2 Supply, Demand and Elasticity

ECO202 Fall 2019

September 3, 2019

Outline

1. Supply and Demand Functions
2. Comparative Statics
3. Elasticity

Supply and Demand Functions

Supply is what firms decide

Supply function: Positive relationship between the quantity of a good producers are willing to sell and the price of that good

The higher the price, the more supply is offered (move along S curve)

If technology improves, more supply can be offered at any price (shift S curve)

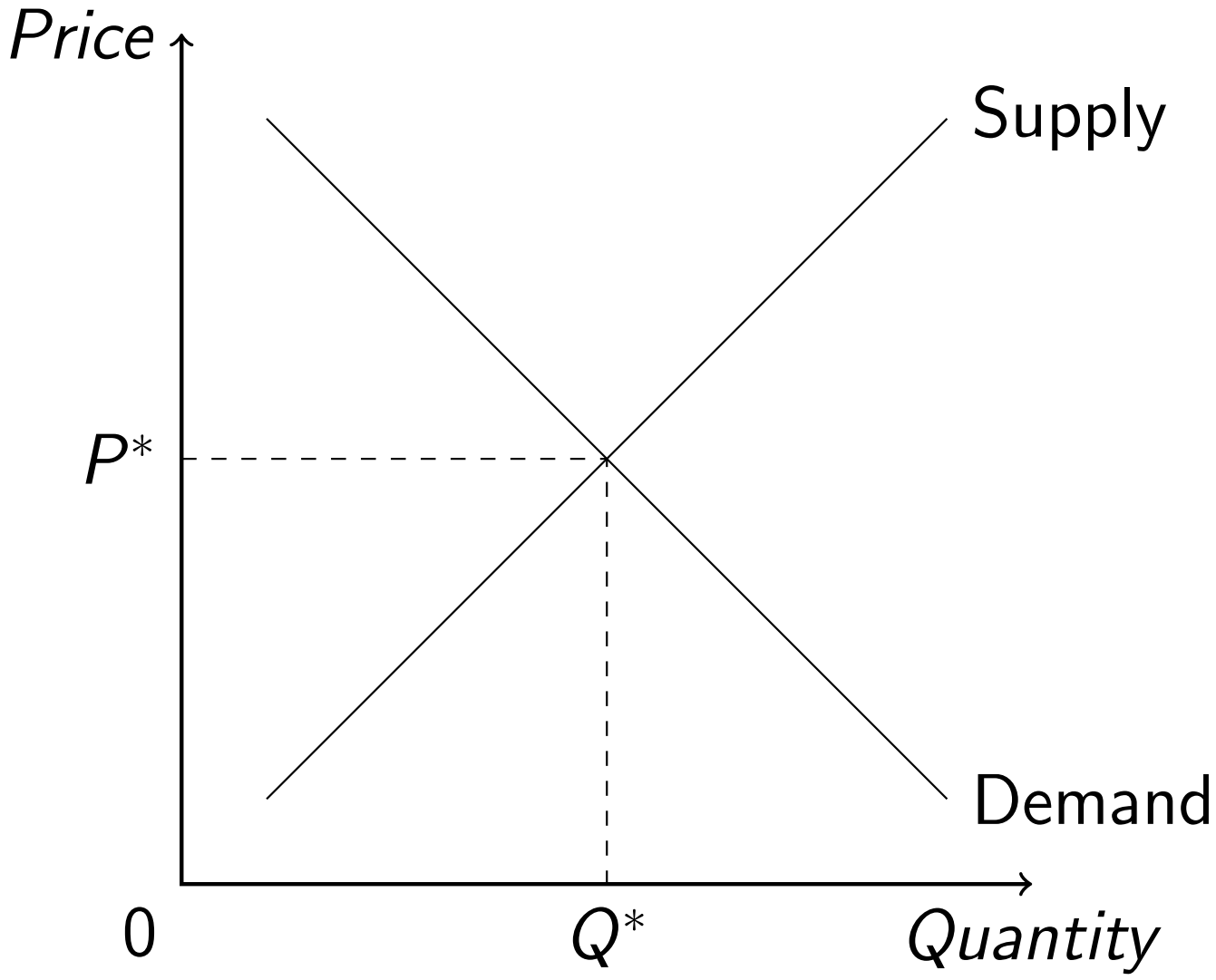
Demand is what consumers decide

Demand function: Negative relationship between the quantity of a good consumers are willing to pay for and the price of that good

The higher the price, the less consumers demand (move along D curve)

If preferences change, more demand will be made at any price (shift D curve)

You must have seen this before



Comparative Statics

Market equilibrium

Market clearing price P* where S=D

Shortage with P when D>S

Surplus with P when S>D

Tendency: prices change until equilibrium is reached

Predict price changes better if market is competitive (firms and consumers have little market power)

Shift S and D to predict P*, Q*

Supply function shifters:

- Technologies
- All input prices
- Size of market
- Regulations

Demand function shifters:

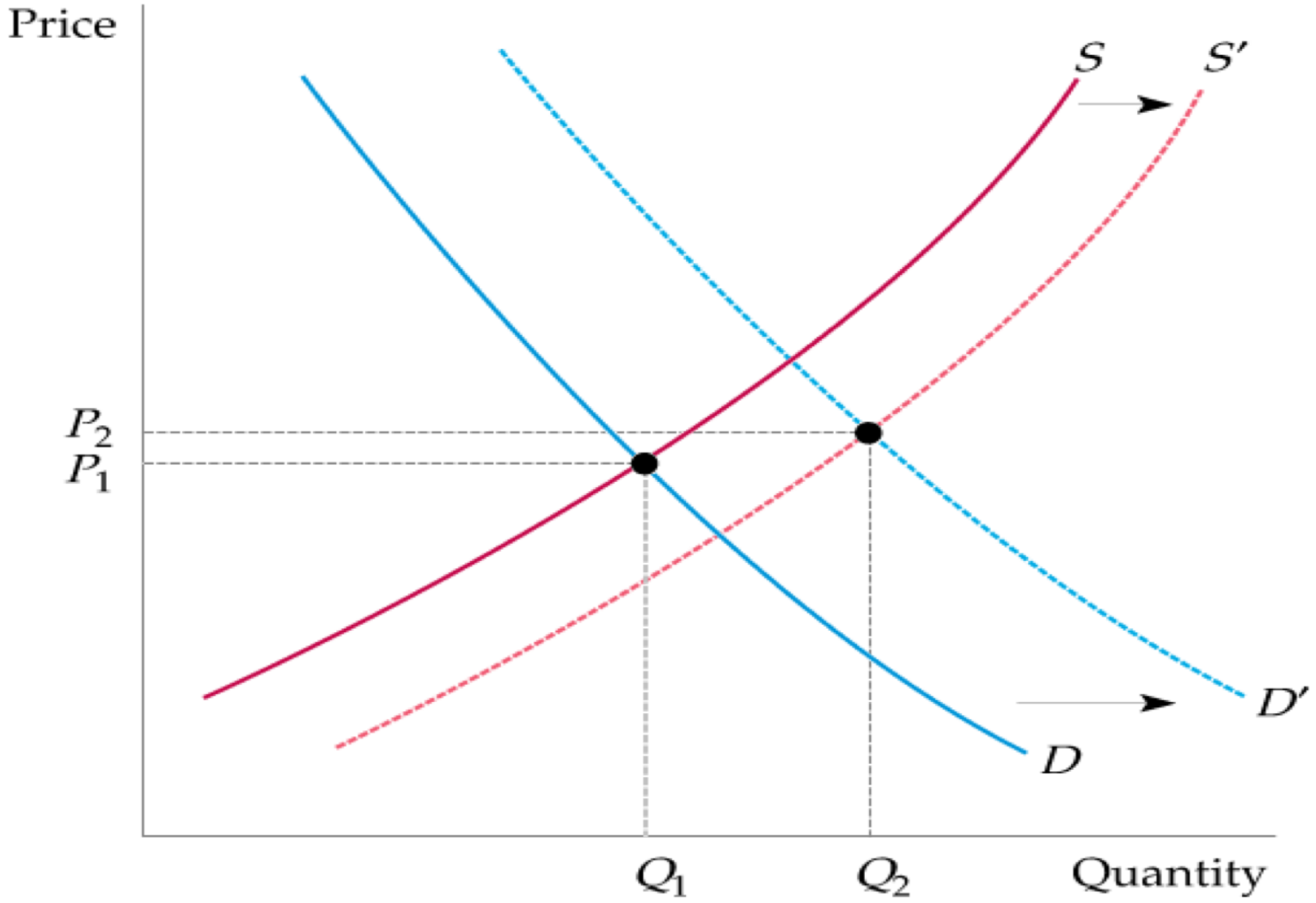
- Preferences
- Prices of complements and substitutes
- Size of market
- Incomes

Can predict any P*, Q*

Need to know:

- Size of shift in S
- Size of shift in D
- Slopes of S and D curves

Shift S or D or both



Elasticity

Elastic means responsive

Elasticity: Percentage change in one variable resulting from a 1% change in another variable

Price Elasticity of Demand: Percentage change in quantity demand over percentage change in price

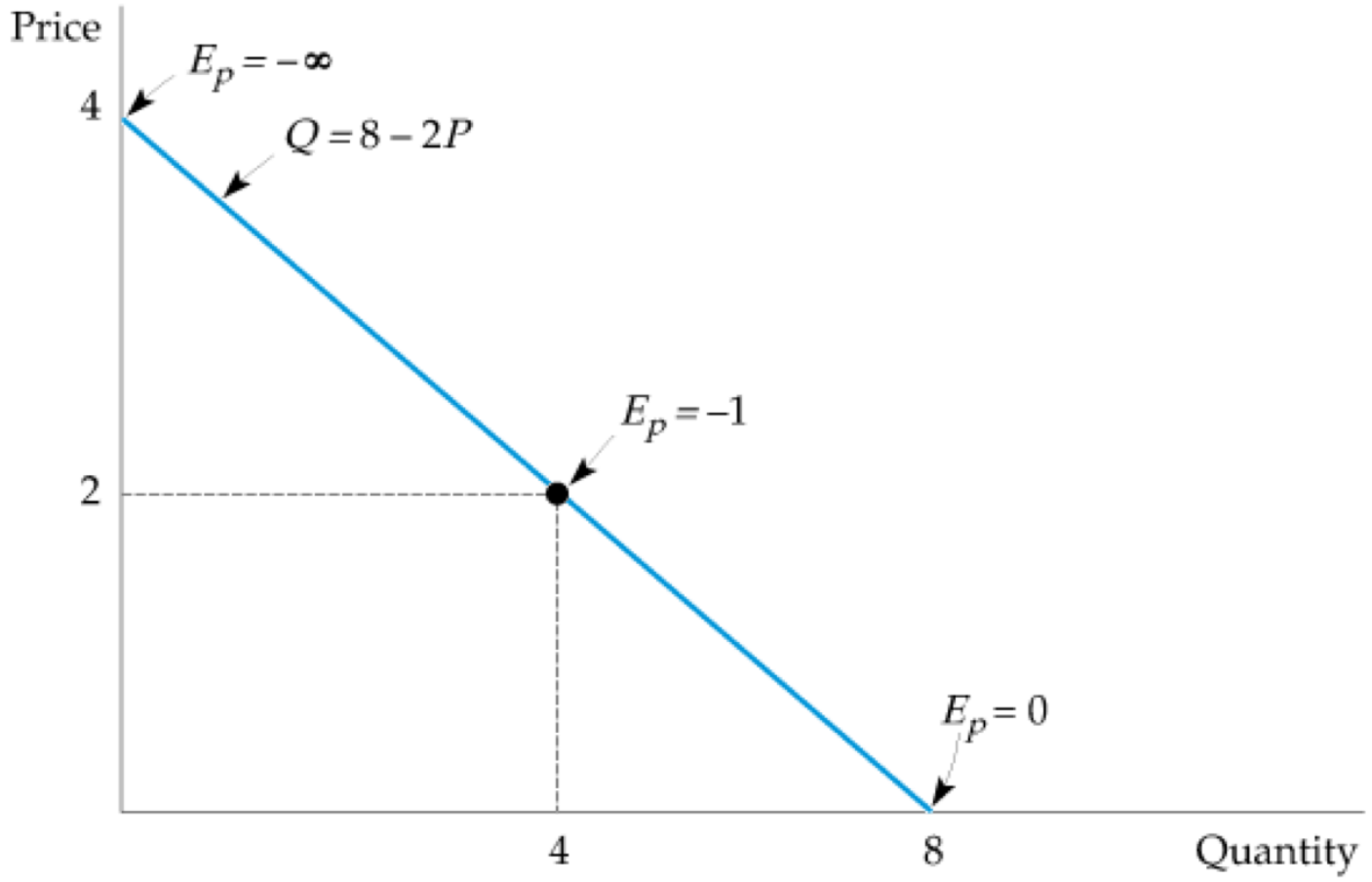
$$\begin{aligned}\epsilon_p &= (\%\Delta Q)/(\%\Delta P) \\ &= (\Delta Q/Q)/(\Delta P/P) \\ &= (\Delta Q/\Delta P)(P/Q)\end{aligned}$$

Elasticity changes with price

- The slope and the elasticity of the demand curve are not the same thing
- Slope is only $\Delta Q/\Delta P$

$$Q = a - bP$$
$$\epsilon_p = (\Delta Q/\Delta P)(P/Q)$$
$$\epsilon_p = -b(P/Q)$$
$$\epsilon_p = -b(P/(a - bP)$$

Sample demand function: Q=8-2P



Sample demand function: Q=1150-100P

$\epsilon_p = (\Delta Q/\Delta P)(P/Q)$

If Q =1150-100P

$\Delta Q/\Delta P = -100$

If P=2.5, Q=900

$\epsilon_p = (-100) \times (2.5/900) = -0.28$

If P=5.0, Q=650

$\epsilon_p = (-100) \times (5.0/650) = -0.77$

Iso-elastic demand function

Demand functions can take many forms

Iso-elastic: where ϵ_p is constant

Plausible as a simple rule for consumers

Whatever starting P is:

if P$\uparrow$10%, then $Q_d\downarrow$20% $\quad \Longrightarrow \bar{\epsilon_p} = -2$

Iso-elastic demand function is easy:

$$Q = \alpha P^{-\beta}$$

Deriving iso-elastic demand function

$$
\begin{aligned}
Q &= \alpha P^{-\beta} \\
\Delta Q/\Delta P &= -\alpha\beta P^{(-\beta-1)} \\
\epsilon_p &= (\Delta Q/\Delta P)(P/Q) \\
\epsilon_p &= (-\alpha\beta P^{(-\beta-1)})(P/Q) \\
\epsilon_p &= (-\alpha\beta P^{(-\beta-1)})(P/\alpha P^{-\beta}) \\
\epsilon_p &= -\beta
\end{aligned}
$$

Other elasticities

Income elasticity of demand:

$$\epsilon_m = (\Delta Q/\Delta M)(M/Q)$$

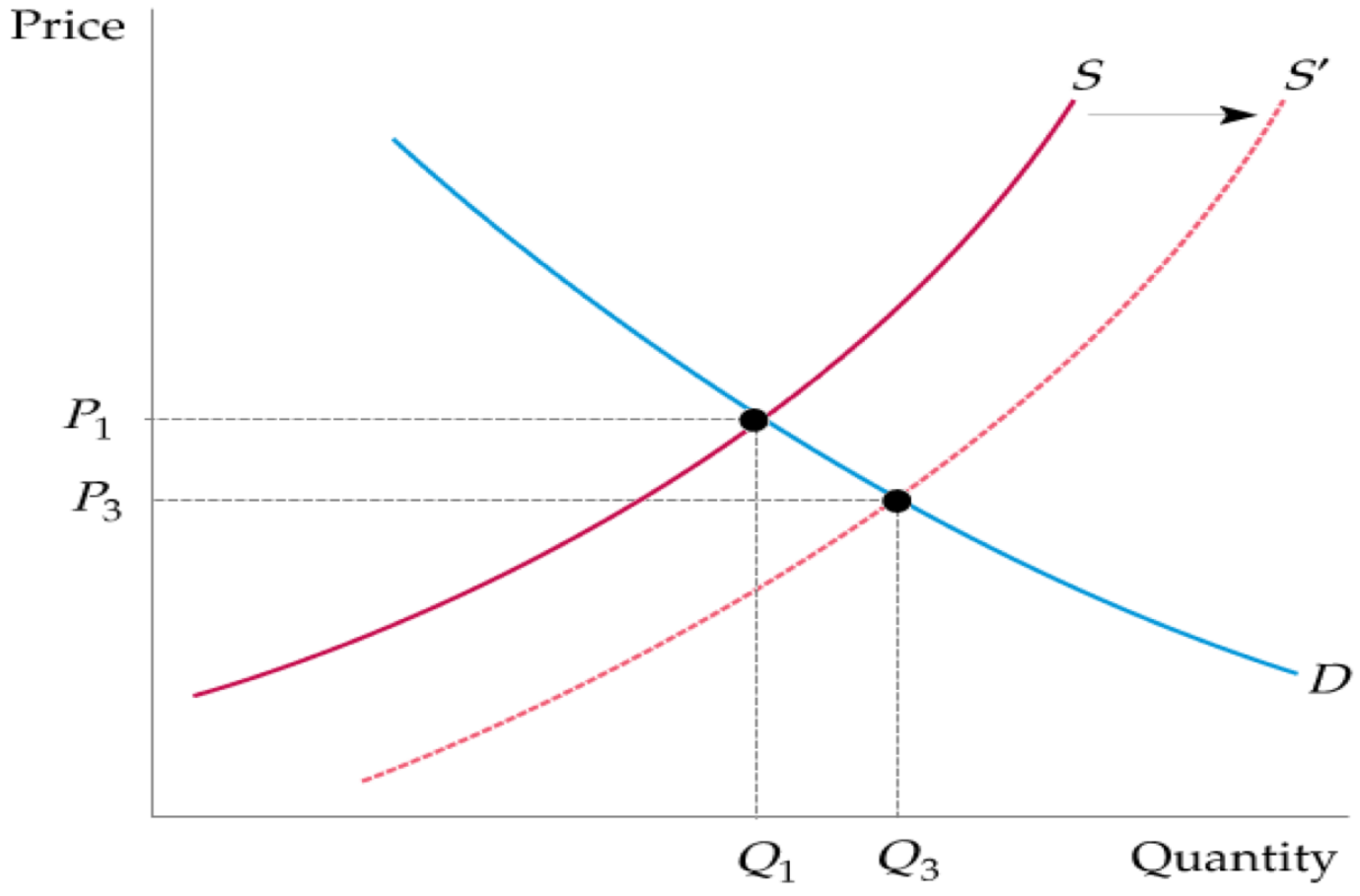
Cross-price elasticity of demand: (goods X_1, X_2)

$$\epsilon_{px} = (\Delta Q_{X_1}/\Delta P_{X_2})(P_{X_2}/Q_{X_1})$$

Price elasticity of supply:

$$\epsilon_s = (\Delta Q_S/\Delta P)(P/Q_S)$$

Elasticity and revenue 1/3



Elasticity and revenue 2/3

From (P_1, Q_1) to (P_3, Q_3)

$$\text{Revenue gain} = (Q_3 - Q_1)P_3$$

$$\text{Revenue loss} = (P_3 - P_1)Q_1$$

Simplify to $\Delta TR = \Delta QP + \Delta PQ$

Elasticity and revenue 3/3

$$\Delta TR = \Delta QP + \Delta PQ$$
$$\Delta TR/(\Delta PQ) = \Delta QP/(\Delta PQ) + \Delta PQ/(\Delta PQ)$$
$$\Delta TR/(\Delta PQ) = \epsilon_p + 1$$
$$\Delta TR/\Delta P = Q(1 + \epsilon_p)$$

Total Revenue depends on ϵ_p

If $\epsilon_p < -1 \implies \Delta TR/\Delta P < 0$

If $\epsilon_p > -1 \implies \Delta TR/\Delta P > 0$

P, Q, ϵ_p and TR: Q=1150-100P

Price	Quantity	ϵ_p	Total Revenue
1	1050	-0.10	1050
2	950	-0.21	1900
3	850	-0.35	2550
4	750	-0.53	3000
5	650	-0.77	3250
6	550	-1.09	3300
7	450	-1.56	3150
8	350	-2.29	2800
9	250	-3.60	2250
10	150	-6.67	1500
11	50	-22.00	550

P, Q, ϵ_p and TR: Q=1150-100P

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4	750	-0.53	3000
5	650	-0.77	3250
5.75	**575**	**-1.00**	**3306**
6	550	-1.09	3300
7	450	-1.56	3150
8	350	-2.29	2800
9	250	-3.60	2250
10	150	-6.67	1500
11	50	-22.00	550

Using elasticities

If $\epsilon_p > -1 \implies \Delta TR/\Delta P > 0$

So firm should keep increasing price to get higher spending by customers

But as price increases, ϵ_p becomes more elastic

Once $\epsilon_p < -1$, spending starts to fall

Should every ϵ_p equal -1?

Any Questions?

Supply and Demand Functions

Comparative Statics

Elasticity