

Lecture 7 – Supply and Demand: Teacher Wages and College Seats

The Puzzle

A district has 40 unfilled math and special ed jobs, yet dozens of applicants for every PE job. Same salary schedule. Is there a teacher shortage?

Markets in Education

A **market** is buyers and sellers trading at a price.

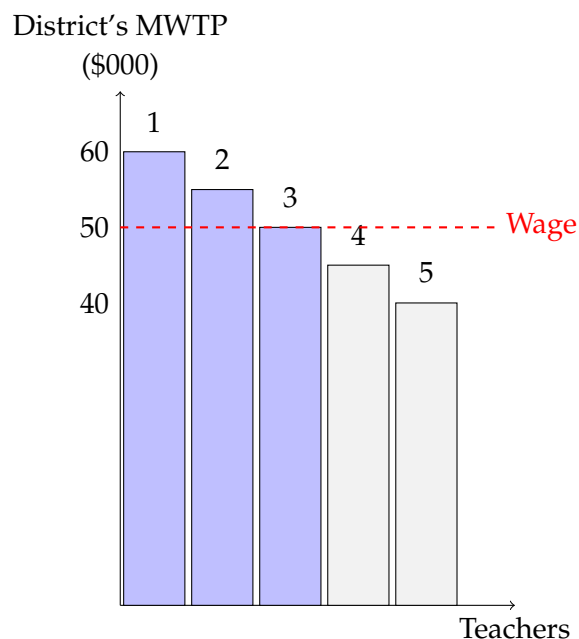
Teachers: districts buy labor, workers sell it. The price is the wage.

College seats: students buy, colleges sell. The price is tuition.

Demand and Marginal Willingness to Pay

Marginal willingness to pay (MWTP): the most a buyer would pay for one more unit. A buyer buys if $MWTP \geq \text{price}$.

A district's MWTP for one more teacher is the Lecture 6 marginal benefit in dollars. Because MB diminishes, MWTP falls with each teacher hired. Here is a small district:



At a wage of \$50,000 the district hires 3 teachers. Lining buyers up from highest to lowest MWTP gives the demand curve.

How many at \$45,000? – 4. At \$60,000? – 1. Why does MWTP fall? – *The 1st teacher covers a needed course. The 5th shrinks an already-small class.*

Students buying college work the same way: MWTP is the value of a degree to them, and it differs with earnings gains, alternatives, and ability to pay.

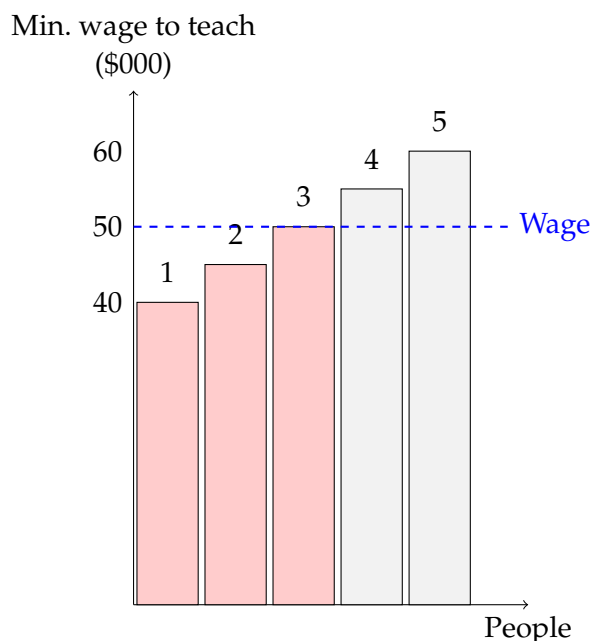
Along the curve: the price changes. *Shift:* anything else that changes MWTP.

Teachers: enrollment, budget, class-size mandate.

College: returns to a degree, number of 18-year-olds, Pell Grants, a recession.

Supply and Marginal Cost

Each seller has a minimum price she will accept: her opportunity cost. Line sellers up from lowest to highest to get the **supply curve**. Here are the five people in that district's labor market:

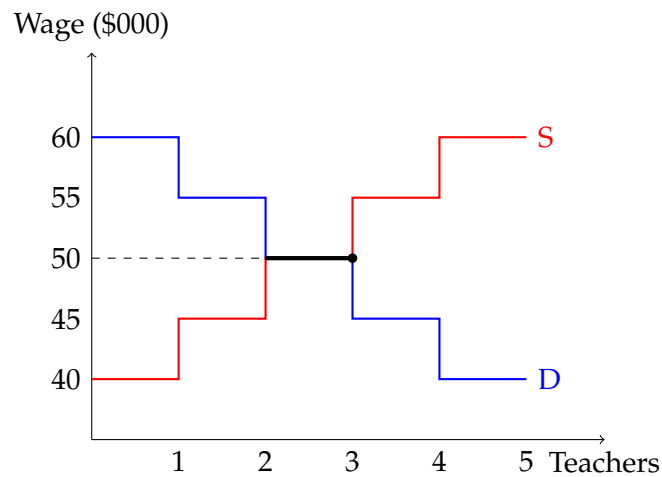


At a wage of \$50,000, people 1, 2, and 3 are willing to teach. Higher wages draw in people with better alternatives.

Shifters: outside wages (nursing, engineering), certification costs, working conditions. For college seats: state funding, new campuses, online programs.

Putting Them Together

Put the two bar graphs on one set of axes. Demand steps down, supply steps up.



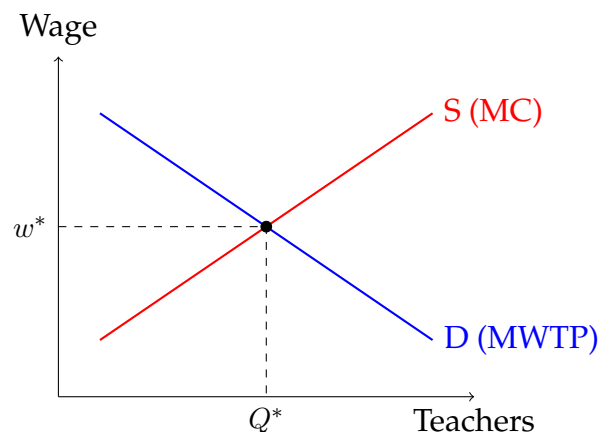
The 3rd teacher is the last one worth hiring: the district's MWTP (\$50,000) equals her minimum wage (\$50,000). The bold step is where the two graphs meet.

Reading the same thing as a table:

Wage	Demand	Supply	Gap
\$40,000	5	1	4 short
\$45,000	4	2	2 short
\$50,000	3	3	none
\$55,000	2	4	2 extra
\$60,000	1	5	4 extra

At \$50,000 demand equals supply: the **market-clearing wage**. Teachers 1 and 2 were worth more to the district than they cost the worker. The 3rd is a wash. The 4th would cost more than she is worth. This is $MB = MC$ from Lecture 6.

With many buyers and sellers the steps get small and the staircases look like curves:



Finding Equilibrium with Equations

The staircases follow two lines (w in thousands):

$$Q_D = 13 - 0.2w \quad Q_S = 0.2w - 7$$

Check against the table: at $w = 40$, $Q_D = 5$ and $Q_S = 1$.

Set $Q_D = Q_S$ and solve:

$$13 - 0.2w = 0.2w - 7 \Rightarrow 20 = 0.4w \Rightarrow w^* = 50$$

Plug back in: $Q^* = 13 - 0.2(50) = 3$.

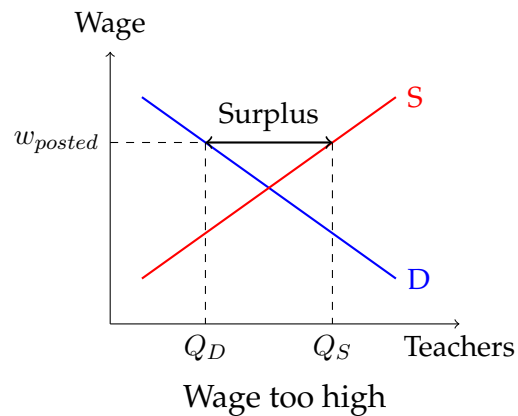
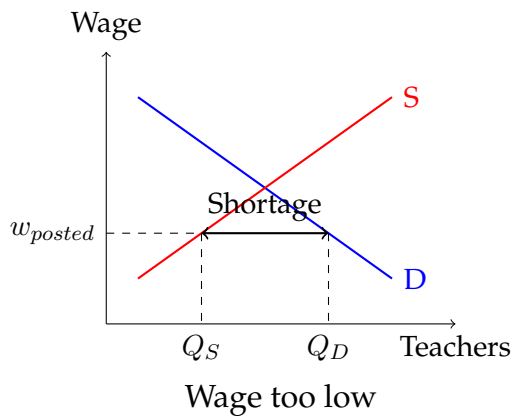
1. Set $Q_D = Q_S$.
2. Solve for the price.
3. Plug the price into either curve for the quantity.

Shortage at \$45,000: $Q_D = 4$, $Q_S = 2$, so 2 short.

Shifts change the intercept. Class-size cap, demand +2: $15 - 0.2w = 0.2w - 7$, so $w^* = 55$, $Q^* = 4$. Nursing boom, supply -2: $13 - 0.2w = 0.2w - 9$, so $w^* = 55$, $Q^* = 2$.

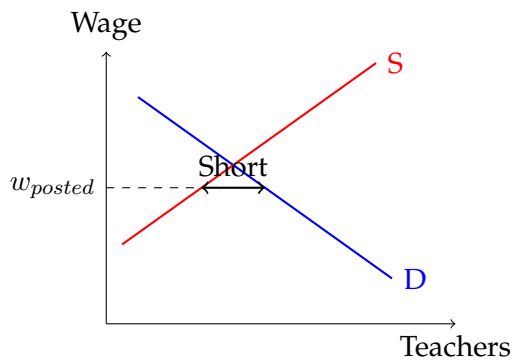
Fixed seats: supply is just a number. Set Q_D equal to it and solve for the price.

Shortages and Surpluses

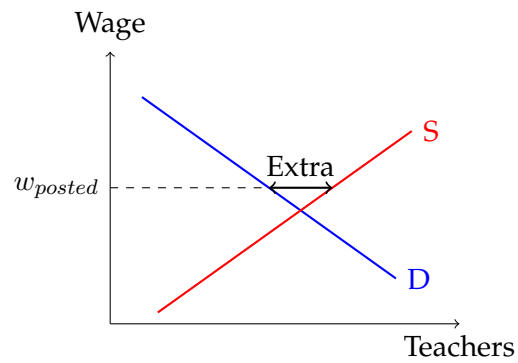


Why doesn't the wage adjust? – *Salary schedules, contracts, fixed budgets*. Something else gives: vacancies, uncertified hires, out-of-field teaching, bigger classes. A shortage is always *at a price*: ask “at what wage?”

Back to the puzzle. Why math and special ed short, PE in surplus?



Math



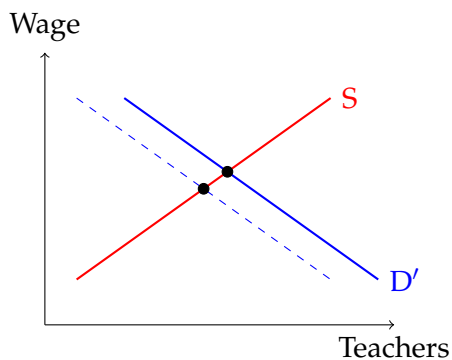
PE

Math majors have better outside options, so the supply of math teachers sits to the left of the supply of PE teachers.

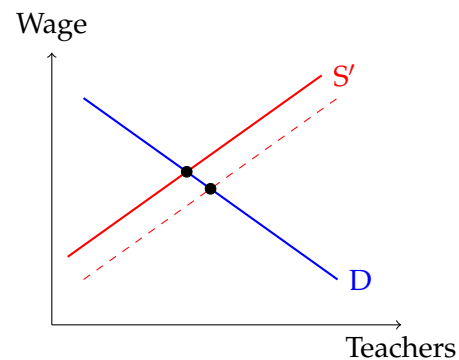
Fixes: pay more in hard-to-fill fields, signing bonuses, alternative certification. Why don't districts? – *Fairness, morale, union contracts.*

Shifting the Curves

Ask: (1) which market, (2) which curve, (3) which direction. Then read off the wage and quantity.



Class-size cap: demand out

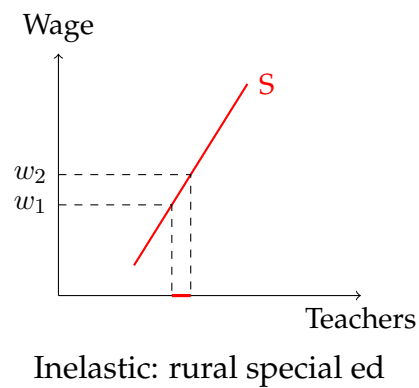
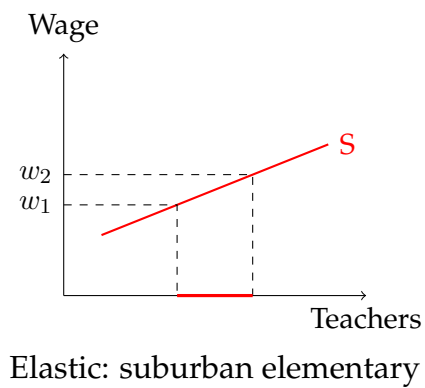


Nursing boom: supply in

Both raise the wage to \$55,000. Demand out takes teachers from 3 to 4. Supply in takes them from 3 to 2. Quantity tells you which curve moved.

How Responsive? Elasticity

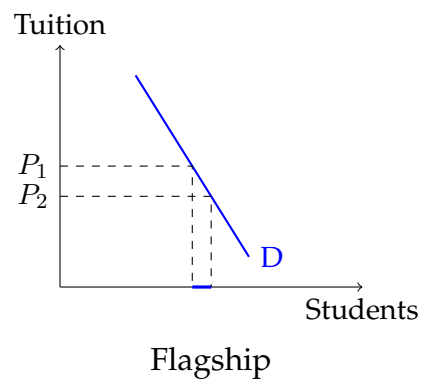
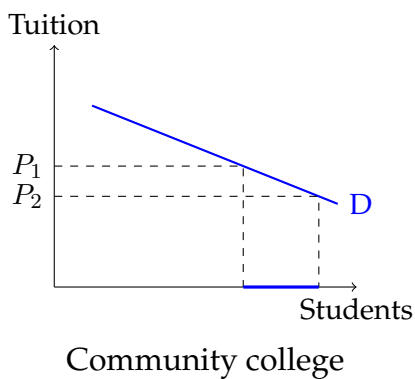
Elasticity: how much quantity responds to price. **Elastic** = flat. **Inelastic** = steep.



Same raise, very different response.

Supply is more elastic with close alternatives, more time, and portable credentials.

Demand can differ too. Who responds more to a \$1,000 tuition cut?

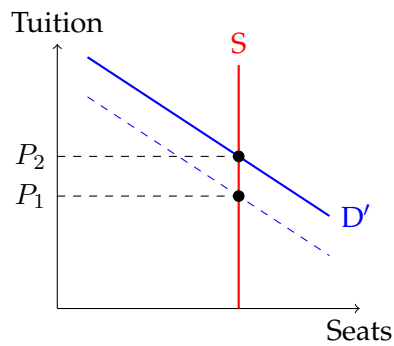


Community college students are lower income and closer to the margin. Flagship students attend either way.

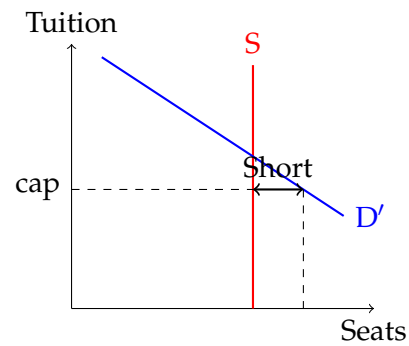
Elasticity also decides who benefits from a subsidy (Week 11).

Higher Education: A Market for Seats

Public colleges have capacity limits. In the short run, seats are nearly fixed.



Demand rises: price rises

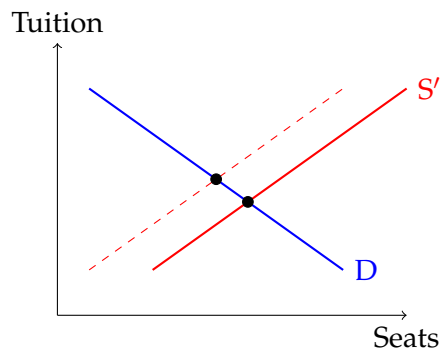


Tuition capped: shortage

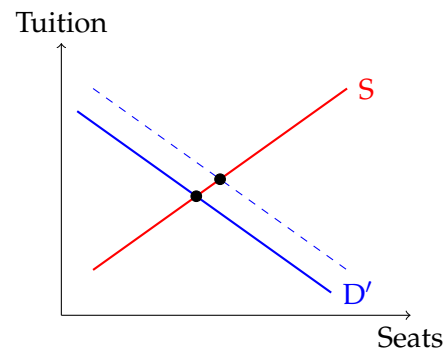
With fixed seats and a price cap, admissions standards do the rationing.

Who is shut out? – *Students at the margin of admission.* Mountjoy studies the marginal student: are those seats worth more than they cost?

Cellini: voters fund more community college seats.



Community college: supply out



For-profit: demand in

New public seats draw students away from nearby for-profits (crowd-out).

Beyond the Classroom

A district can't hire bus drivers. Draw the market. What can it do?

A state freezes tuition below the clearing level. Who wins and who loses?

A state sets one pay level for all teachers and requires a certified teacher in every room. Feasible?

Wrapping Up

Demand is MWTP and slopes down. **Supply** is marginal cost and slopes up.

Price changes move along a curve. Everything else shifts it.

A shortage or surplus is at a price. If the price can't move, something else gives.

Equilibrium: set $Q_D = Q_S$, solve for the price, plug back in.

Shock: which market, which curve, which direction. Quantity tells you which curve moved.

Elasticity: same policy, different effect depending on the slope.

Practice Problems

1. A teacher market (w in thousands):

Wage	Demand	Supply
\$30	90	30
\$35	80	50
\$40	70	70
\$45	60	90
\$50	50	110

- Graph demand and supply. Find the clearing wage and quantity.
 - The schedule pays \$35,000. Mark the shortage or surplus on your graph. How big?
 - Demand rises by 30 at every wage. Draw it and find the new equilibrium.
 - Back to the original. Supply falls by 30 at every wage. Draw it and find the new equilibrium.
 - How can you tell (c) from (d) in the data?
 - The demand and supply equations are $Q_D = 150 - 2w$ and $Q_S = 4w - 90$. Set them equal and solve. Match (a)?
 - Write the new demand equation from (c). Solve. Match (c)?
2. Sketch each. Which curve shifts, and which way?
- Teachers: state caps class size at 20.
 - Teachers: loan forgiveness in shortage fields.
 - Teachers: hospitals raise nurses' pay.
 - Teachers: district raises its salary schedule.
 - College: Pell Grant increase.

- (f) College: recession.
 - (g) College: state funding cut.
3. A district pays math and PE teachers the same. Math has 40 vacancies, PE has 30 applicants per job. Draw the two markets. What would an economist suggest? Why might the district resist?
 4. Sketch supply for (a) suburban elementary vs. rural special ed, and (b) math teachers next month vs. in ten years. Which responds more to a \$5,000 bonus? Then: free community college or a flagship tuition cut, which raises enrollment more?
 5. Five students have MWTP of \$14,000, \$11,000, \$9,000, \$6,000, \$3,000.
 - (a) Draw the bar graph. How many enroll at \$10,000? At \$6,000?
 - (b) A \$3,000 grant is introduced and tuition is \$9,000. How many enroll? What shifted?
 - (c) Who is the marginal student? Why would a policymaker care?
 6. A public university has 10,000 seats and caps tuition at \$8,000. 14,000 students want a seat.
 - (a) Graph it. Shortage or surplus? How big? How is it rationed?
 - (b) Demand rises by 2,000 at every price. What happens?
 - (c) The state funds 1,000 more seats. What happens? What do you need to know to judge it?
 7. A community college adds 1,000 seats. A for-profit college is nearby. Draw both markets.
 - (a) How much does enrollment rise if seats were full before? If not?
 - (b) What happens to the for-profit? To total enrollment?
 8. Seats and tuition in thousands: $Q_D = 30 - 2P$, $Q_S = 10 + 2P$.
 - (a) Find the clearing tuition and seats. Graph.
 - (b) Tuition is capped at \$3,000. Find the shortage.
 - (c) Aid raises demand by 8: $Q'_D = 38 - 2P$. Find the new equilibrium.
 - (d) Seats are fixed at 20. With the demand from (c), find the clearing tuition.

Answer Key**1.**

- (a) \$40,000 and 70 teachers. The curves cross there.
- (b) Shortage of 30. Demand is 80 and supply is 50.
- (c) New demand: 120, 110, 100, 90, 80. At \$45,000 both are 90. Wage \$45,000, quantity 90.
- (d) New supply: 0, 20, 40, 60, 80. At \$45,000 both are 60. Wage \$45,000, quantity 60.
- (e) Quantity: up in (c), down in (d).
- (f) $150 - 2w = 4w - 90$, so $w^* = 40$ and $Q^* = 70$. Matches.
- (g) $Q'_D = 180 - 2w$. $180 - 2w = 4w - 90$, so $w^* = 45$ and $Q^* = 90$. Matches.

2.

- (a) Demand out.
- (b) Supply out.
- (c) Supply in.
- (d) Movement along the curves. The shortage shrinks.
- (e) Demand out.
- (f) Demand out. The wages students give up fall.
- (g) Supply in.

3. Math majors have better outside options, so math supply is further left. The one wage is too low for math (shortage) and too high for PE (surplus). Pay more for math through salary, bonuses, or paid certification. The district may resist because of fairness, morale, contracts, and budget.

4. (a) Suburban elementary (many certified people near the margin). (b) Ten years from now (people can retrain and move). Free community college raises enrollment more: those students are closer to the margin. A flagship cut mostly goes to students who would enroll anyway.

5.

- (a) Two at \$10,000. Four at \$6,000.
- (b) Four. The net price is \$6,000. Without the grant only three enroll at \$9,000. Demand shifted out.

(c) The \$6,000 student enrolls only because of the grant. The other three would enroll anyway. Policy changes outcomes at the margin.

6.

(a) Shortage of 4,000. Rationed by grades, test scores, or a lottery.

(b) Enrollment stays 10,000. The shortage grows to 6,000 and admissions get more selective.

(c) Enrollment rises by 1,000 if the seats fill. Compare the MWTP (or benefits) of the extra students with the MC of the seats, and ask whether they would have gone elsewhere.

7.

(a) If full before, enrollment rises by about 1,000. If not full, by little or nothing.

(b) The for-profit loses students because demand shifts in. Total enrollment rises by less than 1,000.

8.

(a) $30 - 2P = 10 + 2P$, so $P^* = 5$ and $Q^* = 20$. \$5,000 and 20,000 seats.

(b) At $P = 3$, $Q_D = 24$ and $Q_S = 16$. Shortage of 8,000.

(c) $38 - 2P = 10 + 2P$, so $P^* = 7$ and $Q^* = 24$. \$7,000 and 24,000 seats.

(d) $38 - 2P = 20$, so $P = 9$. Tuition \$9,000. All of the demand rise goes into price.