Lecture 9 – Competition: School Districts and the Remedies for Market Power

What Makes a Monopoly

Three conditions.

One seller. Inside an attendance zone, one.

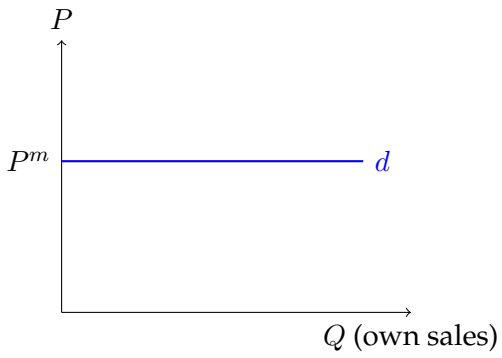
No close substitutes. Private school means paying twice. Moving means buying a different house.

Barriers to entry. A rival needs a charter from the state, a building, a staff, and the ability to charge zero.

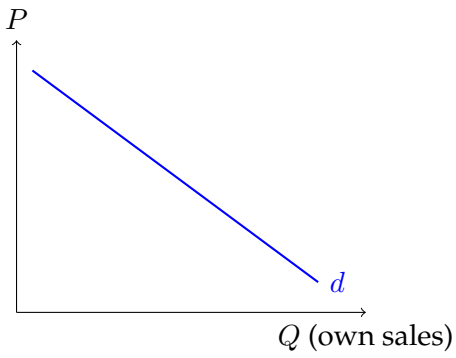
The third is the interesting one. Most monopolies in an intro course rest on a patent or a mine. A district's rests on law: the attendance zone is a prohibition on entry.

Demand Facing One Seller

Market power is one picture: **the demand curve facing you slopes down.**



Price taker



Market power

On the left, charge a penny above P^m and you sell nothing. On the right, raise the price and you lose some customers but keep most of them.

The Monopoly Outcome

A regional college is the only one within two hours. Inverse demand for its seats, with P and Q in thousands:

$$P = 20 - Q$$

Marginal cost is \$4,000 per student.

A price taker sets $P = MC$. A monopolist does not. Why not?

Where marginal revenue comes from

Marginal revenue is what Lecture 6 said it was: how much total revenue goes up if we enroll one more student. So ask what actually happens when the college enrolls one more.

Two things, and they pull in opposite directions.

> **You collect tuition from the new student.** That is a gain, and it is the price.
>
> **You have to cut tuition to attract her, and the cut applies to everyone.** A college cannot charge the new student less and leave the others alone — that is one price for one good. So every student already enrolled now pays less, and that is a loss.

Write it down:

$$MR = \underbrace{P}_{\text{tuition from the new student}} - \underbrace{(\text{the price cut}) \times (\text{students already enrolled})}_{\text{the discount to everyone else}}$$

Our demand curve is $P = 20 - Q$, so one more student pushes tuition down by \$1,000, and that \$1,000 comes off each of the Q students already there:

$$MR = (20 - Q) - 1 \cdot Q = 20 - 2Q$$

Same intercept, twice the slope. Notice where each piece of that comes from. At $Q = 0$ there is nobody to discount, so the second term vanishes and MR starts exactly where demand starts. After that, each student costs you the price cut a second time, so the line falls twice as fast.

This is also why the gap between P and MR widens as you go: the more students you have already enrolled, the more expensive it gets to attract one more.

Doing it with algebra

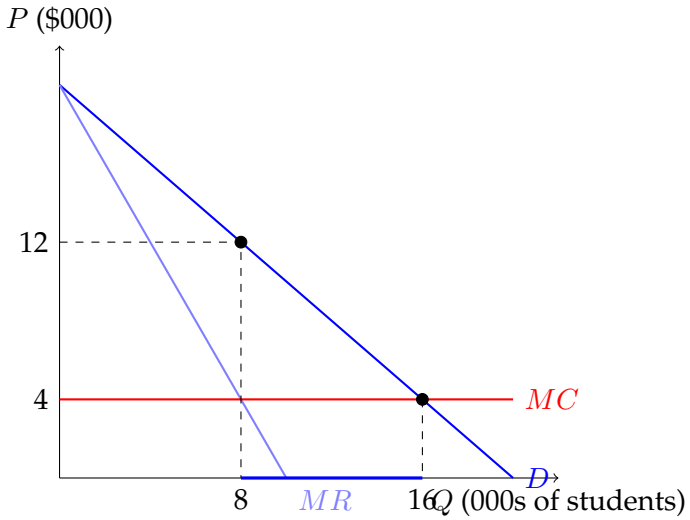
The compact version, if you want it:

$$TR = PQ = (20 - Q)Q = 20Q - Q^2 \qquad \Rightarrow \qquad MR = 20 - 2Q$$

For any linear demand $P = a - bQ$, the rule is $MR = a - 2bQ$: same intercept, twice the slope. You now know why.

Set $MR = MC$, as in Lecture 6:

$$20 - 2Q = 4 \;\Rightarrow\; Q_m = 8 \;\Rightarrow\; P_m = 20 - 8 = 12$$



The monopolist stops at $MR = MC$ and charges what demand will bear. A price taker would go to 16,000 students at \$4,000. The thick segment is the difference.

Profit $(12 - 4) \times 8 = 64$, so \$64 million above cost.

At 16,000 the last student's willingness to pay is \$4,000, exactly what her seat costs: she is a wash, and everyone before her was worth more than she cost. The monopolist stops at 8,000. **So 8,000 people for whom a seat was worth more than it cost do not get one.**

Why stop, when all 8,000 would pay above \$4,000? – Enrolling them means cutting tuition for everyone already enrolled. The college prefers 8,000 at \$12,000 to 16,000 at \$4,000.

From Seats to Quality

One sentence carries the rest of the lecture: **a monopolist restricts output.** The college restricted it from 16,000 seats to 8,000.

So ask: *output of what?*

Education output has two dimensions.

$$\text{output} \;=\; \text{seats} \;\times\; \text{quality}$$

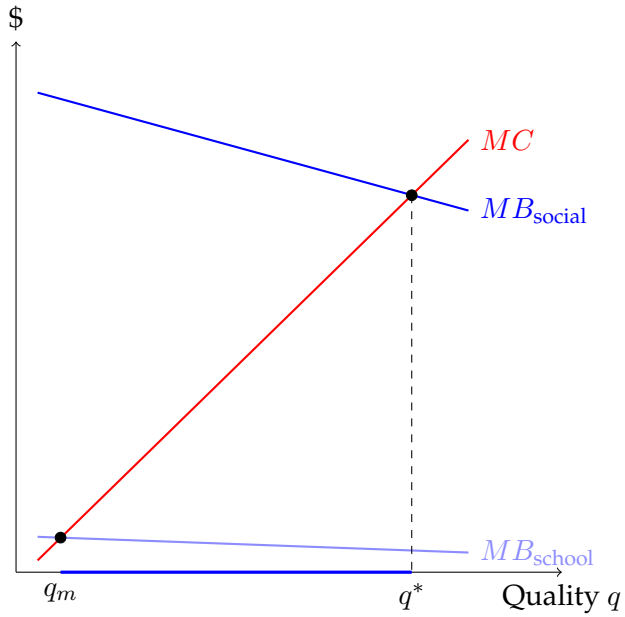
Every child in the zone must be enrolled, so seats cannot be restricted. No child may be charged, so price cannot be raised.

The market power has one place left to go. If output is restricted and seats cannot fall, **what falls is the quality in them.** What might this look like? A curriculum

nobody has revisited, a difficult conversation nobody has to have, teachers not receiving necessary training, etc.

The Same Diagram, in Quality

Redraw it with quality on the horizontal axis.



The school stops where $MB_{\text{school}} = MC$; efficiency wants $MB_{\text{social}} = MC$. The thick segment is the quality nobody gets.

> $\boldsymbol{MB}_{\text{social}}$ **replaces** $\boldsymbol{D}$: what one more unit of quality is worth to the children.
>
> $\boldsymbol{MB}_{\text{school}}$ **replaces** $\boldsymbol{MR}$: how much of that comes back to the school. It lies below MB_{social} for the reason MR lay below D — a producer does not capture everything its buyers value.
>
> The school stops at q_m. Efficiency wants q^*.

The structure is identical; the size of the gap is not. A college captures much of what its students value, so MR sits below D but not far below. A district behind an attendance zone captures almost none — enrollment does not respond, nobody is paid more or dismissed — so MB_{school} lies nearly on the axis and q_m near zero.

The school at q_m is not lazy. It is at $MB = MC$, like every optimizing agent in this course. **Change the payoff and you change the behavior.** Each remedy below lifts MB_{school}.

Remedy 1: Promote Entry

The textbook offers three remedies for monopoly: let competitors in, regulate, or require disclosure. Education policy has tried all three in various ways

Charters are entry. A provider the state authorizes may operate inside the zone and be paid per child, which lifts MB_{school}: some of the value of being good now returns as enrollment and money.

What are school vouchers trying to do?

Things that matter for impact:

How many alternatives, and how far away.

Is transportation provided?

How easy is it to apply?

Can families can tell the schools apart?

Entry's standard failure modes:

Small communities can't reasonably build another school.

An effective charter model may not replicate.

An entrant can compete by attracting strong students rather than by teaching well.

Discipline requires that bad providers close, and closing a school is very difficult

And entry is not free for the children who stay. Costs are mostly fixed — building, boiler, principal, bus routes — and they do not leave when a child does.

	2,000 students	1,700 students
Fixed cost	\$4.0m	\$4.0m
Variable cost at \$6,000 each	\$12.0m	\$10.2m
Total cost	\$16.0m	\$14.2m
Cost per student	**\$8,000**	**\$8,353**

Funding follows the child at \$8,000. The district sheds \$6,000. The \$2,000 difference is stranded on the children who stayed.

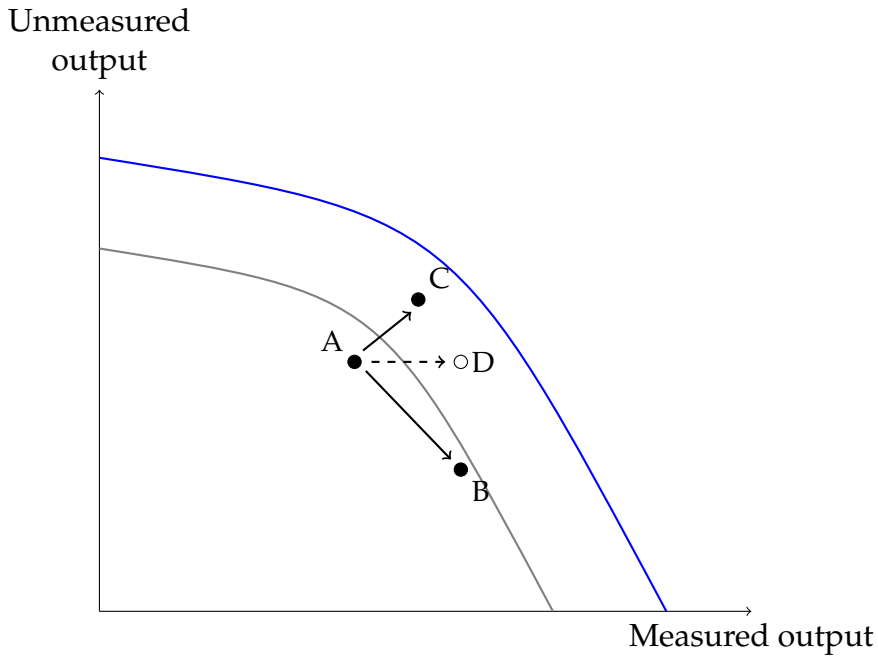
So how much should follow a departing child? – \$6,000. Transferring marginal cost leaves those who stay as they were; transferring the average makes every departure a loss. The fiscal argument about charters is the gap between those two numbers.

Remedy 2: Regulate

Where entry is unavailable, regulate directly: set a standard, measure against it, attach consequences. That is an accountability system. It works on MB_{school} with nobody switching schools, so in a rural district it is the only remedy available.

The regulator must measure something, and the firm optimizes against the measure rather than the true objective.

Schools produce reading and math, but also science, writing, attendance, behavior, music. Accountability measures a few. Put measured output against everything else and bring back the frontier from Lecture 1.



A to C is a real gain. A to B is reallocation along the frontier. A to D is the number moving while nothing else does.

> **Real gain (A to C).** The school got better at everything. This is what the regulation was for.
>
> **Reallocation (A to B).** Hours came out of science and recess. Measured output rose by exactly what unmeasured output fell.
>
> **Manipulation (A to D).** Children reclassified out of the tested population, suspensions timed around the test window, the test taught item by item, and at the far end, erasures.

In test-score data, which of the three looks like success? – All of them. So ask **what happened to the things nobody counted**: untested subjects, later outcomes, who sat for

the test, etc.

Thresholds make it worse. If you rate a school on the share of children above a bar, what will happen? Schools will focus on students near the bar. Helping students far below or comfortably above pays nothing. So effort concentrates in schools near the threshold rather than the worst ones, and within a school on the children near the bar. The furthest behind get less, and so do the strongest.

You could rate on average scores, but then you weight every student equally. What if you have equity concerns and want struggling students to receive more attention?

Remedy 3: Require Disclosure

One unique thing about this setting is it is hard for families to observe school quality. A parent sees the **level** — average scores, which mostly reflect who enrolls. What they (may) want is the **growth** the school adds, which is much harder to observe.

So if families choose on levels, the way to attract them is to enroll strong children rather than teach well.

Many school districts produce report cards, it does does two jobs:

It informs families, flattening the demand curve each school faces.

It pressures the school directly, working on MB_{school} with nobody switching.

Beyond the Classroom

Rank the three barriers to entry protecting your nearest district by how hard each would be to remove. Which remedy does your ranking imply?

A state rates schools on the share of children scoring proficient. Name three ways a school raises its rating without teaching anyone more. Now design a better measure, and say what new gaming it invites.

Why can a monopoly school district not simply be told to produce more quality, the way a regulated utility is told to charge less?

A county of 4,000 has one high school and it is bad. You may use exactly one remedy. Which, and why not the other two?

Rents here are taken as slack rather than profit. Does that make the loss larger or smaller than an ordinary monopoly's? Argue both sides.

Wrapping Up

Market power is a downward-sloping demand curve facing one seller. A district's rests on a line on a map.

Marginal revenue is the price minus the discount you owe everyone else. That is why it lies below demand, why the gap widens, and why a linear demand $P = a - bQ$ gives $MR = a - 2bQ$ — same intercept, twice the slope.

A monopolist produces where $MR = MC$, short of the efficient quantity. Count the cost in people: those worth more than they cost who did not get served.

Output is seats times quality. Fix the seats and the price at zero and the only dimension left to restrict is quality, with the saving taken as slack rather than profit.

A school at q_m is optimizing, not misbehaving. Change the payoff and you change the behavior.

Fixed costs do not leave when a child does, so money should follow at marginal cost, not at the full per-student amount.

Three remedies: entry, regulation, disclosure. Each fails in a standard way: thin entry and cream-skimming, gaming the measure, disclosing the wrong statistic.

Practice Problems

1. A college is the only provider within two hours. Inverse demand is $P = 24 - 2Q$, with P and Q in thousands. Marginal cost is \$4,000 per student.

(a) Why does MR lie below P? Write the MR curve, by the decomposition, by the rule, or by building a table of TR — whichever you find clearest.

(b) Find Q_m and P_m. Graph D, MR and MC.

(c) Find the competitive quantity and price.

(d) How much does the college earn above cost?

(e) How many students were worth more than they cost and did not get a seat? Mark them on your graph.

(f) Why does the college leave them out when every one would pay above marginal cost?

(g) The state caps tuition at \$8,000. How many enroll, and how does that compare with (b)? Find the cap that produces the competitive quantity, and say what happens below it.

2. For each, say whether it is a barrier to entry, and if so which kind: legal, cost-based, or informational.

(a) An attendance zone.

(b) A statutory cap on the number of charters in a state.

(c) The cost of a school building.

(d) A requirement that a new school charge no tuition.

(e) Parents being unable to compare schools except by average score.

(f) A shortage of certified math teachers.

3. A school may choose quality q from 0 to 5. Per unit, in thousands:

Unit of q	1st	2nd	3rd	4th	5th
MC	250	300	350	400	450
MB_{social}	700	650	600	550	500

(a) What is the efficient q?

(b) The school is a protected monopoly: enrollment is 500 at every quality level and nobody's pay depends on it. What is MB to the school, and what q does it choose?

(c) Entry arrives. Enrollment becomes 400, 460, 510, 550, 580, 600 as q runs 0 to 5, and each child brings \$10,000. Find the school's MB column and its q.

(d) Instead of entry, a rating system worth \$325,000 per unit of quality, with no enrollment effect. Find q.

(e) Both at once. Find q and compare with (a).

(f) Which remedy would you use in a county with one high school, and what does (c) have to do with it?

4. A district has 2,000 students, fixed costs of \$4m, and variable costs of \$6,000 per student.

(a) Find total cost and cost per student at 2,000 and at 1,700. Why does cost per student rise as enrollment falls?

(b) Funding is \$8,000 per student and follows the child. 300 leave. Find revenue, cost, and the gap.

(c) How much per remaining student must be cut to balance?

(d) How much should follow each departing child to leave those who stay unharmed? Why marginal cost rather than cost per student?

(e) A state sets the transfer at the full \$8,000 and calls it fair, since the money belongs to the child. Answer the argument.

5. A school has 1,000 instructional hours. Each hour produces 0.5 units of tested or 0.5 units of untested achievement. It currently splits 600 / 400.

(a) Draw the frontier and mark the current point. What are tested and untested output?

(b) Accountability arrives and the school moves to 800 / 200. Find the new point, the measured gain, and the unmeasured loss.

(c) Instead, the school finds a better method and every hour yields 0.6 units. Keeping 600/400, find the new point.

(d) You observe tested scores only. Can you tell (b) from (c)? What one extra variable would settle it?

(e) A third school tests 100 children with a mean of 50, then excludes the 20 lowest, whose mean is 25. Compute the reported mean. How much did anyone learn?

6. A school is rated on the number of children scoring at or above 240. Tutoring raises any score by exactly 15 points. Current scores:

190, 205, 228, 232, 236, 238, 244, 250, 265, 280

(a) With unlimited slots, which children would raise the rating if tutored?

(b) The school has 3 slots. Who gets them, and name the two distinct reasons a child can be passed over.

(c) The state switches to rating on the mean score. Redo (b).

(d) Which rule is better? Say what each is good at and what each gives up.

Answer Key

1.

(a) $TR = 24Q - 2Q^2$, so $MR = 24 - 4Q$. MR lies below P because another seat requires cutting tuition on every seat: the gain is the new seat's price minus the discount to all the others.

(b) $24 - 4Q = 4 \Rightarrow Q_m = 5$, $P_m = 14$. So 5,000 students at \$14,000.

(c) $4 = 24 - 2Q \Rightarrow Q_c = 10$ at \$4,000.

(d) $(14 - 4) \times 5 = 50$, so \$50 million above cost.

(e) Five thousand. At 10,000 the last student's willingness to pay is exactly \$4,000, so everyone between 5,000 and 10,000 was worth more than she cost. Mark the axis between Q_m and Q_c.

(f) Enrolling them requires cutting tuition for all 5,000 already enrolled. The college prefers 5,000 at \$14,000 to 10,000 at \$4,000.

(g) The college now receives \$8,000 on every seat, so $MR = 8$ up to $Q_D = 8$. Since $8 > MC$ it enrolls all of them: 8,000, up from 5,000. A price ceiling on a monopolist *raises* output, which it never does in a competitive market, because the cap removes the reason to hold seats back. The cap giving the competitive quantity is \$4,000 $= MC$, with 10,000 students. Below \$4,000 the college no longer covers marginal cost, cuts enrollment, and you get a shortage.

2.

(a) Legal, and the purest in the lecture. (b) Legal. (c) Cost-based: paid before the first child enrolls. (d) Cost-based in effect: it forecloses any entrant needing revenue above the per-pupil amount. (e) Informational, and the one that turns entry into cream-skimming. (f) Cost-based, and it binds entrant and incumbent alike.

3.

(a) Every unit has MB_{social} above MC, including the fifth ($500 > 450$). Efficient $q = 5$.

(b) $MB = 0$, so $q = 0$. All five units of value are forgone.

(c) Enrollment gains are 60, 50, 40, 30, 20, so $MB =$ \$600k, \$500k, \$400k, \$300k, \$200k. Against MC: $600 > 250$, $500 > 300$, $400 > 350$, $300 < 400$. So $q = 3$.

(d) $MB =$ \$325k throughout: $325 > 250$, $325 > 300$, $325 < 350$. So $q = 2$.

(e) $MB =$ \$925k, \$825k, \$725k, \$625k, \$525k, all above MC. So $q = 5$, the efficient level. Neither remedy alone reaches it; together they do, because each raises the return at a margin the other leaves short.

(f) Regulation, from (d). Entry is unavailable in a county of 4,000 whatever the law permits, so (c) is not on the menu however well it performs elsewhere.

4.

(a) At 2,000: $TC = \$16$m, or \$8,000 each. At 1,700: $TC = \$14.2$m, or \$8,353 each. The \$4m of fixed cost is divided among fewer children.

(b) Revenue \$13.6m against cost \$14.2m: a gap of \$0.6m.

(c) $\$600{,}000/1{,}700 = \$353$ per remaining student.

(d) $\$16\text{m} - 300f = \$14.2\text{m}$ gives $f = \$6{,}000$. Marginal cost is what the district actually stops spending when a child leaves; cost per student includes fixed costs that do not leave with the child.

(e) The money belongs to the child, but the building does not go with them. Transferring the full \$8,000 moves \$2,000 of someone else's fixed costs onto the children who stayed, who chose nothing and lost \$353 each. Fund the stranded costs separately instead.

5.

(a) Tested 300, untested 200, on a straight frontier from (0,500) to (500,0).

(b) Tested 400, untested 100: gain $+100$, loss -100. A slide along the frontier, total output unchanged.

(c) Tested 360, untested 240. Both rose: the frontier moved out.

(d) No — tested output rises in both. You need an outcome outside the measure: an unrated subject, attendance, a later-grade result.

(e) $(100 \times 50 - 20 \times 25)/80 = 56.25$. The reported mean rises 6.25 points and nobody learned anything.

6.

(a) Those below 240 but within 15 points: 228, 232, 236, 238.

(b) Any three of those four. Two reasons to be passed over: 190 and 205 cannot reach the bar even with help, and 244 through 280 are already counted. The two children furthest behind get nothing.

(c) Every child contributes the same 15 points, so the school is indifferent among all ten and the triage disappears.

(d) The bar focuses attention on a chosen standard and is terrible at both tails. The mean treats every child equally, has no notion of a standard, and rewards the cheapest points available. Choosing a measure is choosing who gets ignored.