Competitive Equilibrium

Econ 50 | Lecture 16 | March 1, 2016

Lecture

- Review: **profit maximization**
  Produce where MR = MC

- New choice: **entry/exit**
  Enter if P > ATC,
  exit if P < ATC

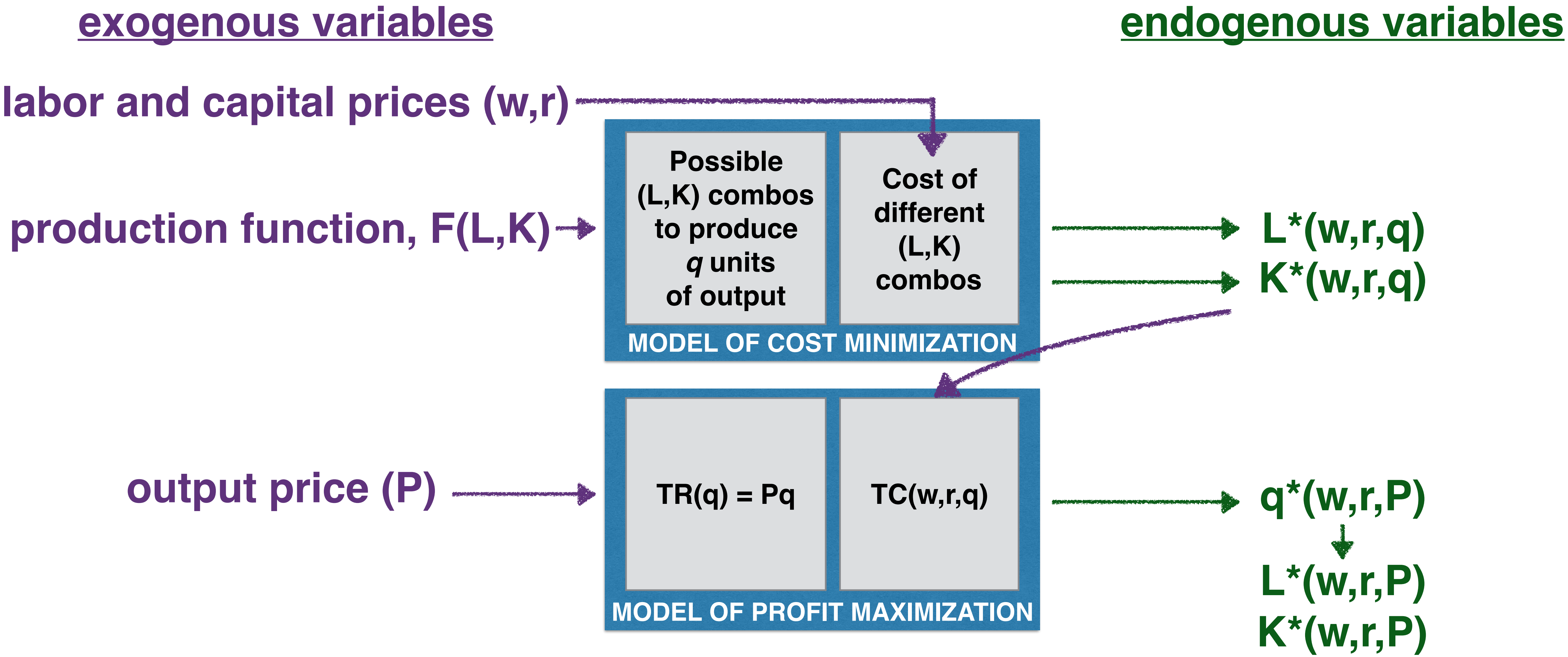
- New concept: **equilibrium**

- Long-run industry supply

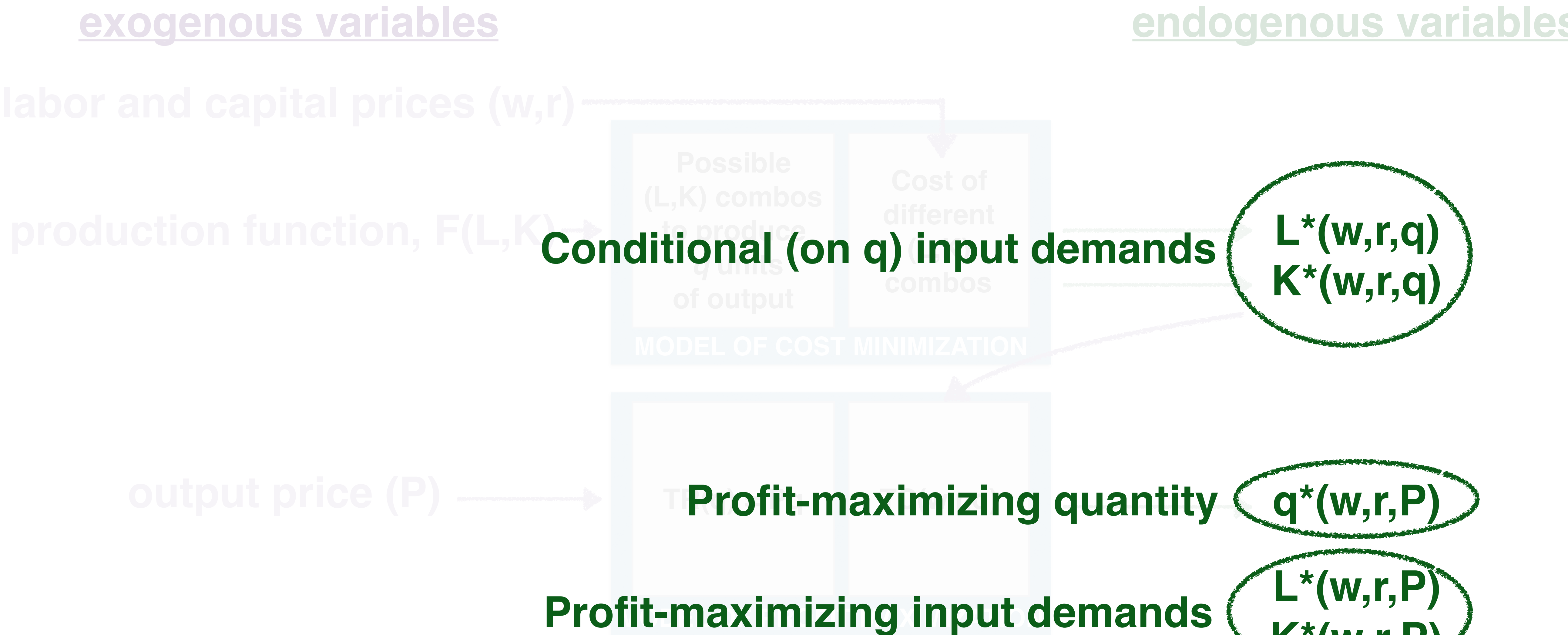
Group Work

- Start on HW7, Q2

Recall: **Perfect Competition**



Unified Producer Theory: **Perfect Competition**



Conditional (on q) input demands — **L*(w,r,q)**, **K*(w,r,q)**

Profit-maximizing quantity — **q*(w,r,P)**

Profit-maximizing input demands — **L*(w,r,P)**, **K*(w,r,P)**

Given a production function $q = f(L, K)$

input prices (w, r),

and the market price of output (P),

there are two ways of thinking about the firm's problem:

	Profit =	Total Revenue	– Total Costs
Choosing **inputs**:	$\pi(L, K) =$	$P \times f(L, K)$	$-\ (wL + rK)$
Choosing **output**:	$\pi(q) =$	$P \times q$	$-\ TC(q)$
		(Value of output)	(Cost of inputs)

Part I
Review: Profit Maximization

Choosing Output

	Profit =	Total Revenue	−	Total Costs
		(Value of output)		(Cost of inputs)
Total Profit:	$\pi(q) =$	$P \times q$	−	$TC(q)$
Marginal Profit:	$\frac{d\pi(q)}{dq} =$	P	−	$MC(q)$

Marginal profit = 0 when $P = MC(q)$

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<u>Part II</u>

New choice: entry/exit

Visualizing Profit per Unit

	Profit =	Total Revenue	–	Total Costs
		(Value of output)		(Cost of inputs)
Total Profit:	$\pi(q) =$	$P \times q$	–	$TC(q)$
	$=$	$P \times q$	–	$ATC(q) \times q$
	$=$	$[P - ATC(q)] \times q$		

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What goes into “Average Total Cost”

- Cost of capital, rK
- Cost of labor, wL
- Opportunity cost of exiting
  = “profit in other industries”

Zero Economic Profit Condition
(or "equal profit condition")

A Firm will Exit If Profit is Negative

SUPPLY DECISIONS: SUMMARY

Short run supply: adjust variable inputs (e.g. L)

to set q so that $P = MC(q)$,

as long as $P > \min AVC(q)$

Long run supply: adjust all inputs (e.g., K and L)

to set q so that $P = MC(q)$,

as long as $P > \min AC(q)$,

including opportunity costs of leaving industry.

Part III

Equilibrium

Equilibrium: A General Definition

An economic model is in **equilibrium** if,

given what each of the other agents in the model is doing,

no agent has any incentive to change what they are doing.

Partial Competitive Equilibrium

There are two types of agents: consumers and firms

All agents take output and input prices as given

Consumers have exogenously given income to spend on goods and try to maximize utility by setting **MRS = Px/Py** for all goods X, Y.

Firms have exogenously given production functions and try to maximize profit by setting **P = MC**

Firms can change labor input in the short run, all inputs in the long run, and change industries in the very long run.

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General Competitive Equilibrium

There are two types of agents: consumers and firms

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Consumers sell **labor** (leisure-consumption model) and **capital** (intertemportal consumption model) and use the income to buy goods.

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Equilibrium occurs when **all input and output markets clear**.

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Industry Long Run Equilibrium

- In the industry long run equilibrium,
  profits in all industries must be the same

- This is the same as saying that
  in each industry, firms are making zero economic profit
  (including the opportunity cost of switching industries)

- If you're told in a problem that an industry is in long-run equilibrium,
  it means you know the (accounting) profits in other industries.

Zero Economic Profit Condition and Minimum Efficient Scale

- Let TC(q) include all economic costs (including opportunity cost of leaving the industry).

- Zero economic profit means: TR = TC => **P = ATC**

- Profit maximization means: MR = MC => **P = MC**

- Since **P = MC = AC**, and since MC intersects AC at the MES, this means that in long run competitive equilibrium, all firms must be operating at minimum efficient scale.

Part IV

Long-Run Industry Supply

Increasing/Decreasing/Constant Cost Industries

- As more firms enter the market, what happens to their cost structure?
- Input prices are bid up => **increasing cost industry**
- Input prices remain unchanged => **constant cost industry**
- Input prices decrease => **decreasing cost industry**

Long-Run Industry Supply

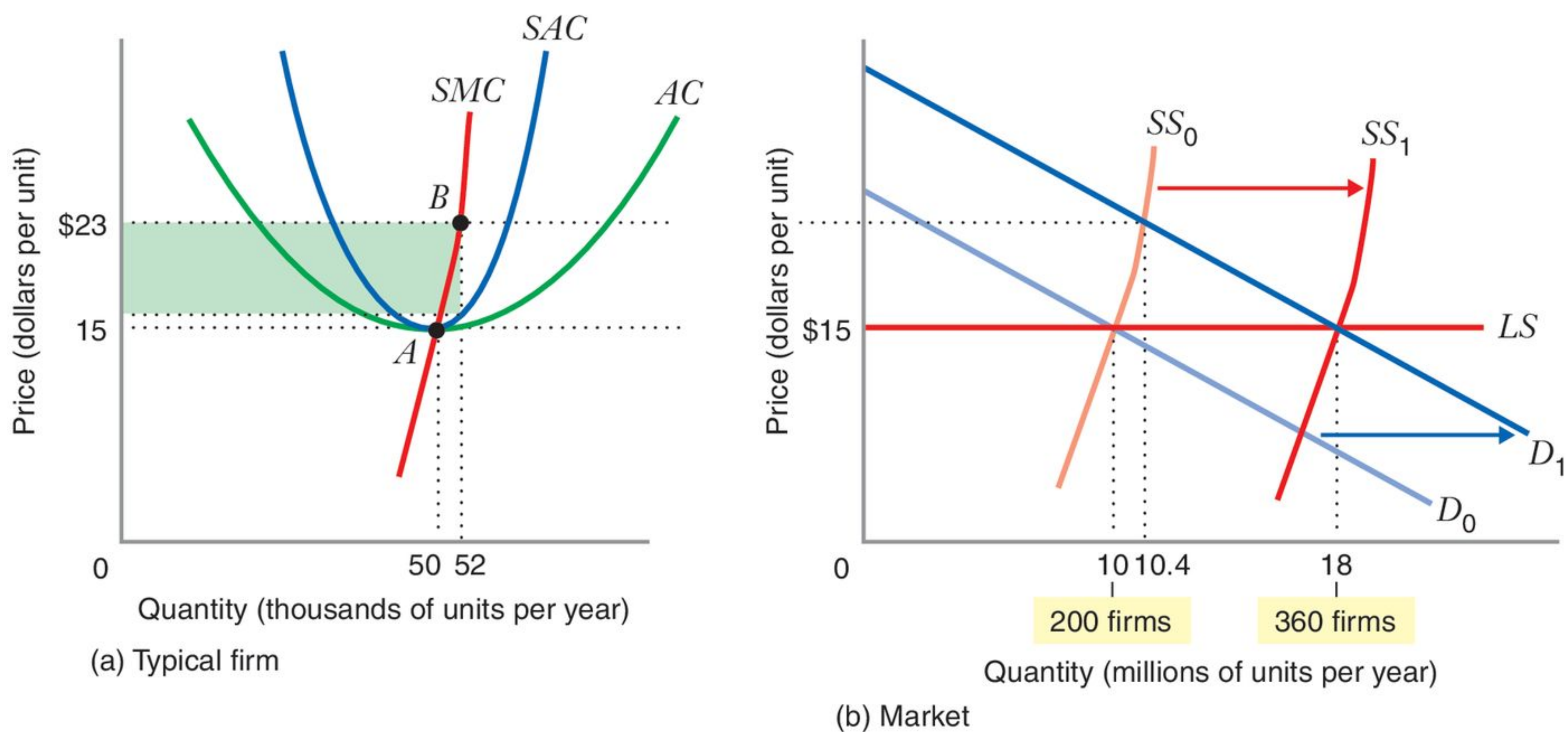
- Not a “normal” supply curve
- Terrible sentence in the book:
  “The long-run supply curve LS is a horizontal line at $15—
  in the long run, all market supply occurs at this price.”
- If you can explain why this is terrible,
  you’re in great shape for the final.

A Good Definition of Long-Run Industry Supply

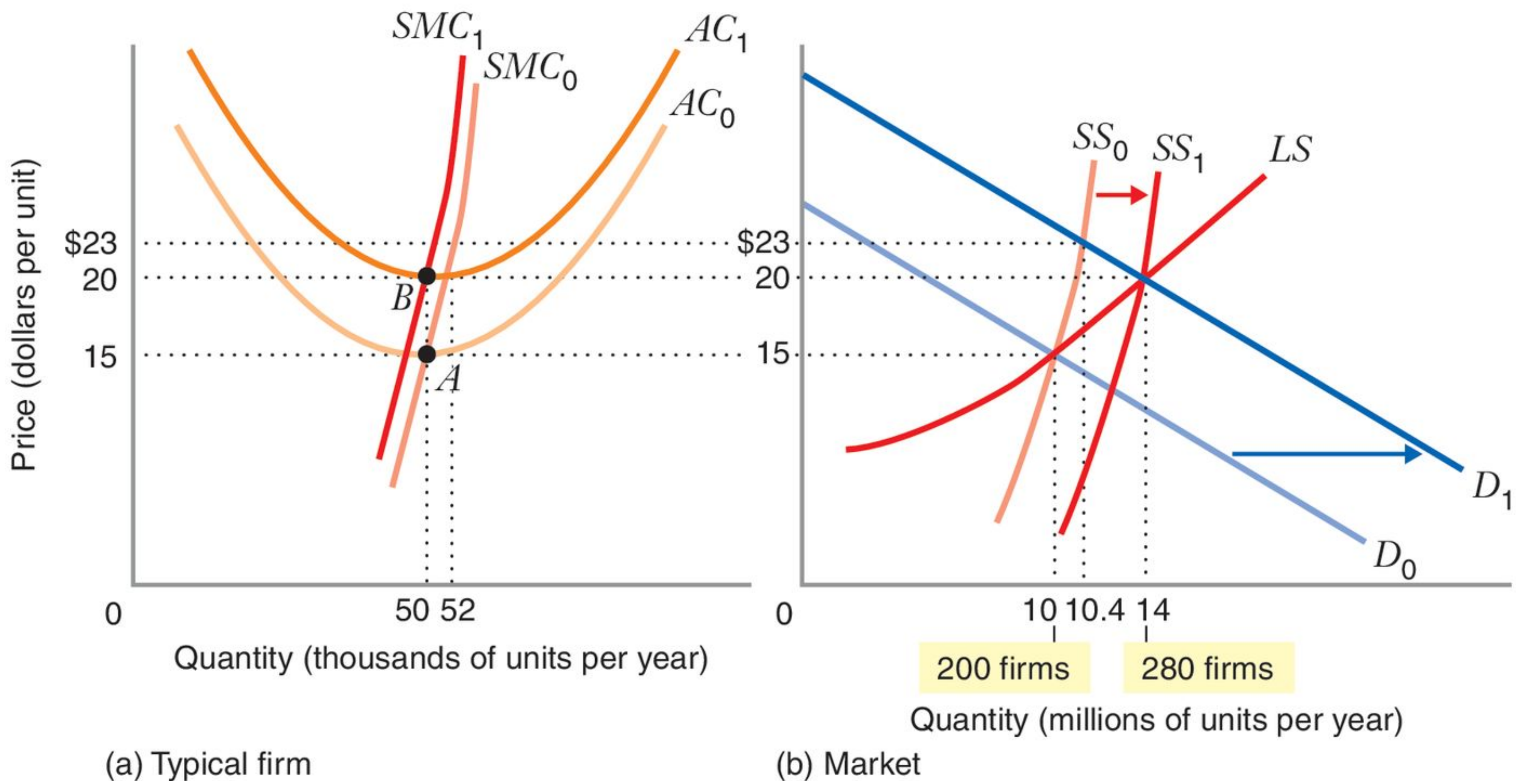
The long-run industry supply
is the set of all points **(P,Q)** such that
for each quantity **Q**, **P** represents the lowest cost
at which society can produce **Q** units.

In other words: it's all possible **(P,Q)**'s
that are long-run competitive equilibria

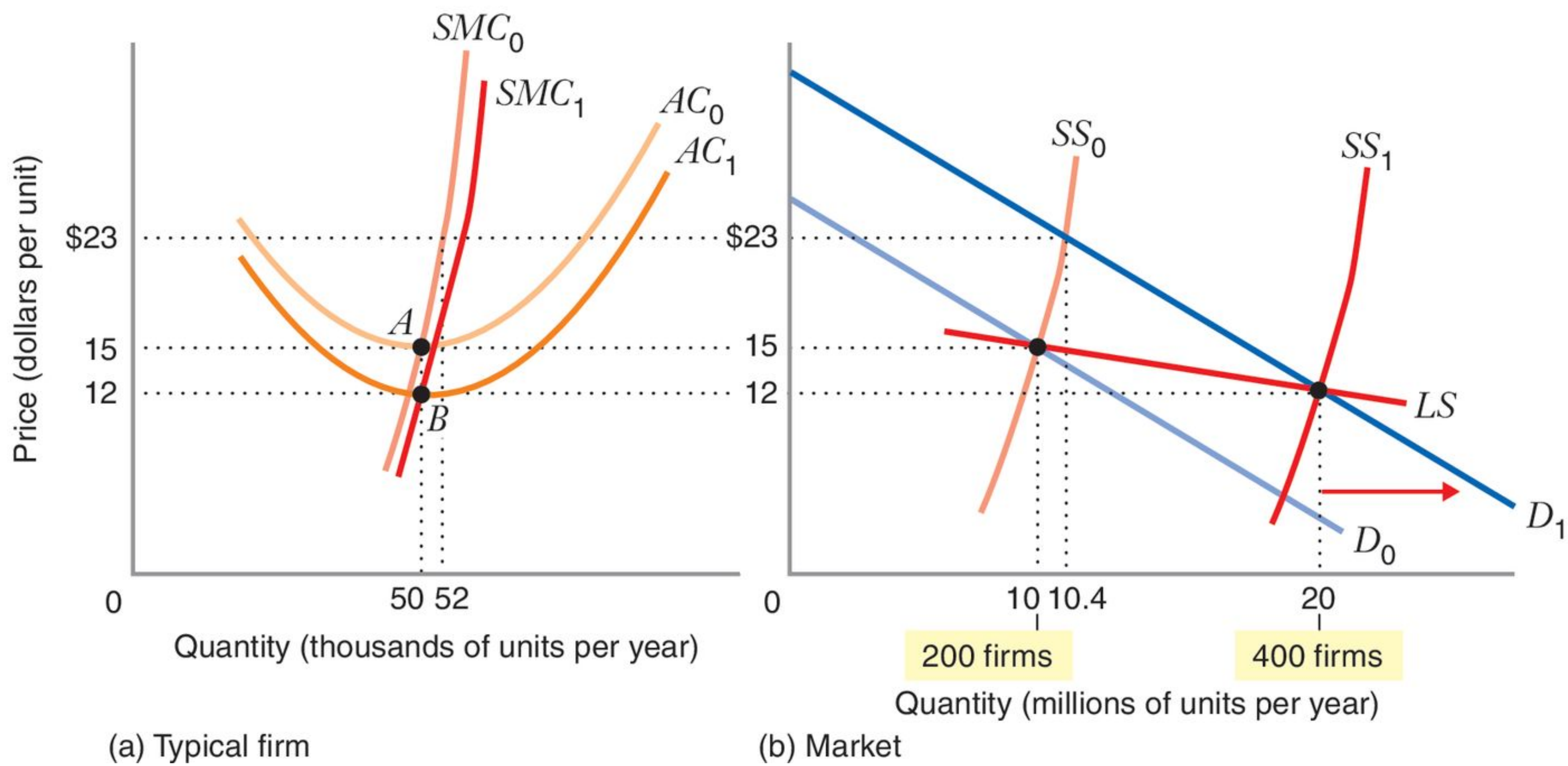
Constant Cost Industry



Increasing Cost Industry



Decreasing Cost Industry



Key Takeaways

- Profit-maximizing condition: P = MC
- Zero profit condition: P = ATC, including opportunity costs
- Equilibrium dynamics: short run, long run, very long run
- Competitive equilibrium produces all goods
  at their lowest possible cost.

	Short Run	Long Run
Conditional Labor Demand, $L^*(q)$	$\frac{1}{\overline{K}}q^4$	q^2
Conditional Capital Demand, $K^*(q)$	N/A	q^2
Total Cost, $TC(q)$	$\overline{K} + \frac{1}{\overline{K}}q^4$	$2q^2$
Marginal Cost, $MC(q)$	$\frac{4}{\overline{K}}q^3$	$4q$
Quantity Supplied, $q^*(P)$	$\left(\frac{\overline{K}P}{4}\right)^{\frac{1}{3}}$	$\frac{1}{4}P$
Maximized Profit, $\pi^*(P)$	$3(\frac{\overline{K}}{256})^{\frac{1}{3}}P^{\frac{4}{3}} - \overline{K}$	$\frac{1}{8}P^2$
Profit-Maximizing Labor Demand, $L^*(q^*(P))$	$\overline{K}^{\frac{1}{3}}(\frac{P}{4})^{\frac{4}{3}}$	$\frac{1}{16}P^2$
Profit-Maximizing Capital Demand, $K^*(q^*(P))$	N/A	$\frac{1}{16}P^2$

Figure 1: Inputs, Costs, Supply, and Profit for $f(L, K) = L^{\frac{1}{4}}K^{\frac{1}{4}}$ with $w = r = 1$

Currently in long-run equilibrium with: $q = 16$ $Q^D(P) = \frac{65{,}536}{P}$

<u>Group Work</u>

Calculating LR Equilibrium
and Transition Dynamics