MANAGERIAL ECONOMICS · WEEK 2

Demand and supply in competitive markets

How do price-taking consumers and firms respond to price?

INDIVIDUAL DEMAND

The most preferred affordable bundle

Preferences rank bundles.
The budget and prices determine which bundles are affordable.

MAYA'S DAILY CHOICE

Biscotti market price: $4

Daily budget: $30

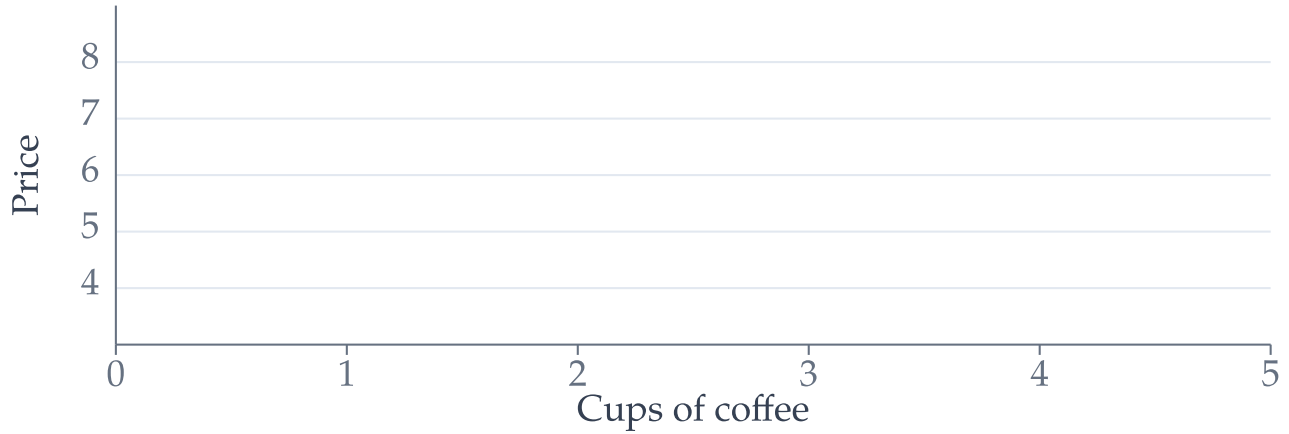
Cup of coffee price $8

Reveal Maya's best bundle

Clear demand points

CUPS OF COFFEE → NUMBER OF BISCOTTI ↓	0	1	2	3	4	5
5	$18	$26	$33	$39	$44	$48
4	$17	$25	$32	$38	$43	$47
3	$15	$23	$30	$36	$41	$45
2	$12	$20	$27	$33	$38	$42
1	$7	$15	$22	$28	$33	$37
0	$0	$8	$15	$21	$26	$30

Maya's demand for coffee



INDIVIDUAL DEMAND

From WTP to demand

At each price, the buyer chooses the highest-value bundle the budget allows.

CHOICE PROBLEM

Maximize value subject to the budget

Choose q and b to maximize $V_C(q) + V_B(b)$

such that $pq + 4b \leq 30$

$V_C(q)$: Maya's total value from q cups of coffee.

$V_B(b)$: Maya's total value from b biscotti.

The coffee quantity in each optimal bundle is a point on Maya's demand curve.

MAYA'S DAILY COFFEE

Coffee in the best bundle

PRICE	QUANTITY
$4	5
$5	4
$6	3
$7	3
$8	2

Each price has a unique best bundle.

CHANGE IN QUANTITY DEMANDED

Along or shift?

OWN PRICE

The buyer chooses another point on the same curve.

Movement along

FUNDAMENTALS

Quantity changes at every price.

Shift

A RISE IN OWN PRICE · INCOME UNCHANGED

Ordinary and Giffen goods

ORDINARY GOOD

A higher own price reduces quantity demanded.

Price rises → purchasing power falls, while alternatives become relatively cheaper → the buyer switches away and buys less.

Quantity demanded falls

GIFFEN GOOD

A higher own price increases quantity demanded.

Price rises → purchasing power falls → the buyer cuts costlier foods and buys more of this staple to get enough to eat.

Quantity demanded rises

Veblen good: A higher price can make the good more desirable (higher status)

DEMAND SHIFTS

Changes in fundamentals

01 Income

02 Preferences

03 Price of a substitute

04 Price of a complement

A RISE IN INCOME · PRICES UNCHANGED

Normal and inferior goods

NORMAL GOOD

Higher income increases demand.

Income rises → purchasing power rises → the buyer chooses more of this good at each price.

Demand shifts right

INFERIOR GOOD

Higher income reduces demand.

Income rises → purchasing power rises → the buyer can afford preferred alternatives and buys less of this good at each price.

Demand shifts left

INDIVIDUAL SUPPLY

From WTA to supply

At each price, the seller chooses the production level to maximize profits.

ECONOMIC PROFIT

Revenue minus economic cost

$$\pi(q) = pq - C(q)$$
$$= [p - AC(q)] \times q$$

Average cost determines the margin; quantity scales it.

FIRM SUPPLY

Two steps

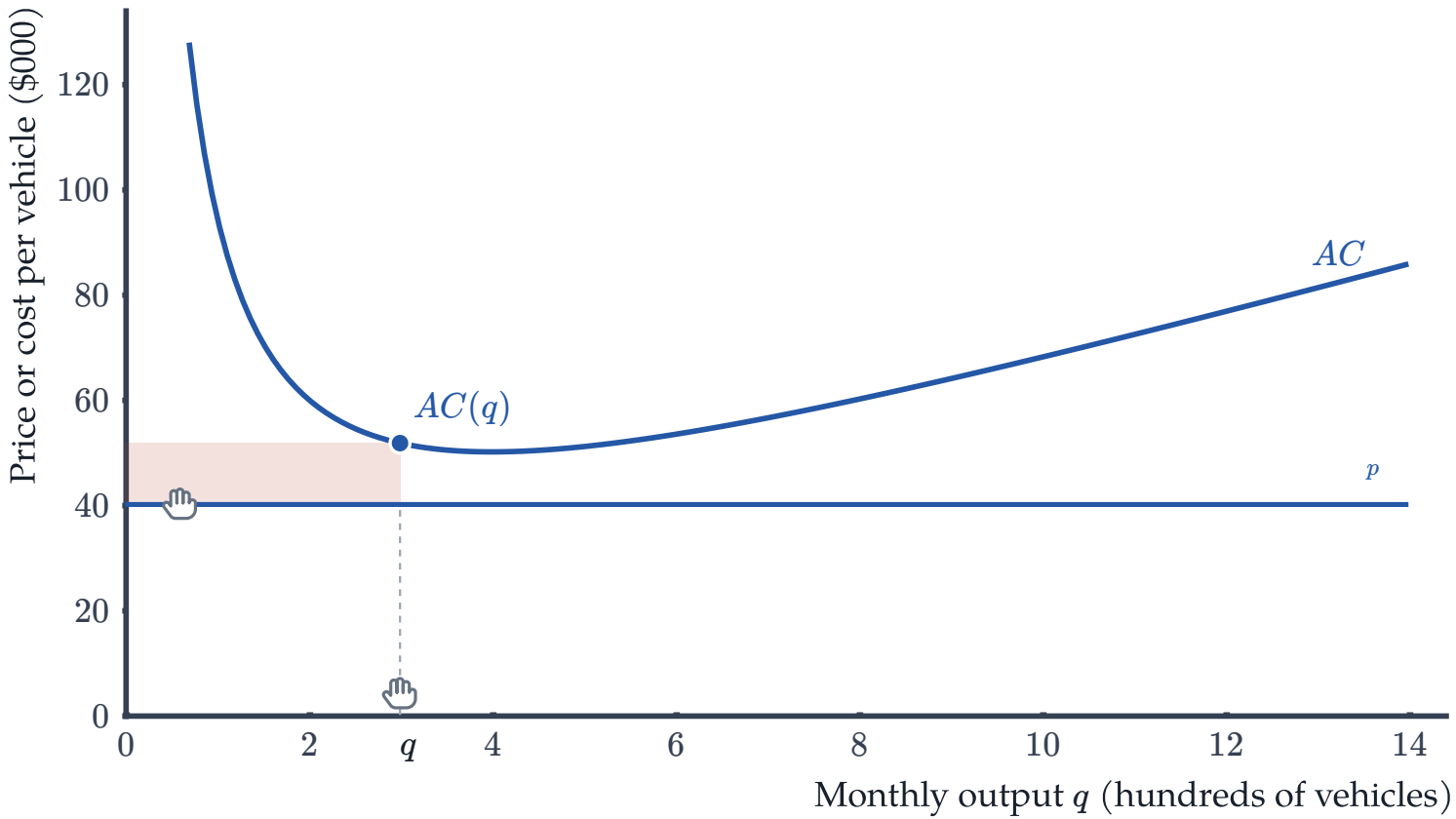
01 **Determine the shutdown threshold**

What is the minimum price above which the seller finds it profitable to produce?

02 **Determine the optimal quantity**

What is the quantity that maximizes the firm's profits at a price above the shutdown threshold?

Auto Eco: price, output and cost



Try a price and an output

Show MC curve

Market price p 40.00

Output q (hundreds of vehicles) 3.00

At $q = 3$, market price is 40 and average cost is 51.70.
Price and cost per 100 vehicles are in hundreds of thousands of dollars.
Monthly economic profit at this output is -3.50 million dollars.

Move the price line up and down to determine the shutdown threshold.
Reveal *MC* curve.
At each price above the threshold, move the quantity line to determine the optimal quantity.

OUTPUT CHOICE

Compare price with marginal cost

$p > MC(q)$: produce more

$p < MC(q)$: produce less

$p = MC(q^*)$

AUTO ECO

One electric-vehicle maker

$$C(q) = 80 + 10q + 5q^2$$

$AC(q) = 80/q + 10 + 5q$

$MC(q) = 10 + 10q$

AUTO ECO

Shut-down threshold

$$MC(q) = AC(q)$$

$$10 + 10q = \frac{80}{q} + 10 + 5q$$

$$5q = \frac{80}{q}$$

$$q^2 = 16$$

$$q = 4$$

$$\text{At } q = 4, \quad MC(4) = AC(4)$$

$$\min AC = 50$$

AUTO ECO

Optimal quantity

$$p = MC(q) \qquad p \geq 50$$

$$p = 10 + 10q \qquad \text{rearrange to find } q$$

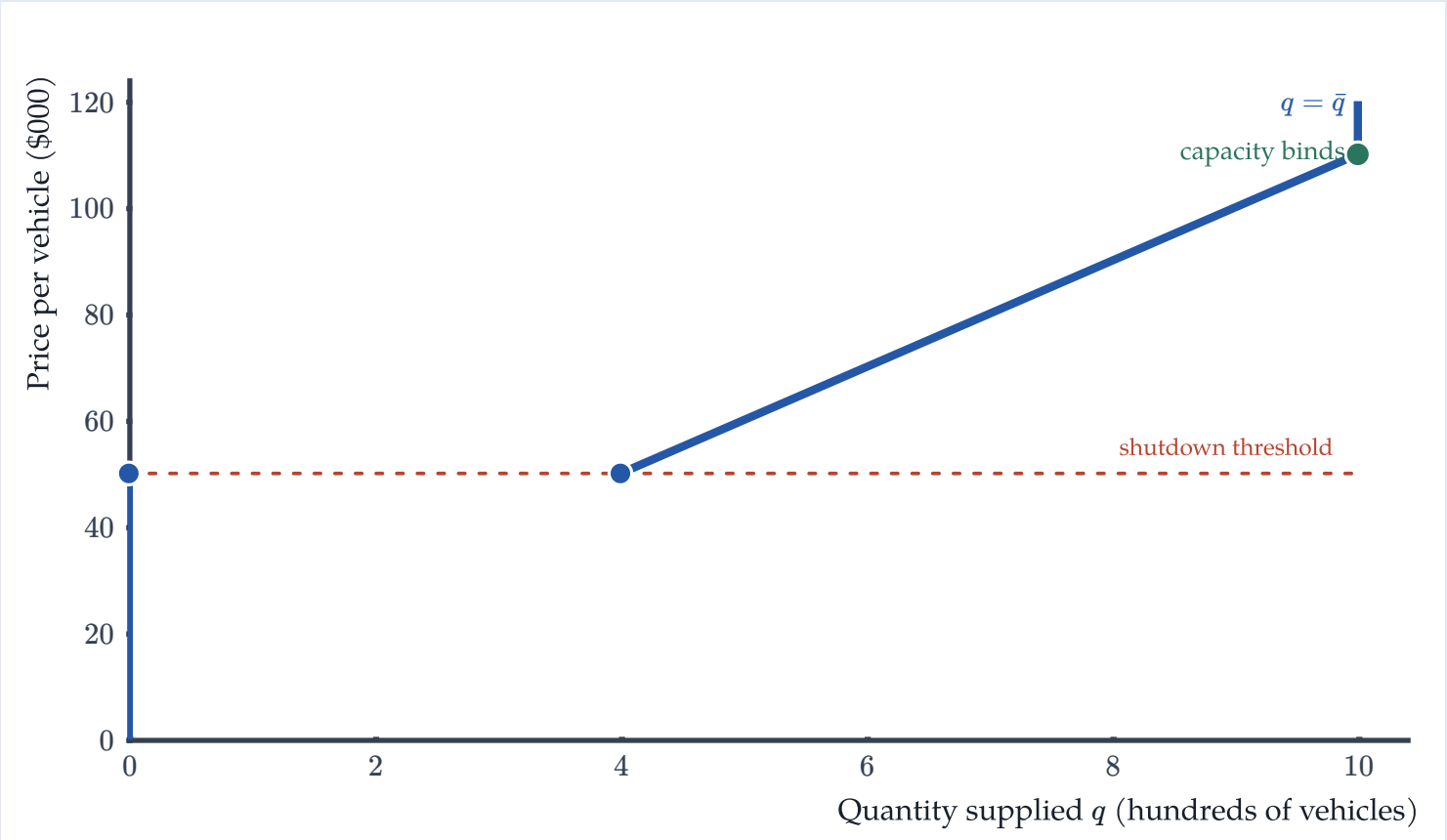
$$q = \frac{p - 10}{10}$$

AUTO ECO

Auto Eco’s supply

$$q^s(p) = \begin{cases} 0 & p < 50 \\ \{0, 4\} & p = 50 \\ \dfrac{p - 10}{10} & p > 50. \end{cases}$$

AUTO ECO'S SUPPLY



Auto Eco's capacity constraint

Capacity $\bar{q}$ 10.00

Capacity is $\bar{q} = 10$ per month.

Auto Eco reaches capacity when price reaches $p = 110$.

$$q^s(p) = \begin{cases} 0 & p < 50 \\ \{0, 4\} & p = 50 \\ \dfrac{p - 10}{10} & 50 < p \leq 110 \\ \bar{q} & p > 110 \end{cases}$$

AGGREGATION

Market demand and market supply

MARKET DEMAND

Add buyers horizontally

Hold price fixed and add quantities demanded.

AGGREGATION

Many individual demands

$$Q^d(p) = \sum_{i=1}^{N} q_i^d(p)$$

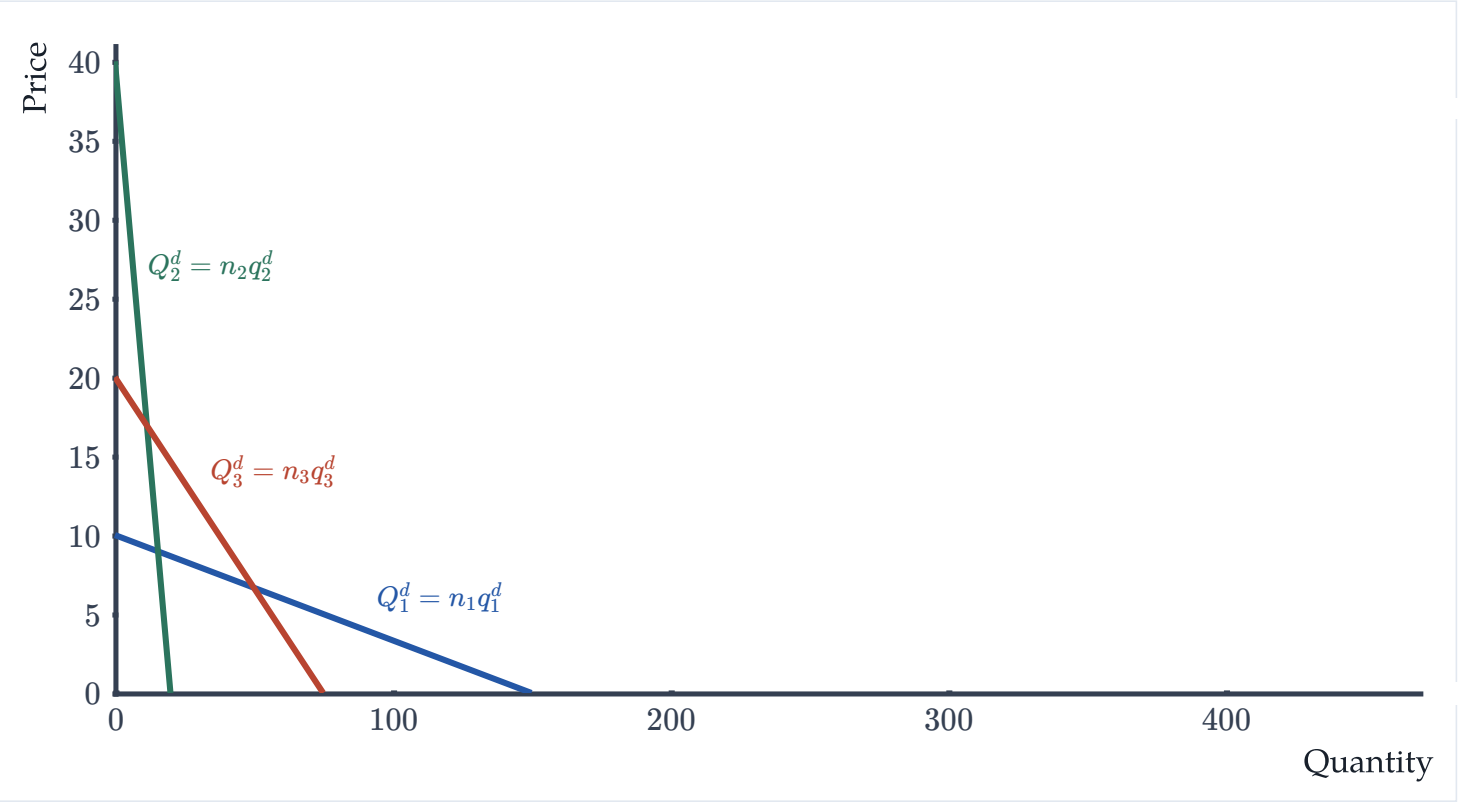
ANN AND BOB

Horizontal addition

PRICE	ANN	BOB	MARKET
$20	30	40	70
$40	20	30	50
$60	10	20	30
$80	0	10	10

At each price, market quantity is the sum of individual quantities.

AGGREGATING DEMAND



Individual demand types

- $q_1^d(p) = 50 - 5p$
- $q_2^d(p) = 10 - 0.25p$
- $q_3^d(p) = 25 - 1.25p$

The number of each type

Type 1 buyers n_1 3

Type 2 buyers n_2 2

Type 3 buyers n_3 3

$Q_1^d = 3q_1^d, \quad Q_2^d = 2q_2^d, \quad Q_3^d = 3q_3^d$

MARKET DEMAND SHIFTS

What shifts market demand?

CHANGE	SHIFT IN MARKET DEMAND
Income rises	Right for a normal good; left for an inferior good
Price of a substitute rises	Right
Price of a complement rises	Left
Preferences move toward the good	Right
Expected future price rises	Current demand may shift right
Number of buyers rises	Right

Market demand shifts by the sum of individual shifts. Buyers may respond in different directions.

Diagnosing a change in sales

The firm's own price changed: movement along demand.
Quantity changed at the same price: demand shifted.
Price and quantity both changed: we need more information.

MARKET SUPPLY

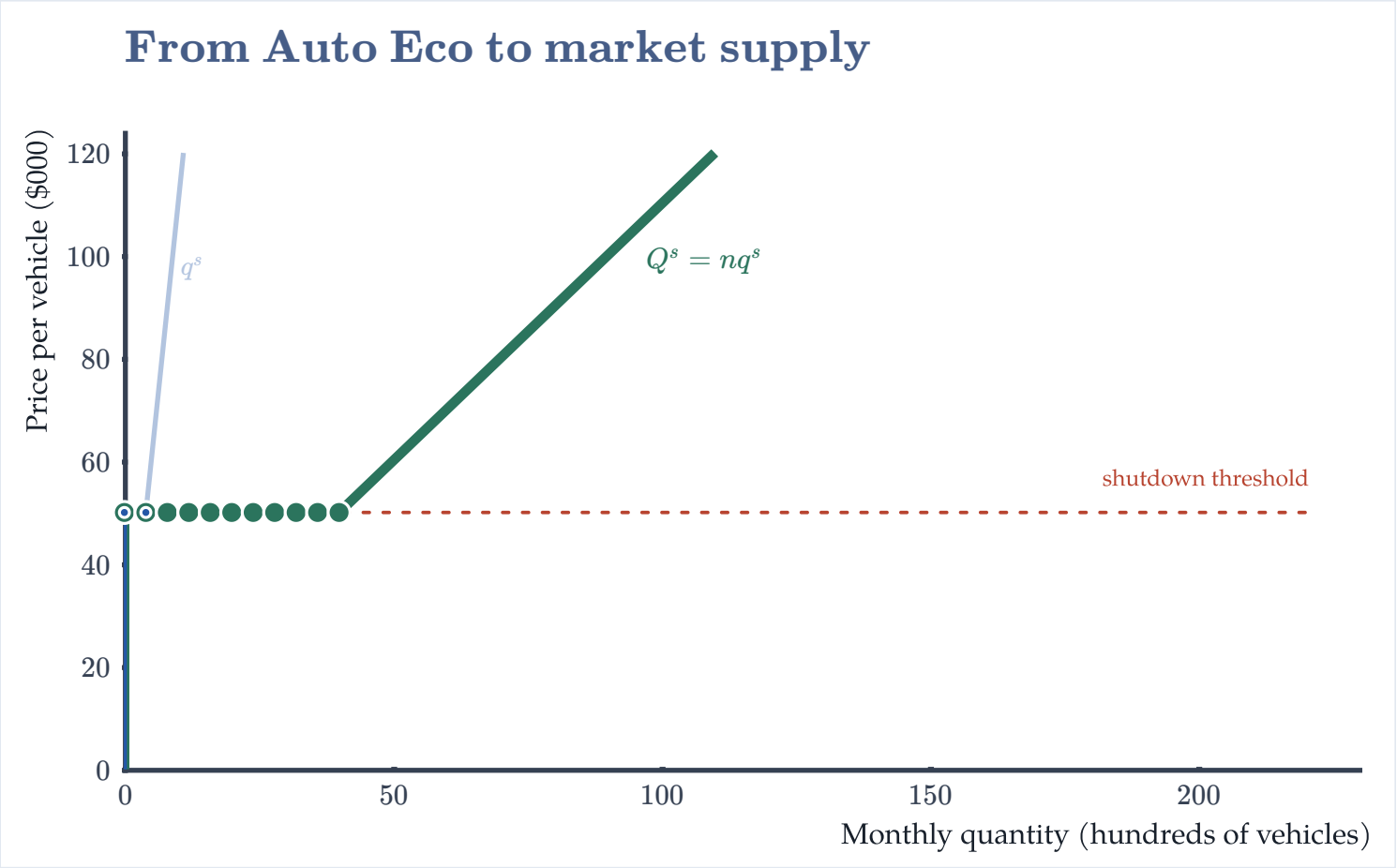
Add firms horizontally

Hold price fixed and add quantities supplied.

AGGREGATION

Many individual firms

$$Q^s(p) = \sum_{j=1}^{N} q_j^s(p)$$



Market supply

Number of firms n 10

$$Q^s(p) = \begin{cases} 0 & p < 50 \\ \{0, 4, 8, \ldots, 40\} & p = 50 \\ \frac{10(p-10)}{10} & p > 50 \end{cases}$$

GENERIC MEDICATION

Two producer groups

APEX-TYPE FIRMS

100 producers

Capacity: 100 packs a month

$C_A(q) = 1{,}000 + 10q$

Fixed cost: $1,000

BOULDER-TYPE FIRMS

300 producers

Capacity: 200 packs a month

$C_B(q) = 6{,}000 + 10q$

Fixed cost: $6,000

STEP 1: APEX

Apex's minimum average cost

$$AC_A(q) = \frac{C_A(q)}{q} = \frac{1{,}000 + 10q}{q}$$

$$= \frac{1{,}000}{q} + 10, \qquad 0 < q \leq 100$$

$\frac{1{,}000}{q}$ falls as q rises

$AC_A(q)$ is smallest at $q = 100$

$$\min AC_A = AC_A(100) = \frac{1{,}000}{100} + 10 = 20$$

Average cost falls with output, so its minimum occurs at capacity.

STEP 1: APEX

Apex's supply

$$q_A^s(p) = \begin{cases} 100 & p > 20 \\ \{0, 100\} & p = 20 \\ 0 & p < 20 \end{cases}$$

At $20, Apex is indifferent between producing 0 and 100 packs.

STEP 2: BOULDER

Boulder’s minimum average cost

$$AC_B(q) = \frac{C_B(q)}{q} = \frac{6{,}000 + 10q}{q}$$

$$= \frac{6{,}000}{q} + 10, \qquad 0 < q \leq 200$$

$\frac{6{,}000}{q}$ falls as q rises

$AC_B(q)$ is smallest at $q = 200$

$$\min AC_B = AC_B(200) = \frac{6{,}000}{200} + 10 = 40$$

Average cost falls with output, so its minimum occurs at capacity.

STEP 2: BOULDER

Boulder's supply

$$q_B^s(p) = \begin{cases} 200 & p > 40 \\ \{0, 200\} & p = 40 \\ 0 & p < 40 \end{cases}$$

At $40, Boulder is indifferent between producing 0 and 200 packs.

STEP 3: AGGREGATE EACH TECHNOLOGY

Technology A and B firms' supply

$$Q_A^s(p) = 100q_A^s(p)$$

The Apex group can supply up to 10,000 packs a month.

$$Q_B^s(p) = 300q_B^s(p)$$

The Boulder group can supply up to 60,000 packs a month.

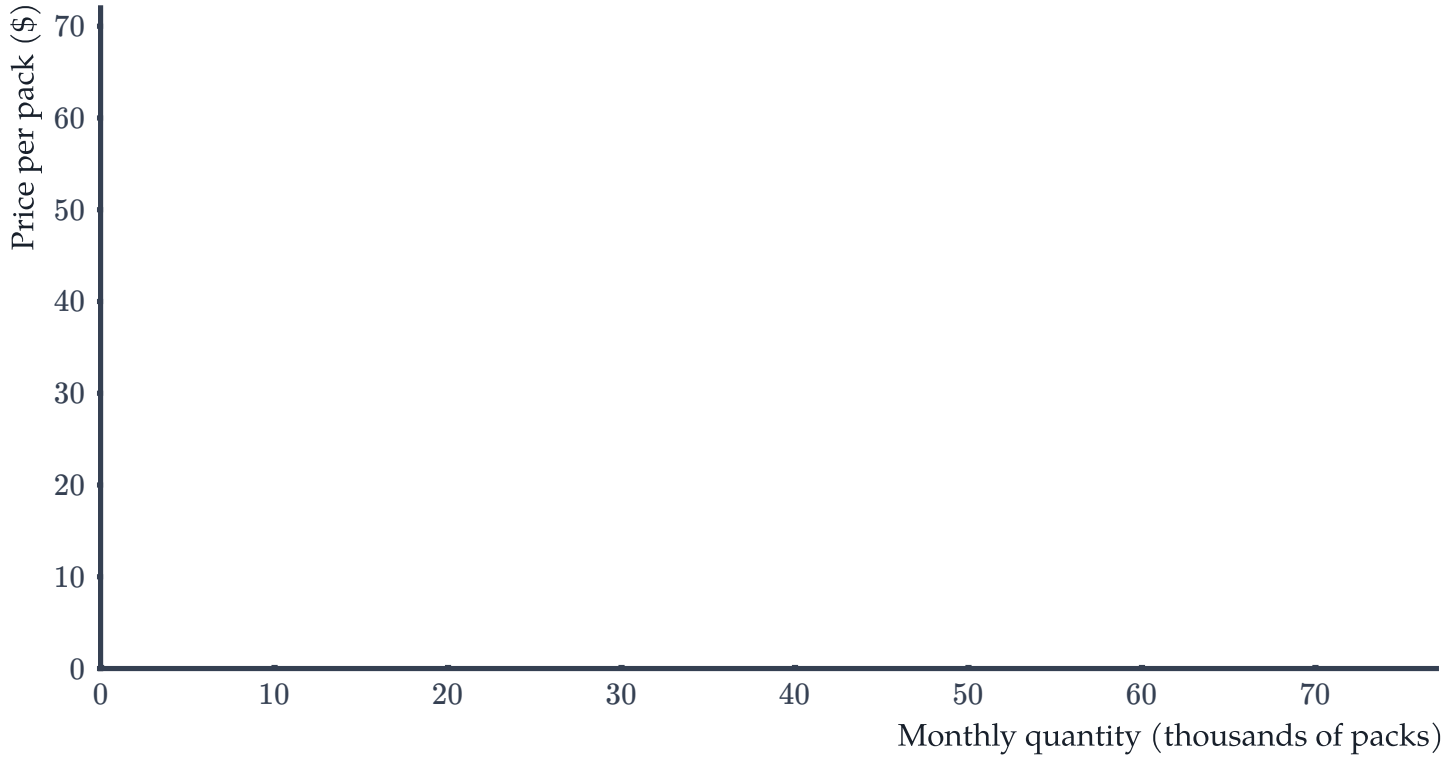
At a threshold, total supply depends on how many identical firms choose to operate.

MARKET SUPPLY

Aggregate the supply of two technologies

$$Q^s(p) = \begin{cases} 70{,}000 & \text{if } p > 40 \\ [10{,}000, 70{,}000] & \text{if } p = 40 \\ 10{,}000 & \text{if } 40 > p > 20 \\ [0, 10{,}000] & \text{if } p = 20 \\ 0 & \text{if } p < 20 \end{cases}$$

MARKET SUPPLY



Determine the market supply at each price

Price per pack p 0

Apex-technology firms + **Boulder-technology firms** = **Market supply**

At $p = 0$, neither group operates. Market supply is 0.

HEALTH DEPARTMENT

More than 10,000 packs requires a price of at least $40

Below $40, only the Apex group operates. At $40, Boulder can add up to 60,000 packs per month.

SUPPLY SHIFTS

What changes firms' costs?

01 Input prices

02 Technology

03 Taxes and subsidies

04 Natural events

05 Number of firms

COMPETITIVE MARKETS

When does price-taking make sense?

Four assumptions support one central consequence.

PERFECT COMPETITION

Four assumptions

01 Homogeneous goods

02 Price-taking buyers and sellers

03 Zero search cost

04 No barriers to entry or exit

FARMER'S MARKET

Tomatoes as the running example

Buyers regard tomatoes as identical.

Every stall's price is visible.

Each grower is small relative to the market.

New growers can enter and incumbents can leave.

TIME HORIZON

Short run and long run

SHORT RUN

At least one commitment and the number of firms are fixed.

Adjust output

LONG RUN

All inputs and the number of firms can change.

Capacity, entry, exit