saxenian (1994)

Knowledge Spillovers

- Knowledge is especially important in highly innovative industries
- Sources of specialized knowledge:
 - Research and Development (R&D)
 - Learning from competitors by studying their products (reverse engineering)
 - Informal exchange of information and ideas that take place at a personal level (knowledge spillover)

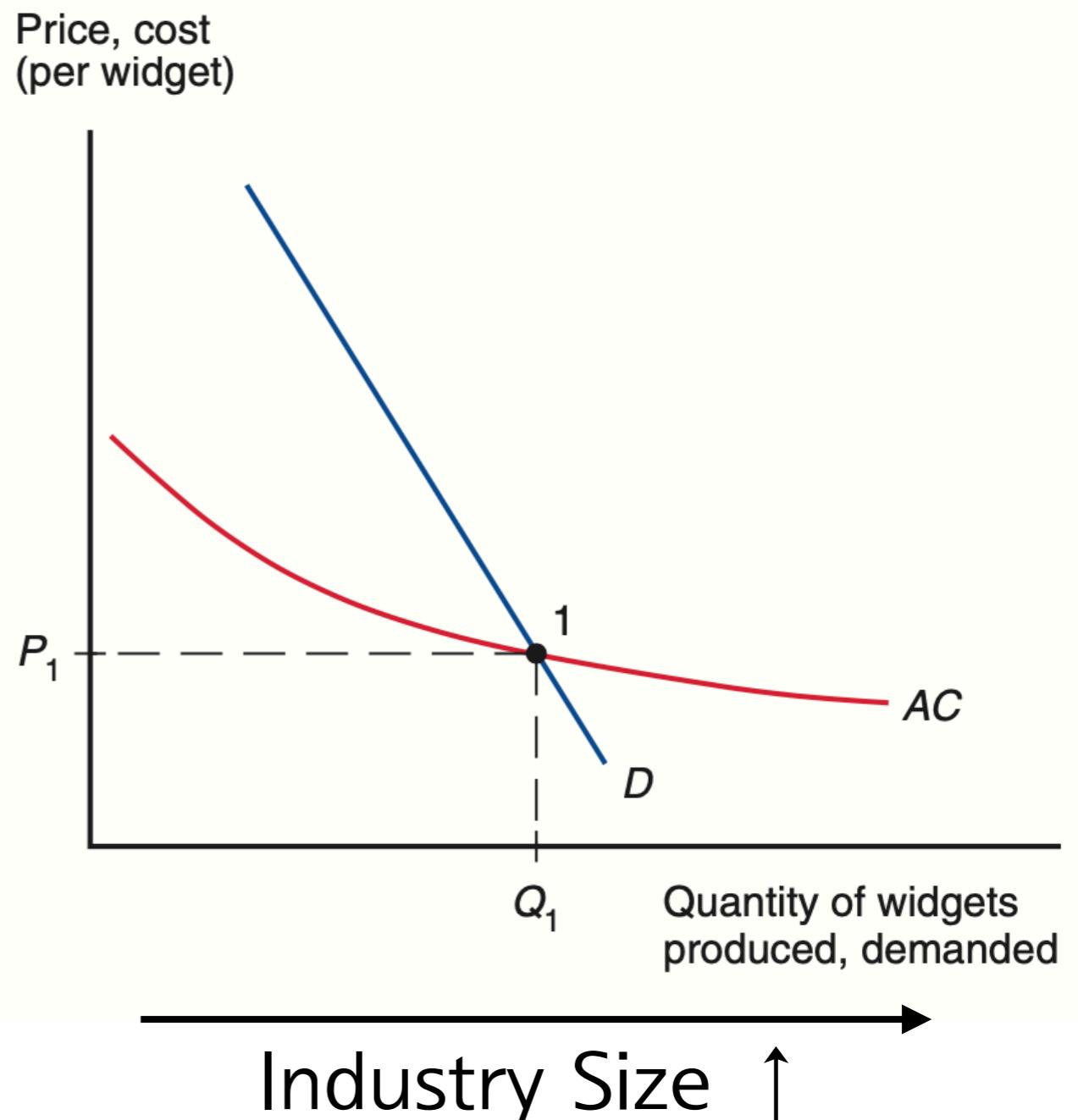
Knowledge Spillover in Silicon Valley

Every year there was some place, the Wagon Wheel, Chez Yvonne, Rickey's, the Roundhouse, where members of this esoteric fraternity, the young men and women of the semiconductor industry, would head after work to have a drink and gossip and trade war stories about phase jitters, phantom circuits, bubble memories, pulse trains, bounceless contacts, burst modes, leapfrog tests, p-n junctions, sleeping sickness modes, slow-death episodes, RAMs, NAKs, MOses, PCMs, PROMs, PROM blowers, PROM blasters, and teramagnitudes...

Saxenian (1994)

External Economies and Market Equilibrium

- Assumption: No trade
- Specialized suppliers, pooled labor market, knowledge spillover imply bigger industry cluster can be more efficient: **forward-falling supply curve**

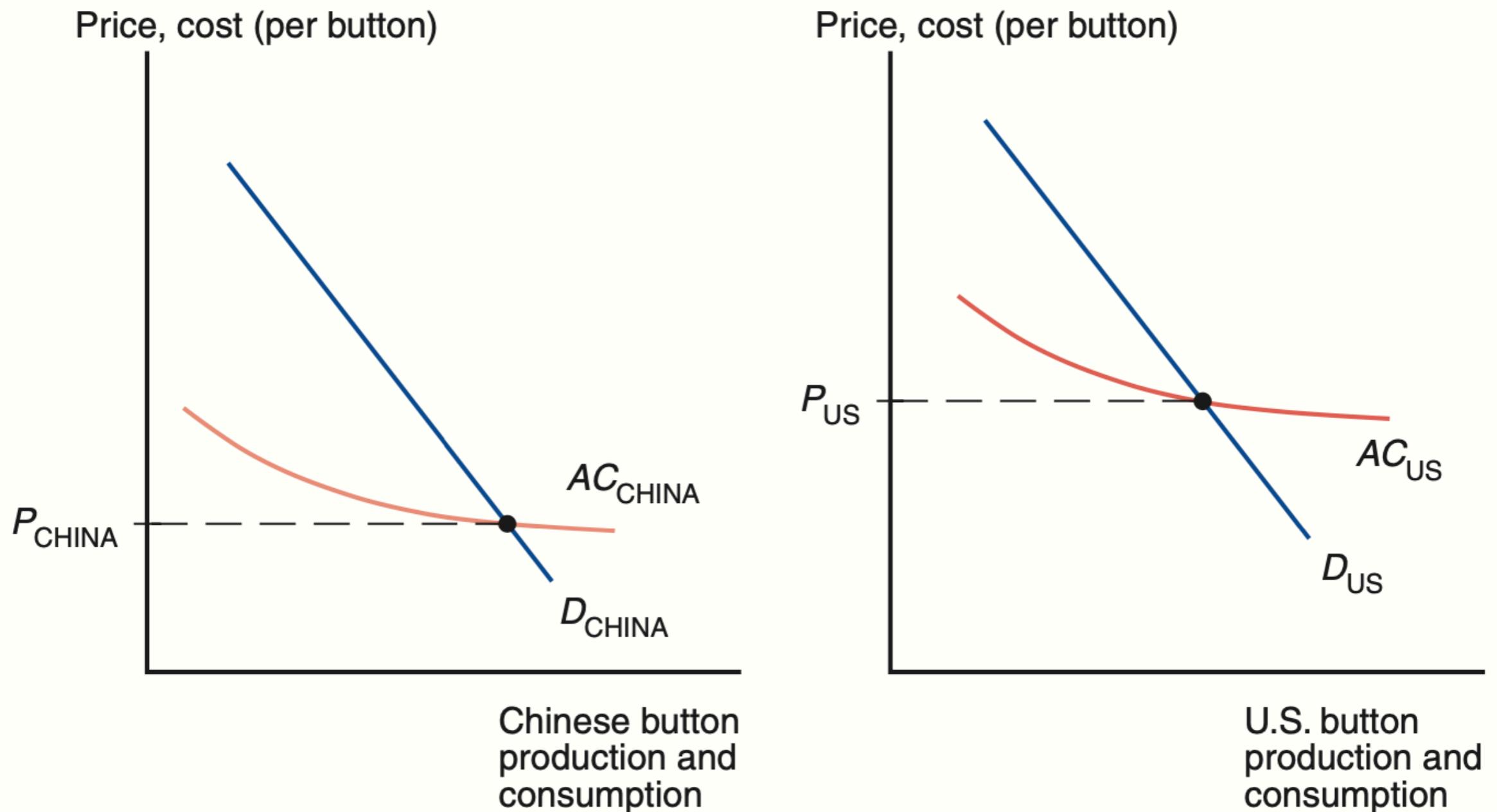


External Economies and International Trade

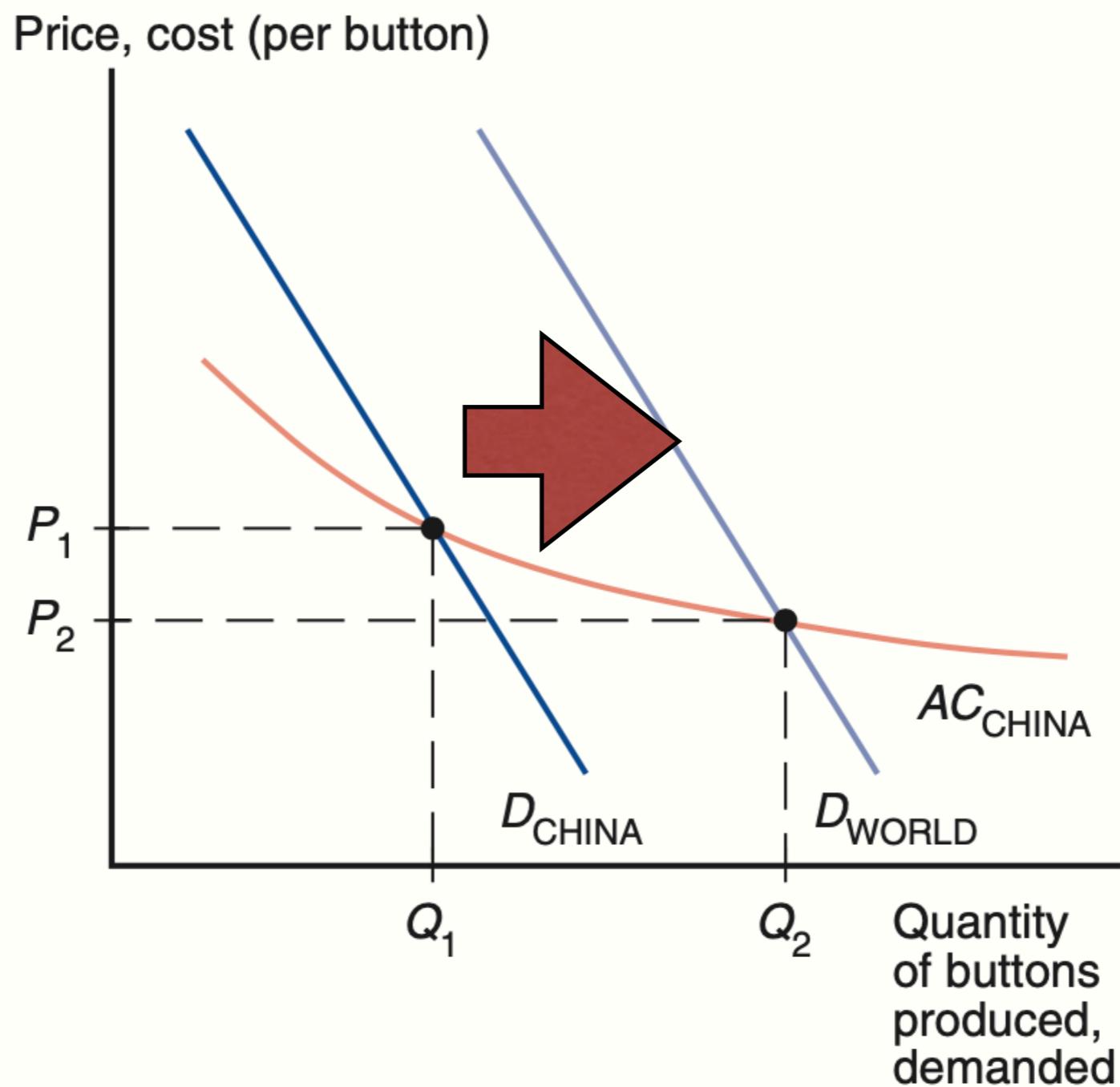
Assumptions

- Two countries: US and CN
- Final product: button
 - Button industry is subject to external economies of scale: forward-falling supply curve
 - Before trade: $P_{CN} < P_{US}$
 - After the international trade, button industry will be concentrate on to CN

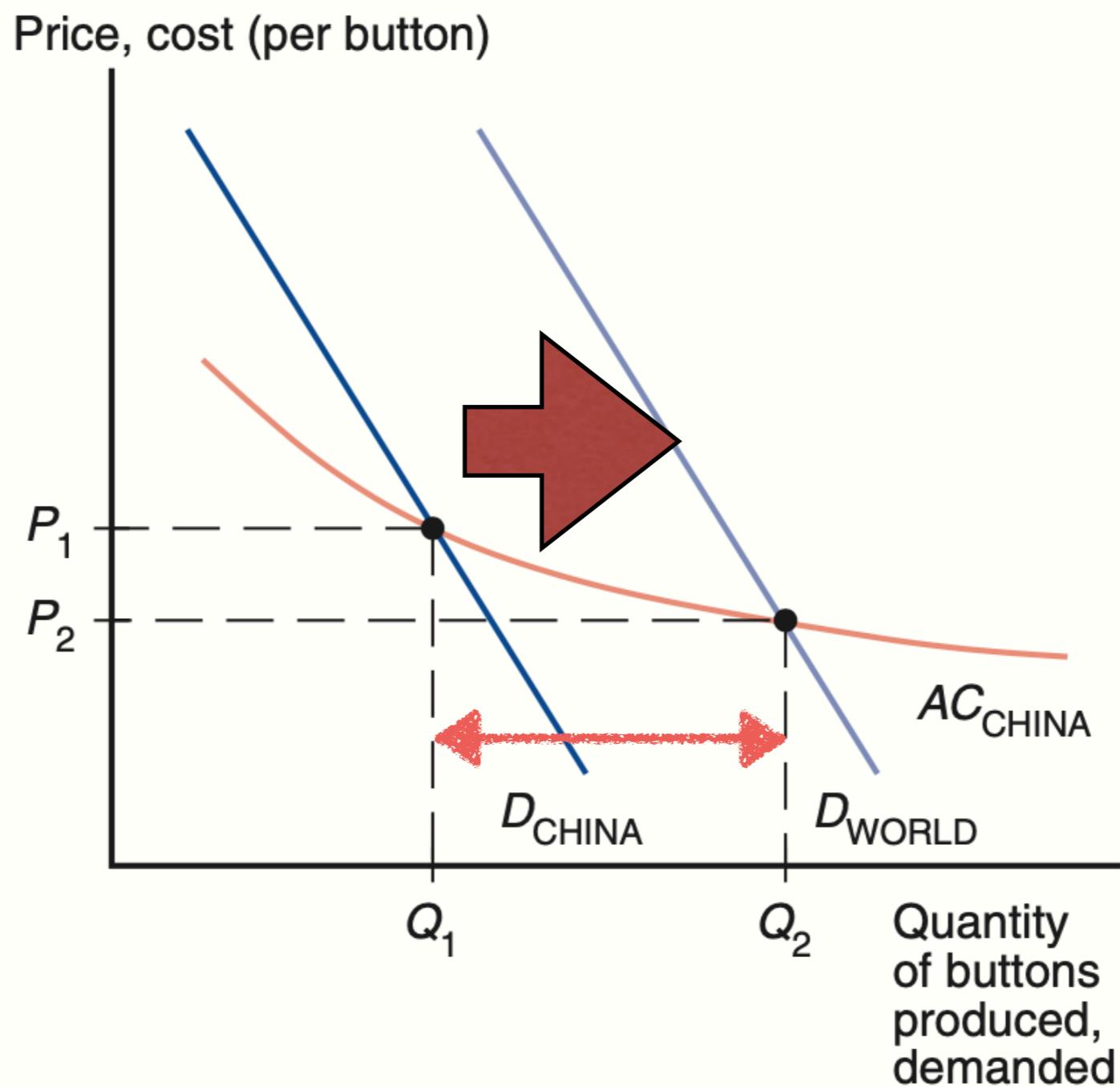
External Economies: Before Trade



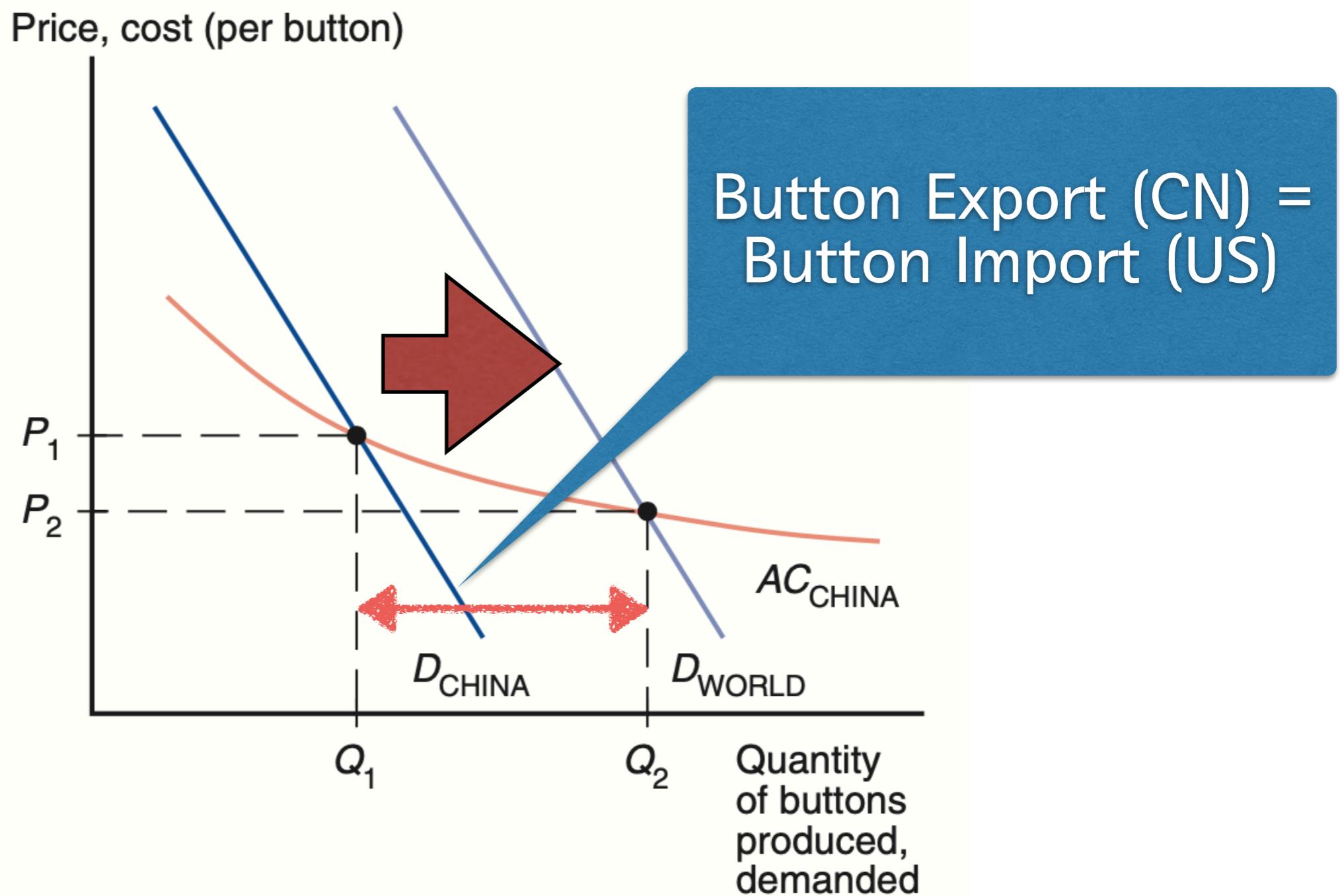
External Economies: After Trade (CN)



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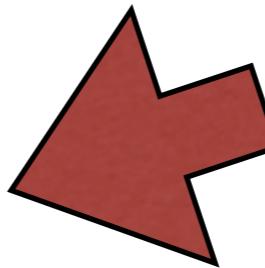


Difference with Former Model

- Standard Trade Model (Chapter 6):
 - $\text{Price}(\text{Home}) < \text{Price}(\text{Foreign}) \Rightarrow \text{Home: Export, Foreign: Import} \Rightarrow \text{Price}(\text{Home}) \uparrow, \text{Price}(\text{Foreign}) \downarrow \Rightarrow \text{Price Convergence: } \text{Price}(\text{Home}) = \text{Price}(\text{Foreign}) = \text{Price}(\text{World})$
 - True when it is subject to diseconomies of scale
- External Economies of scale (Chapter 7):
 - $\text{Price}(\text{Home}) < \text{Price}(\text{Foreign}) \Rightarrow \text{Home: Export, Foreign: Import} \Rightarrow \text{Price}(\text{Home}) \downarrow, \text{Price}(\text{Foreign}) \uparrow \Rightarrow \text{Home produce ALL}$

External Economies and the Pattern of Trade

- Initial advantage:
 - $P_A < P_B \Rightarrow$ country A export to country B
- Determinants of initial advantage
 - Comparative advantage
 - Historical contingency
 - or, path dependency

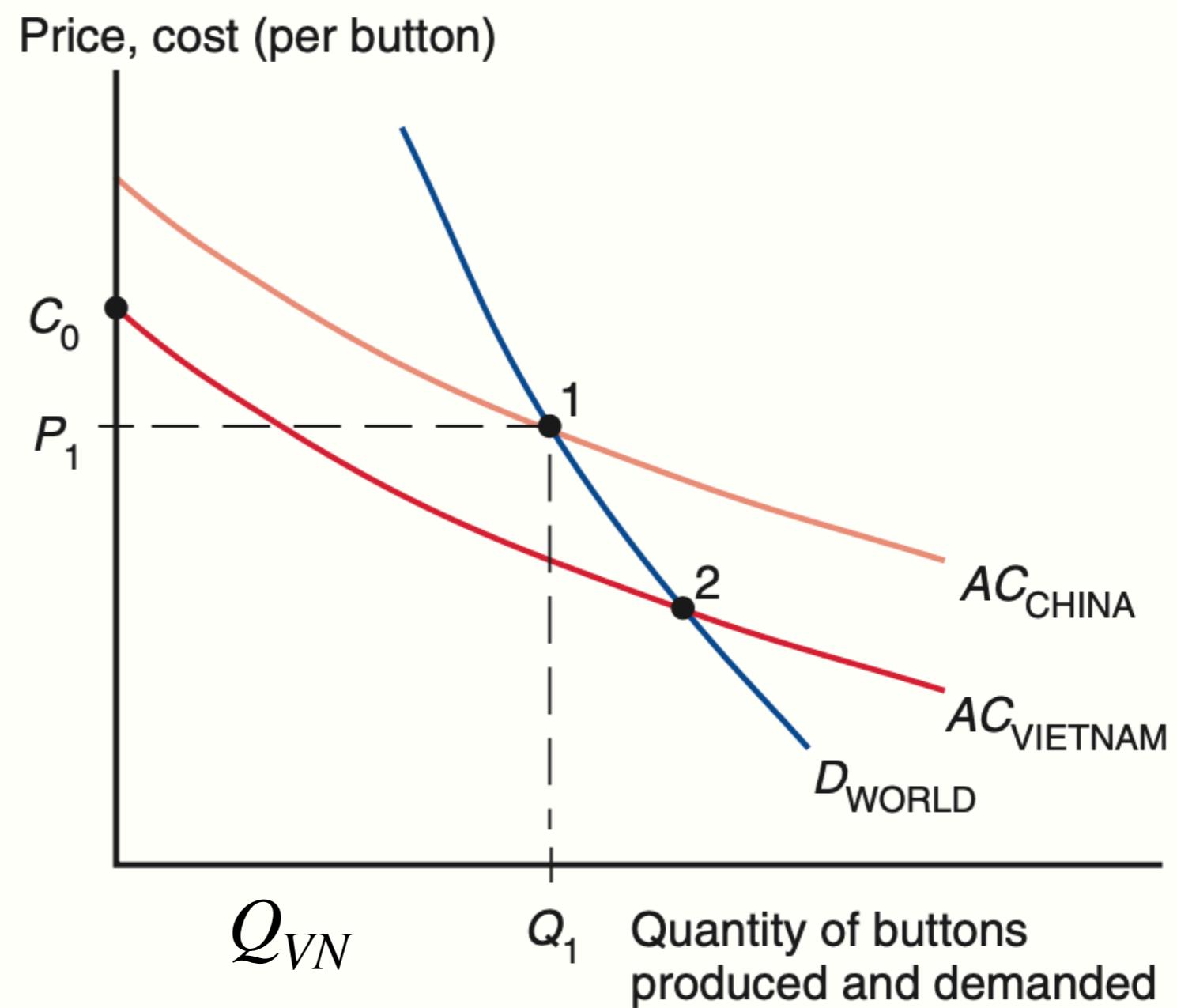


Other Cases of Historical Contingencies

- Silicon Valley (Semiconductor cluster): Hewlett and Packard
- London (Financial center): Britain's World Domination in 19th Century
- Bangalore (India): Texas Instruments
- Even when a country have comparative advantage, other country can produce all of the products which is subject to external economies of scale

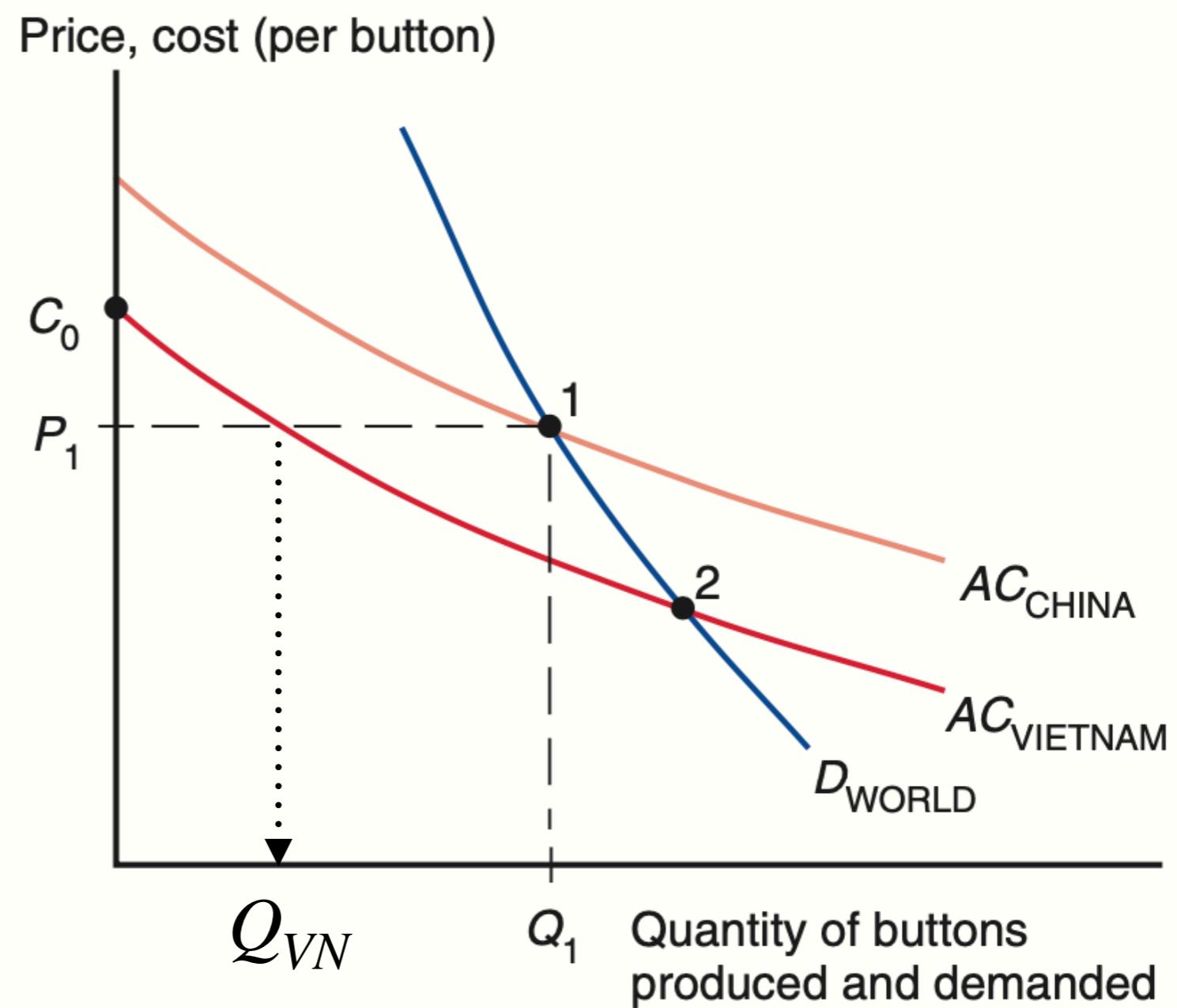
Virtual Example: Button Industry of CN and VN

- Two countries: CN (China) and VN (Vietnam)
 - VN has absolute advantage in producing buttons
- Suppose CN is already providing all of buttons to world (point 1)
- If VN begin to produce button, the price will be $C_0 > P_1$
- Until VN can produce Q_{VN} , VN cannot supply buttons to the world market



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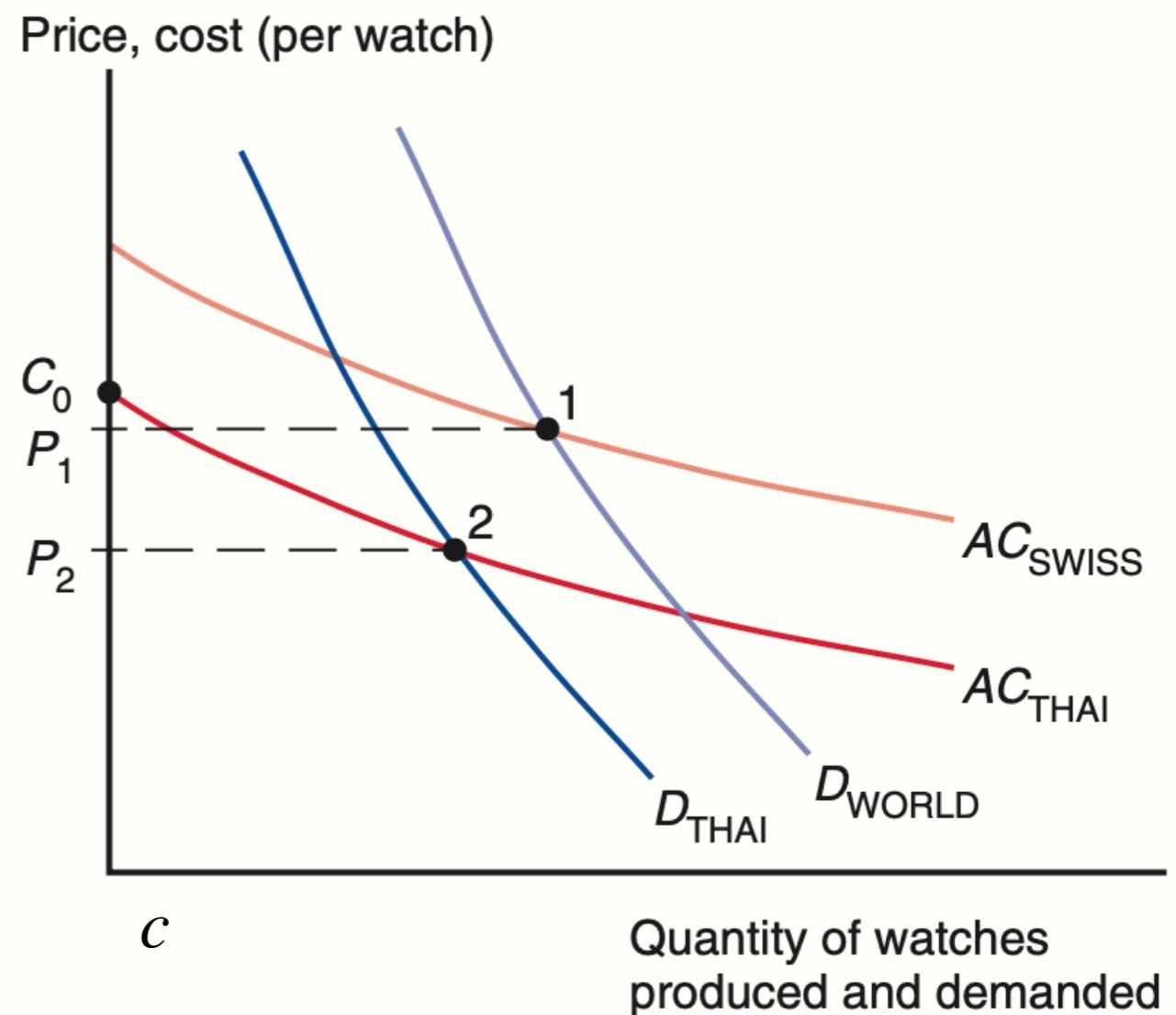


Trade and Welfare with External Economies

- In general, external economies of scale lead to gains from international trade
- However, there is no guarantee that the right (having comparative advantage) country will produce a good subject to external economics
 - Virtual example of button industry in CN and VN
- Trade based on external economies may make a country worse off

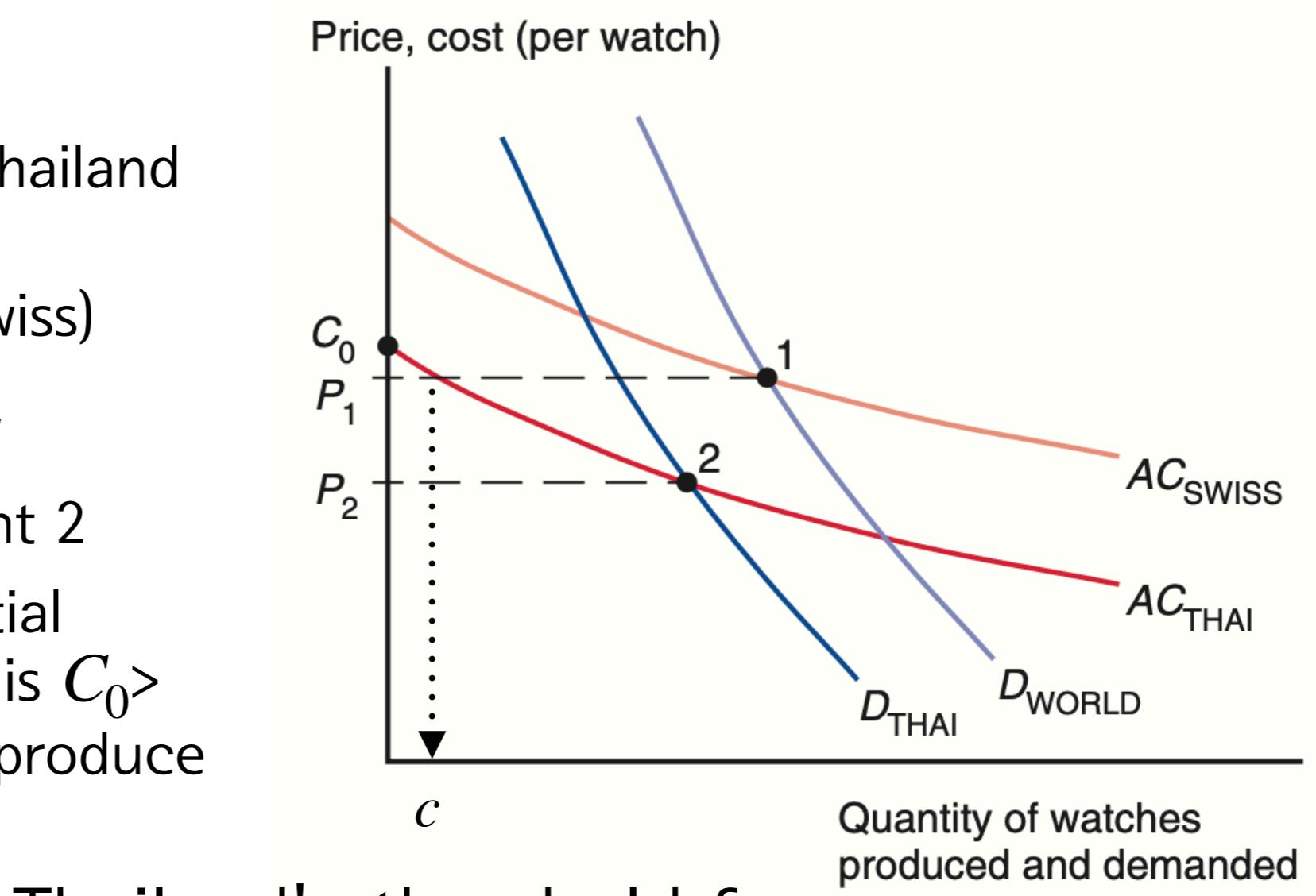
Virtual Example: Thailand and Switzerland

- Watch industry
- Two countries: Thailand and Switzerland
- $AC(\text{Thai}) < AC(\text{Swiss})$
- Before the trade, Thailand's watch production is point 2
- However, the initial break-even price is $C_0 > P_1$: They cannot produce watches



Virtual Example: Thailand and Switzerland

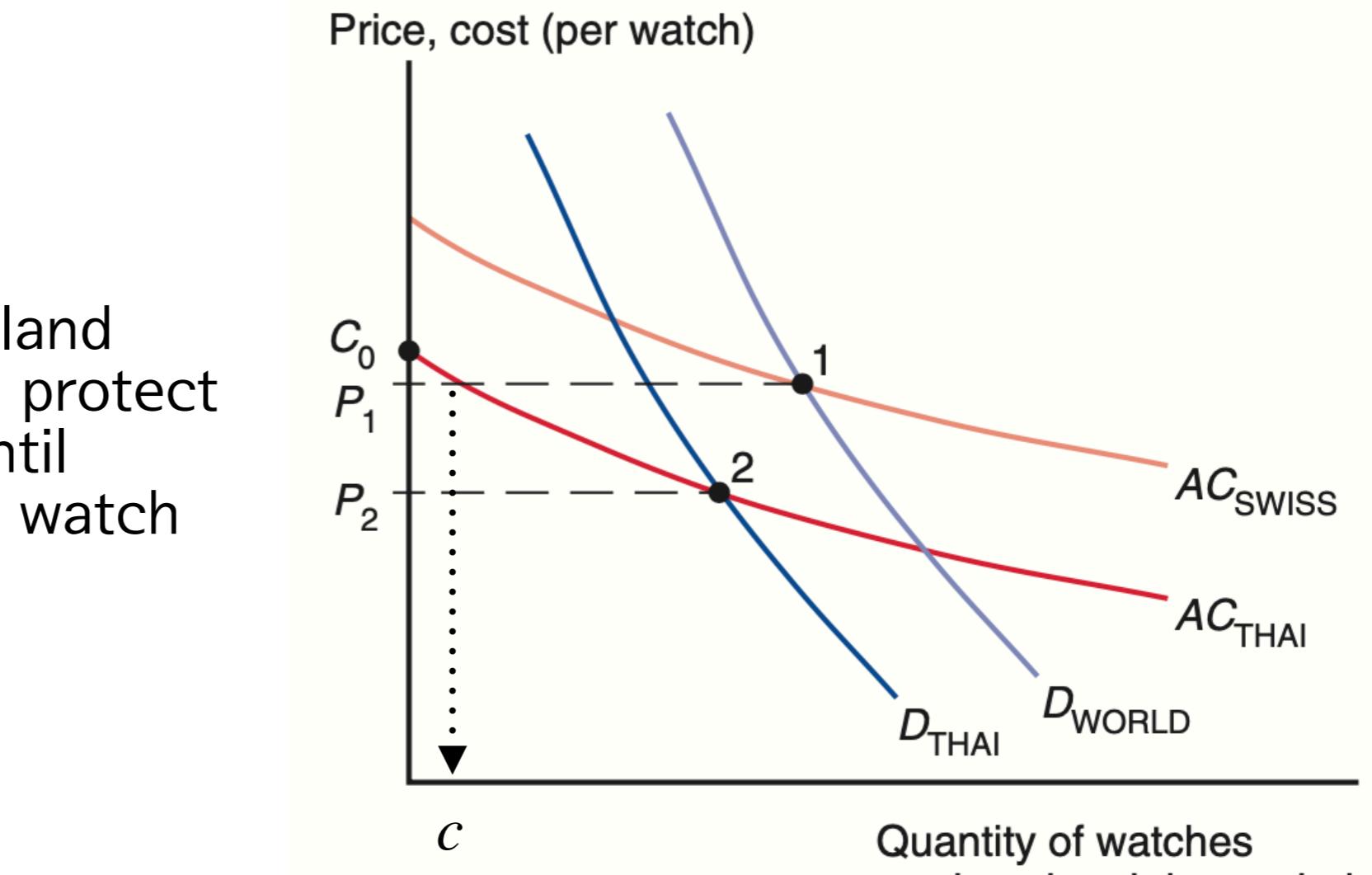
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Thailand's threshold for world supply

Incentive of Protectionism

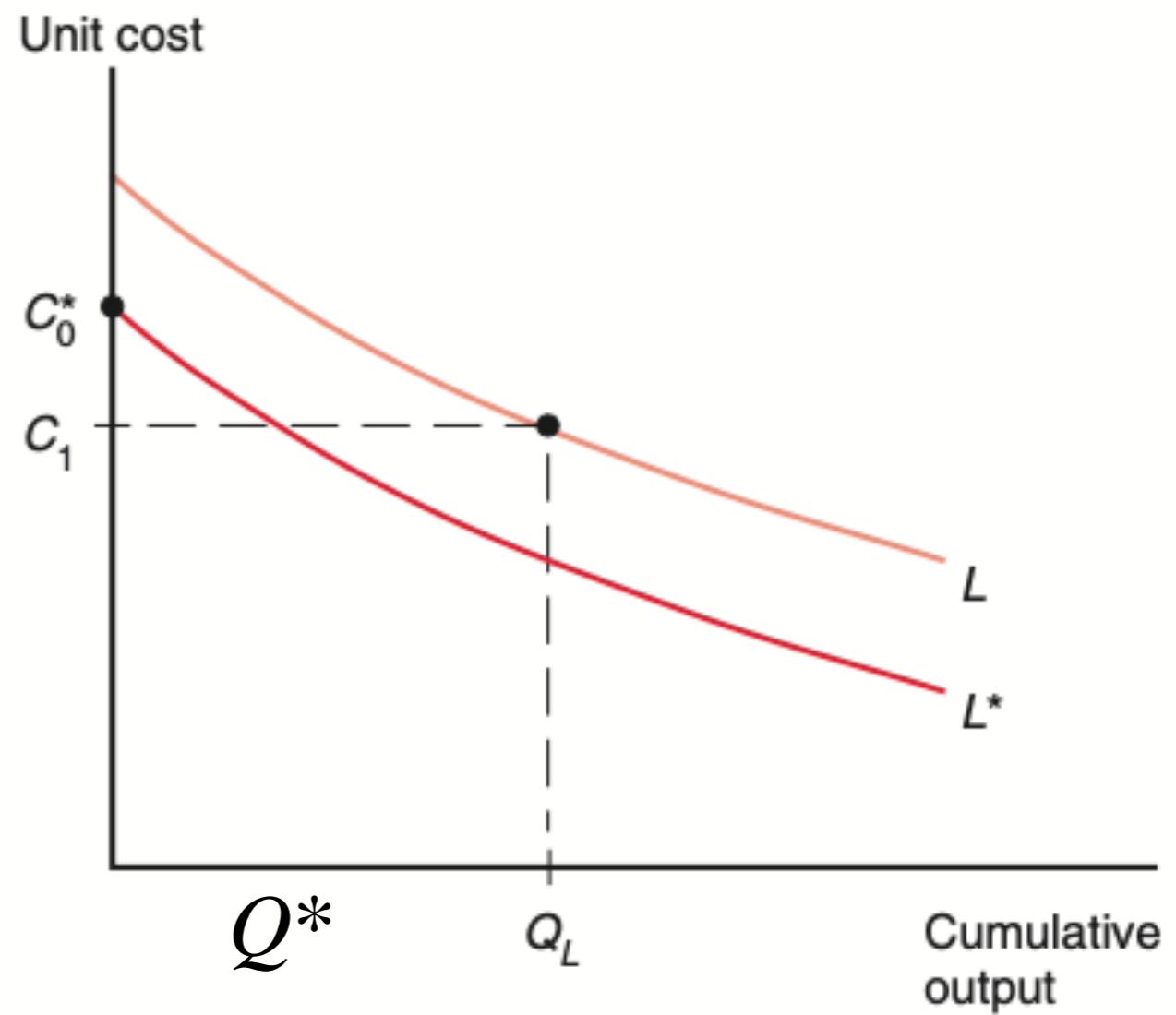
- In this case, Thailand have incentive to protect watch industry until Thailand produce watch at least c



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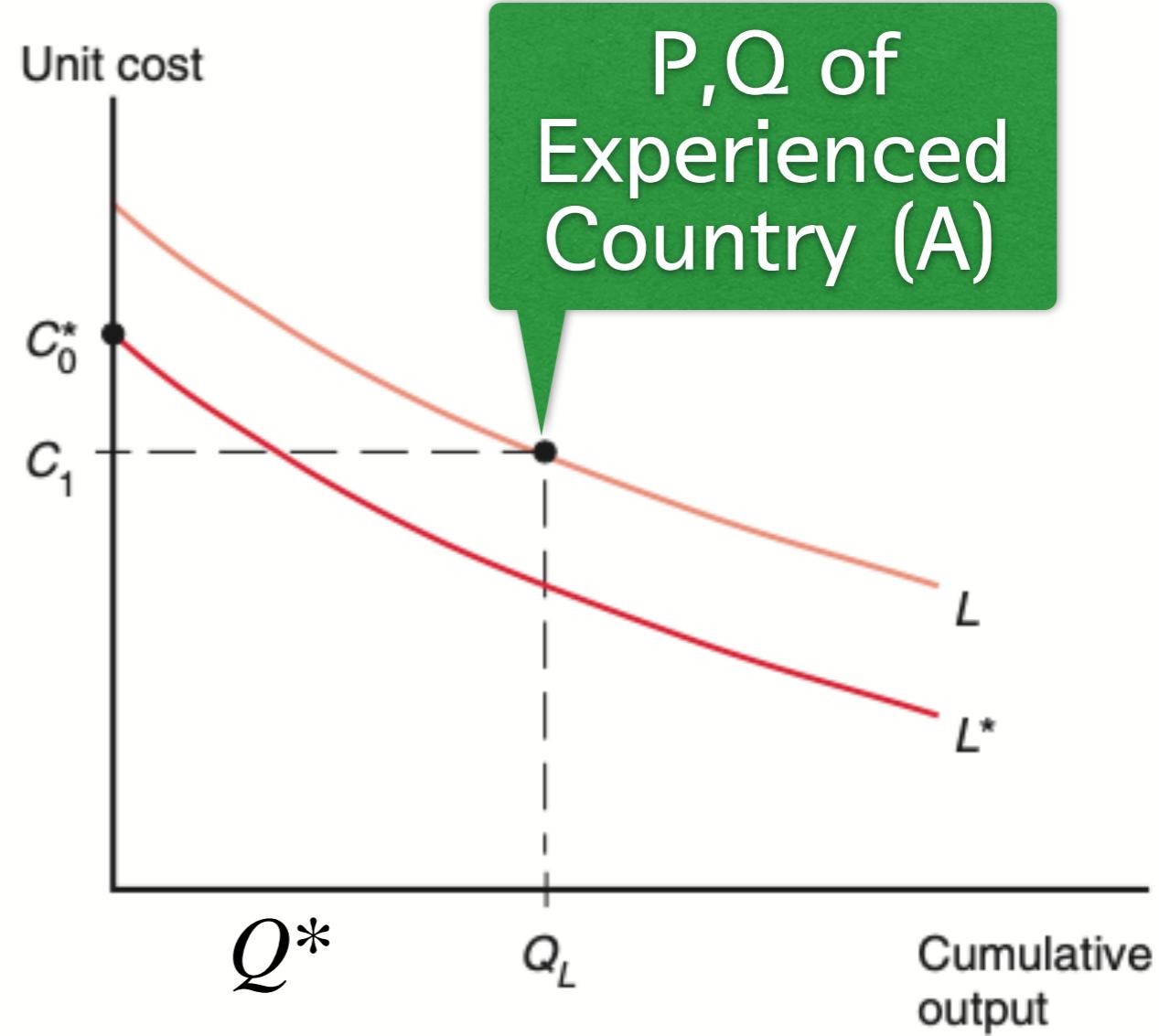
Dynamic Increasing Returns

- Dynamic increasing returns: costs fall with cumulative production over time rather than with the current rate of production
- Learning curve: negative relationship between unit cost to cumulative output
 - L: Learning curve of a country (A) that pioneered an industry
 - L^* : Learning curve of a country (B) that has lower input costs but less production experience



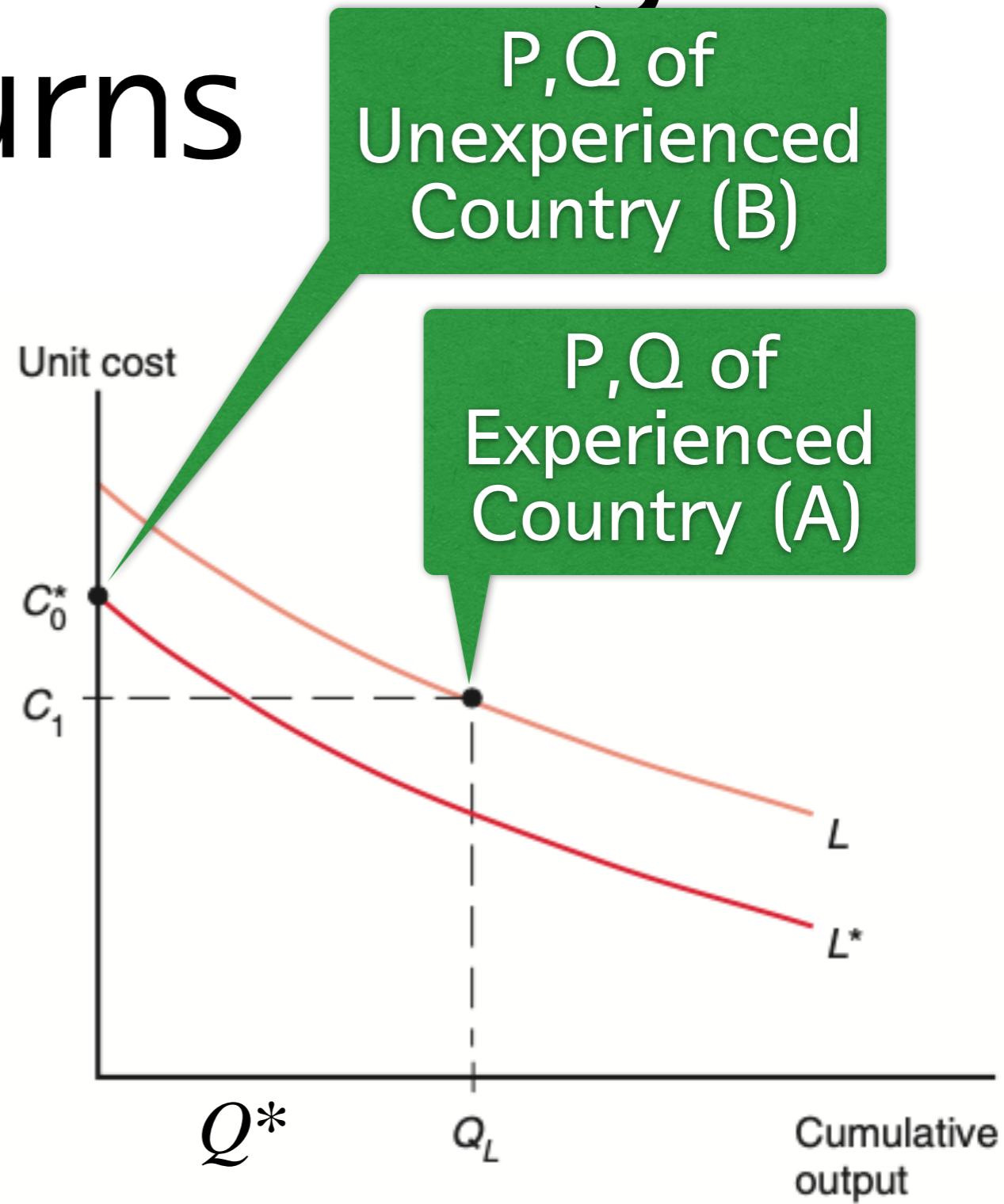
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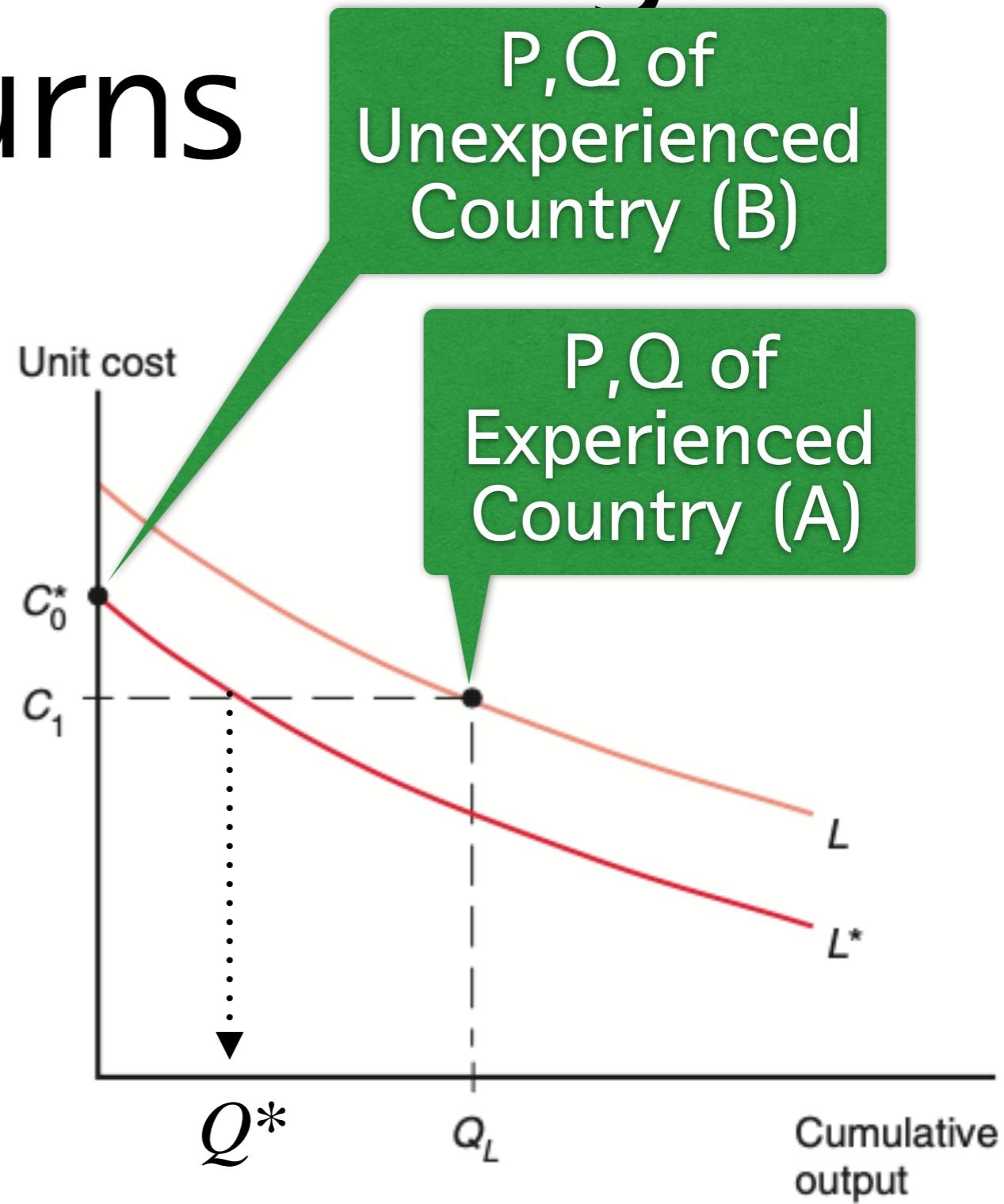
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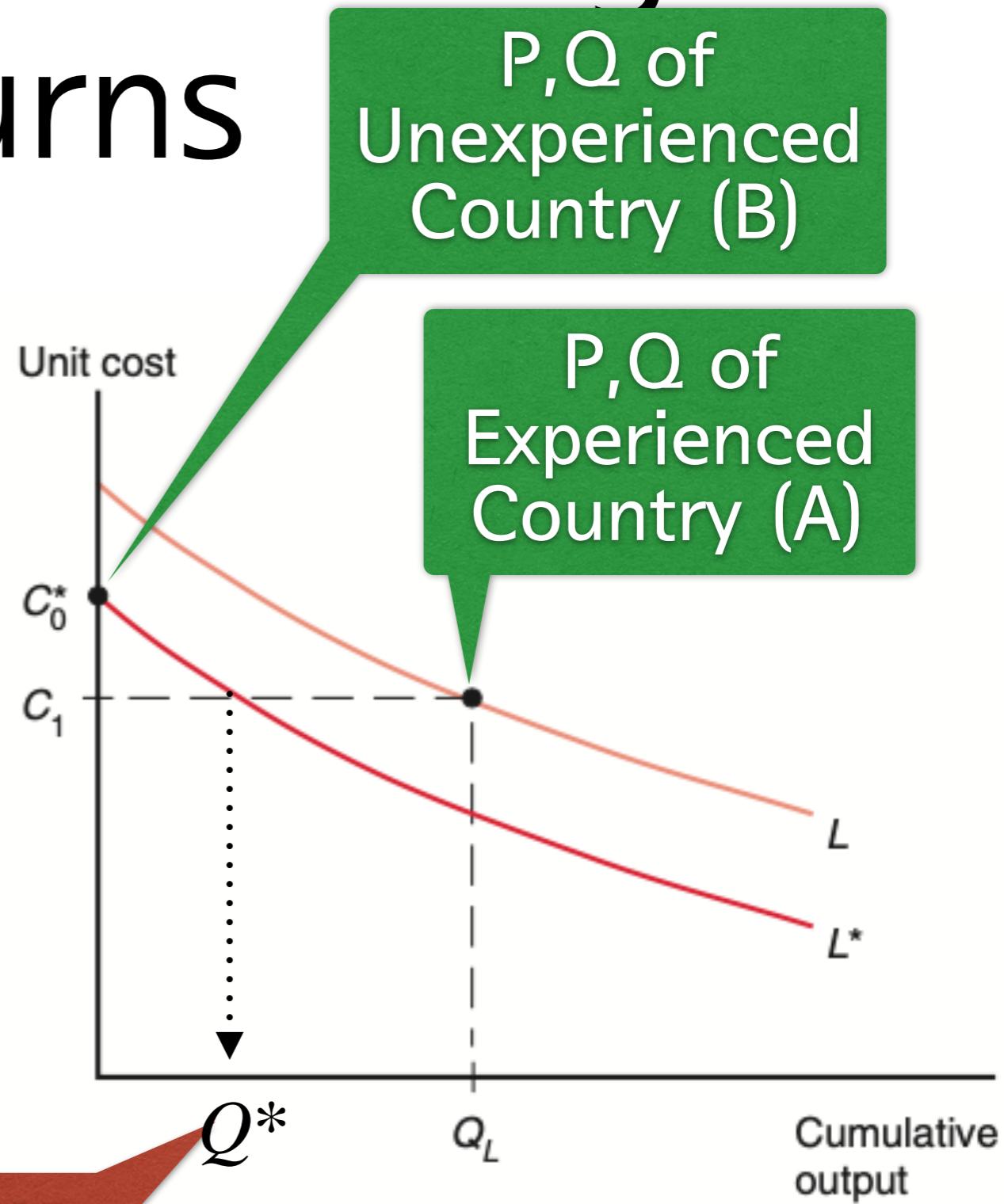
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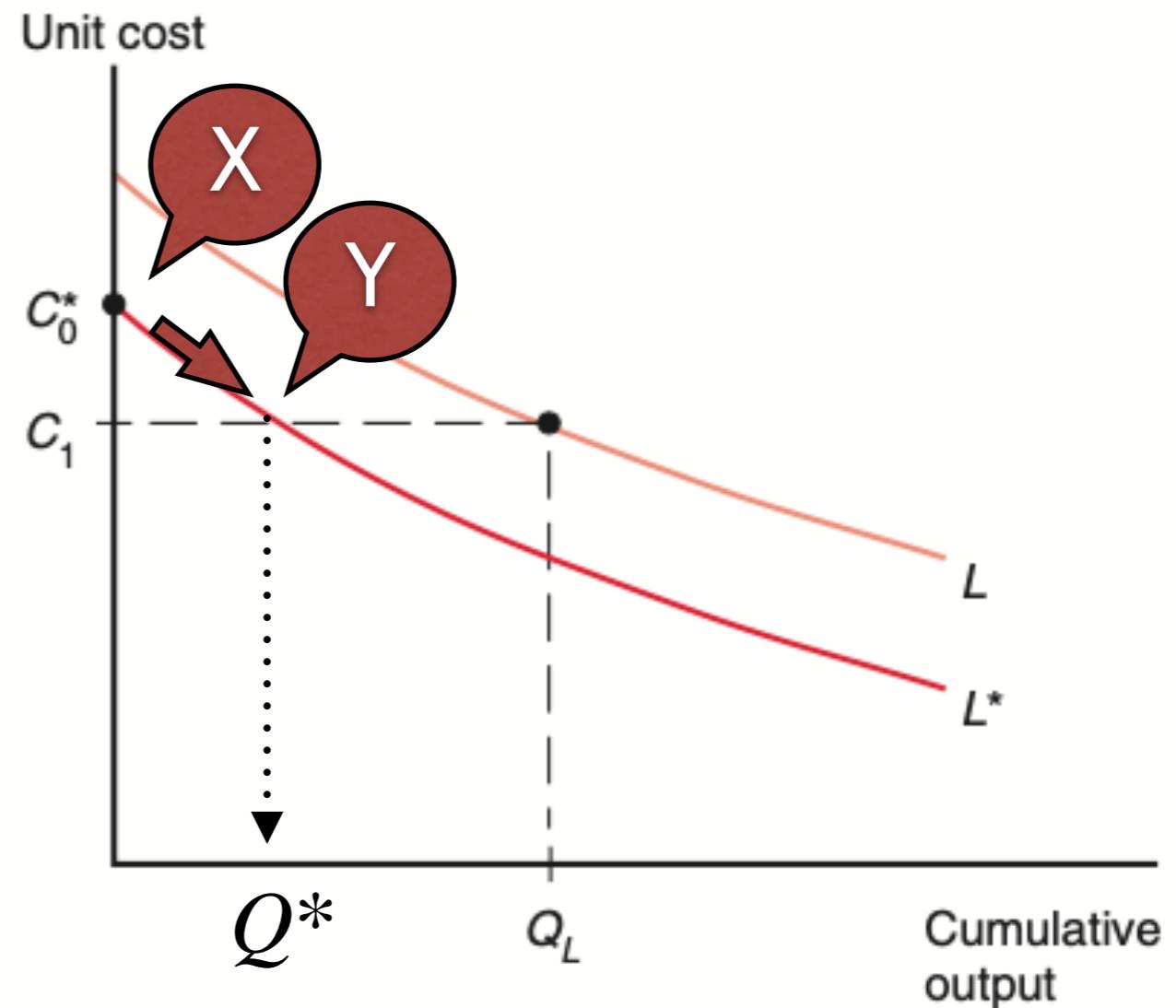
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If country B can produce over Q^* , it can be competitive

Infant Industry Argument

- Country can be better off if they can produce over Q^* ($X \rightarrow Y$) by:
 - Subsidy
 - Tariff
- It is one of the point that justify protectionism
 - Topic of Chapter 10
 - It is hard to identify in practice



Interregional Trade and Economic Geography

Interregional Trade

- Definition: Trade that takes place between regions within countries
- External economies play even more decisive in shaping the pattern of interregional trade

The Nature of Regional Economics

- More than 60% of US workers are employed by industries whose output is nontradable even within the US
 - These products must be supplied locally
 - It is called "nontradable" industry
 - Examples:
 - Ready-mix concrete manufacturing
 - Tax preparation services
 - Funeral service

Employment rate of Tradable and Nontradable Industries

- Nontradable Industries: Similar across regions
 - Restaurants: about 5% of the work force in every major cities
- Tradable Industries: Varies across regions
 - Work force in Manhattan: about 2% of total employment of US
 - Trading socks and bonds: about 25%
 - Advertising industry: about 14%

Determinants of the Location of Tradable Industries

- Natural resources
 - Houston: oil industry
 - Labor and capital is LESS decisive because they are highly mobile
- External economies
 - "The reason why so many advertising agencies located in New York is that so many other advertising agencies are located in New York"

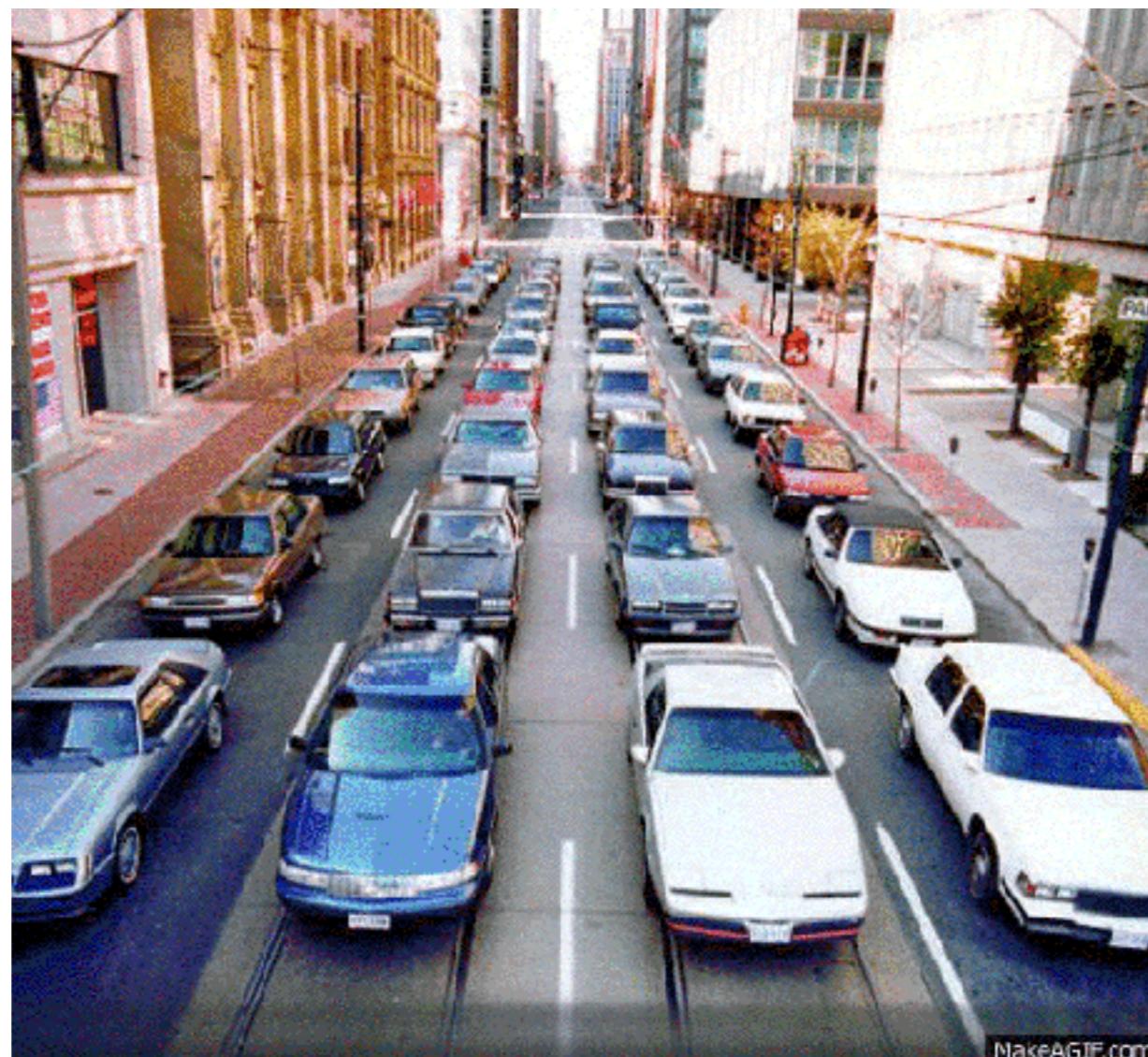
Economic Geography

- The forces driving **interregional trade** are not different with those driving **international trade**
- Economic geography: An approach to model interregional and international trade as well as such phenomena as the rise of cities as different aspects of the same phenomenon:
economic interaction across space

Next Topic

- 2019.10.31: Midterm examination
 - Do not forget bringing your own sheets
 - See the notices in class blackboard site
- 2019.11.7: Firms in the Global Economy
 - Krugman Chapter 7

Thank you!



MakeAGIF.com

Thank you!

