Ecommerce
Foundational Lectures

The Basics: Demand Curves, Costs, and the Monopoly Problem

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Remember demand?

- Relationship describing how much consumers, in aggregate, are willing to pay for a particular quantity of a good.
- For instance, a linear demand curve could take the form $Q = a + bP$, or its inverse version $P = (Q - a)/b$.
- Where does it come from?
  - Maybe the aggregation of individual utility functions, but we will often be agnostic about its origin and foundation.
  - We just take it as given, as firms typically do, and think about how a firm maximizes profits given demand they face.
- Could represent total market demand or residual (left over) demand from other firms.

Remember demand?

- This linear demand— $Q = a + bP$, or $P = (Q - a)/b$ –is pretty bare-bones. We might want to allow for a more general demand function, including prices of substitutes and complements, income, exogenous factors.
  - $Q = a + bP + cPs + dPc + gI + hJ$ could be a more general linear demand function

Remember demand?

- Recall that the demand elasticity is defined as $\varepsilon = \frac{\partial Q}{\partial P}\frac{P}{Q}$
- So if demand takes the convenient form

$$\log(Q) = \alpha + \beta\log(P) + \gamma\log(P_s) + \delta\log(Pc)$$ then

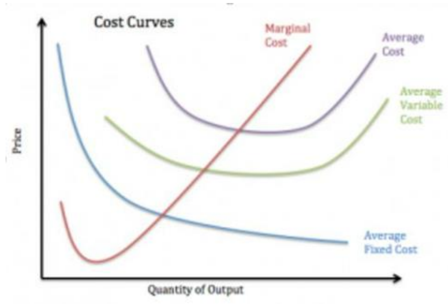
$$\frac{\partial Q/Q}{\partial P/P} = \frac{\partial\log(Q)}{\partial\log(P)} = \beta$$ (own-price elasticity, typically negative) and

$$\frac{\partial Q/Q}{\partial P_s/P_s} = \frac{\partial\log(Q)}{\partial\log(Ps)} = \gamma$$ (cross-price elasticity, typically positive)

Remember demand?

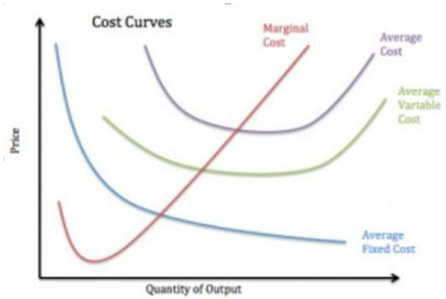
- It is quite common for economists to want to statistically estimate demand curves, and we will see some this semester, but we won't be overly concerned with the mechanics of doing the estimation.
- Just be familiar with the idea of an aggregate demand curve and how we get elasticities from its parameters (or estimated elasticities, if the parameters are estimated).

Remember costs?



- This is literally my least favorite graph in all of economics (marginal, average, average variable, average fixed, …).
- Just need to be aware of two types of costs and their definitions:
  - Fixed costs, F, are independent of output, e.g., building a brewery, setting up a website
  - Marginal costs, c or c(Q), are the incremental cost of producing one additional unit, e.g., additional fuel needed for an extra passenger on a flight, wholesale cost of goods being sold
- We often assume, for modeling purposes, that marginal costs are constant.
- We use C(Q) to denote total costs.

Remember costs?



- Sometimes whether a cost is fixed or variable depends on the range of production you're considering.
  - If output fluctuates +/- 20%, current office space and staff should be fine. Otherwise, we'll need to expand or contract space and staff.

Monopoly

- We’ll start first with something like a formal definition of monopoly: A monopoly or monopolist is a single (profit-maximizing) producer that is the only source for a particular good.
- We use the terms “monopoly” and “monopoly power” (as well as the model that I will cover in a few minutes) to refer to a much broader set of scenarios, though, not just ones that fit the formal definition.
- Roughly speaking, we use it to refer to a situation where firms set prices without consideration of other firms’ actions.

The monopoly problem

- We will start our analysis of the monopoly problem with the assumption that the monopolist is facing an (inverse) demand curve that she knows $P(Q)$.
- We also assume that the monopolist has costs represented by the function $C(Q)$.
- Finally, we assume that the monopolist chooses a common price to sell her good that will maximize profits.

The monopoly problem

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Note that choosing Q is equivalent to choos

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- How do we find the Q that maximizes this equation? Take the derivative wrt Q, set it equal to 0:

$$P'(Q)Q + P(Q) - C'(Q) = 0$$

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When we take the derivative of the expression for revenue, we get marginal revenue, MR.

When we take the derivative of the expression for total cost, we get marginal cost, MC.

The monopoly problem

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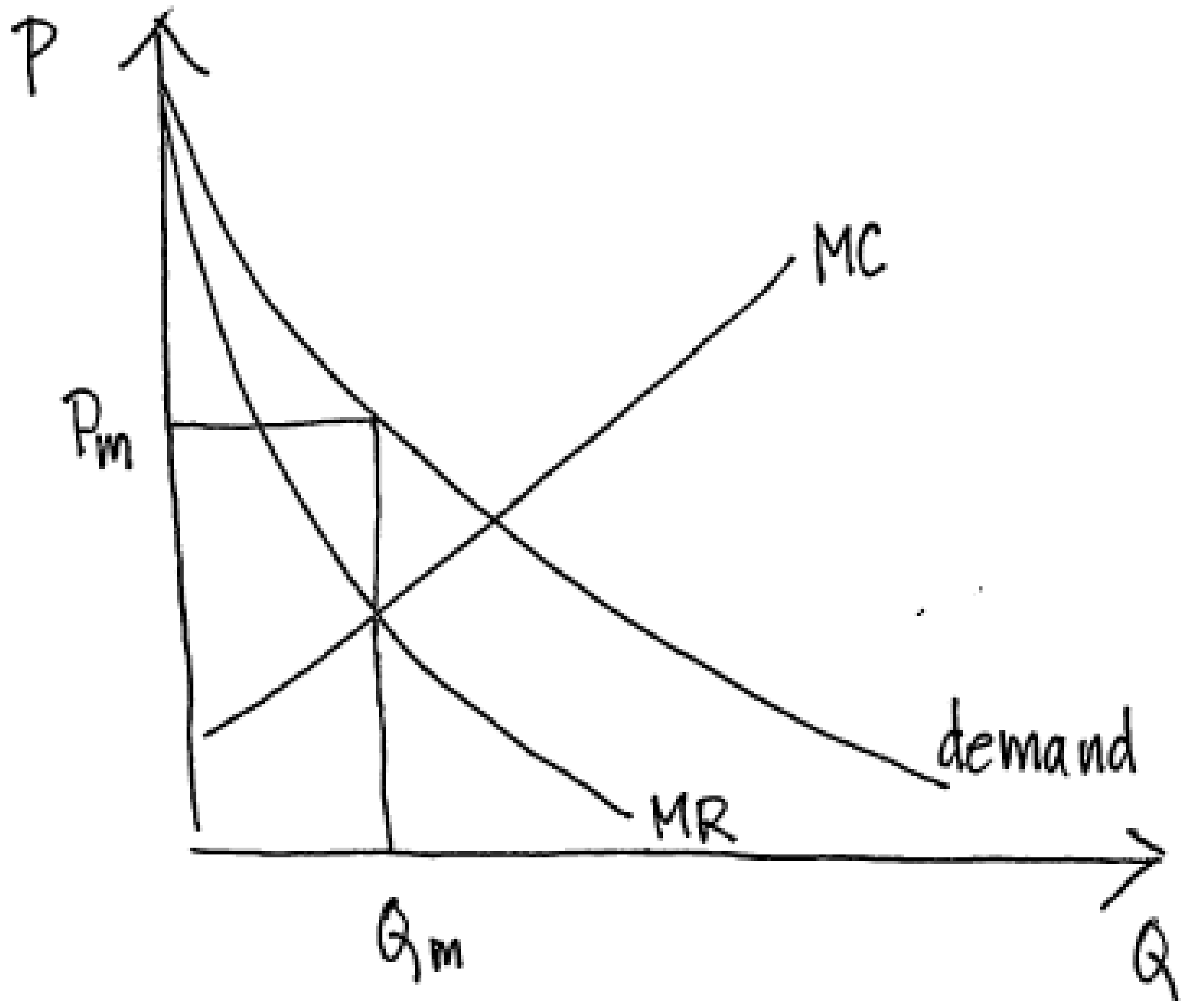
- How do we find the Q that maximizes this equation? Take the derivative wrt Q, set it equal to 0:

$$\underbrace{P'(Q)Q + P(Q)} - C'(Q) = 0$$

Note that MR will lie below demand if demand is downward-sloping because *P'(Q)* < *0*.

Here is a diagram of what monopoly pricing would look like with a particular demand curve and marginal cost curve.



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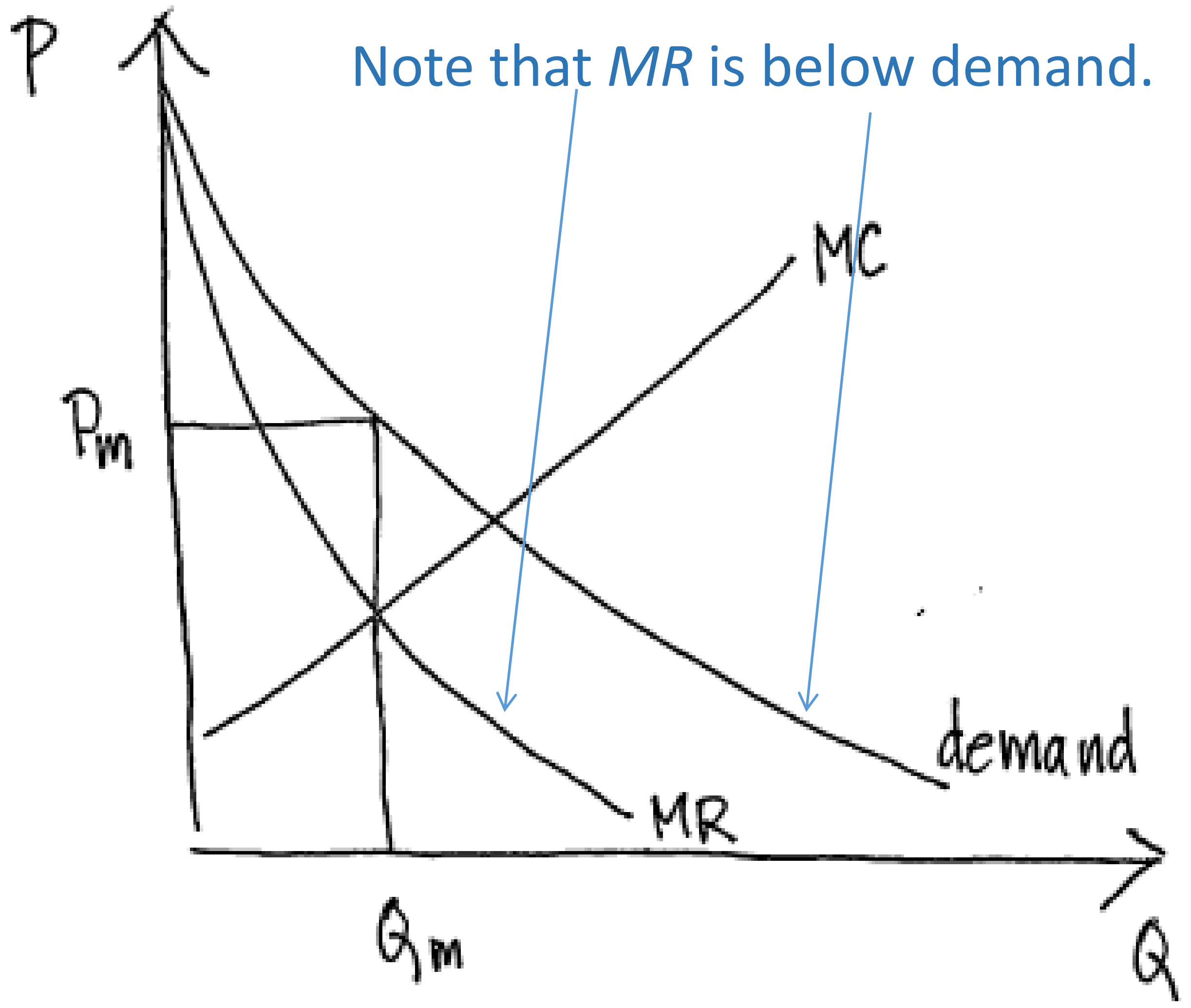

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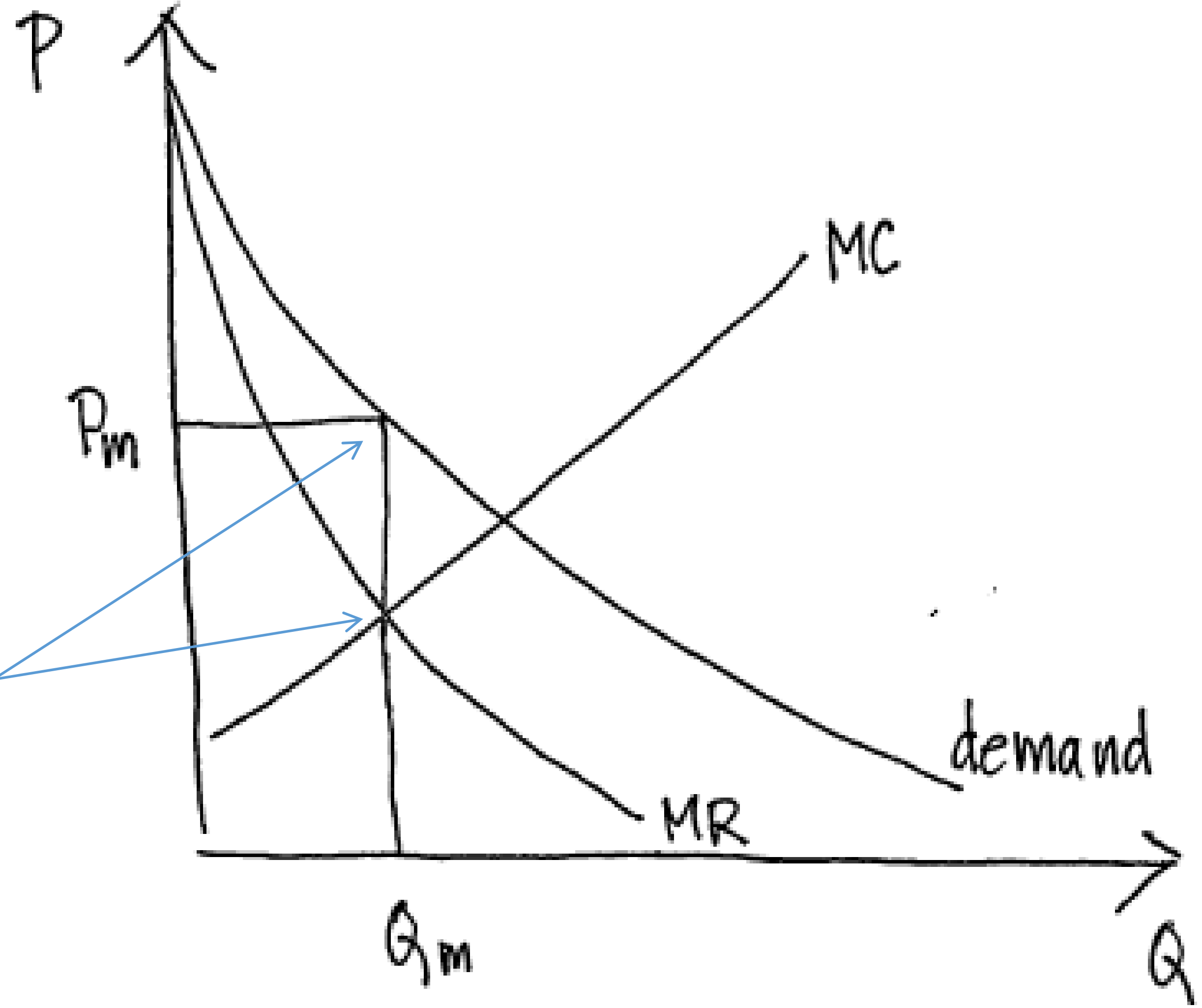
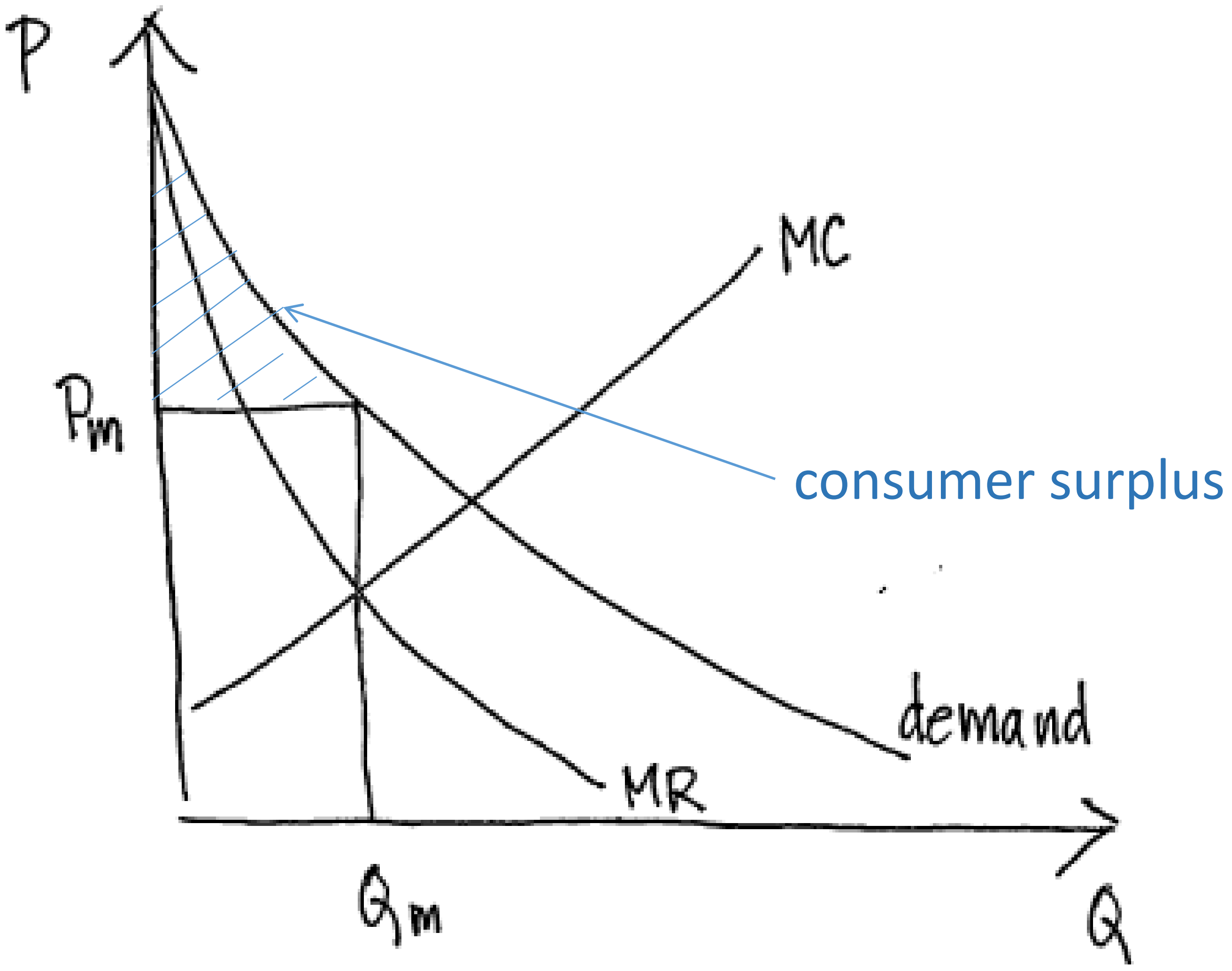
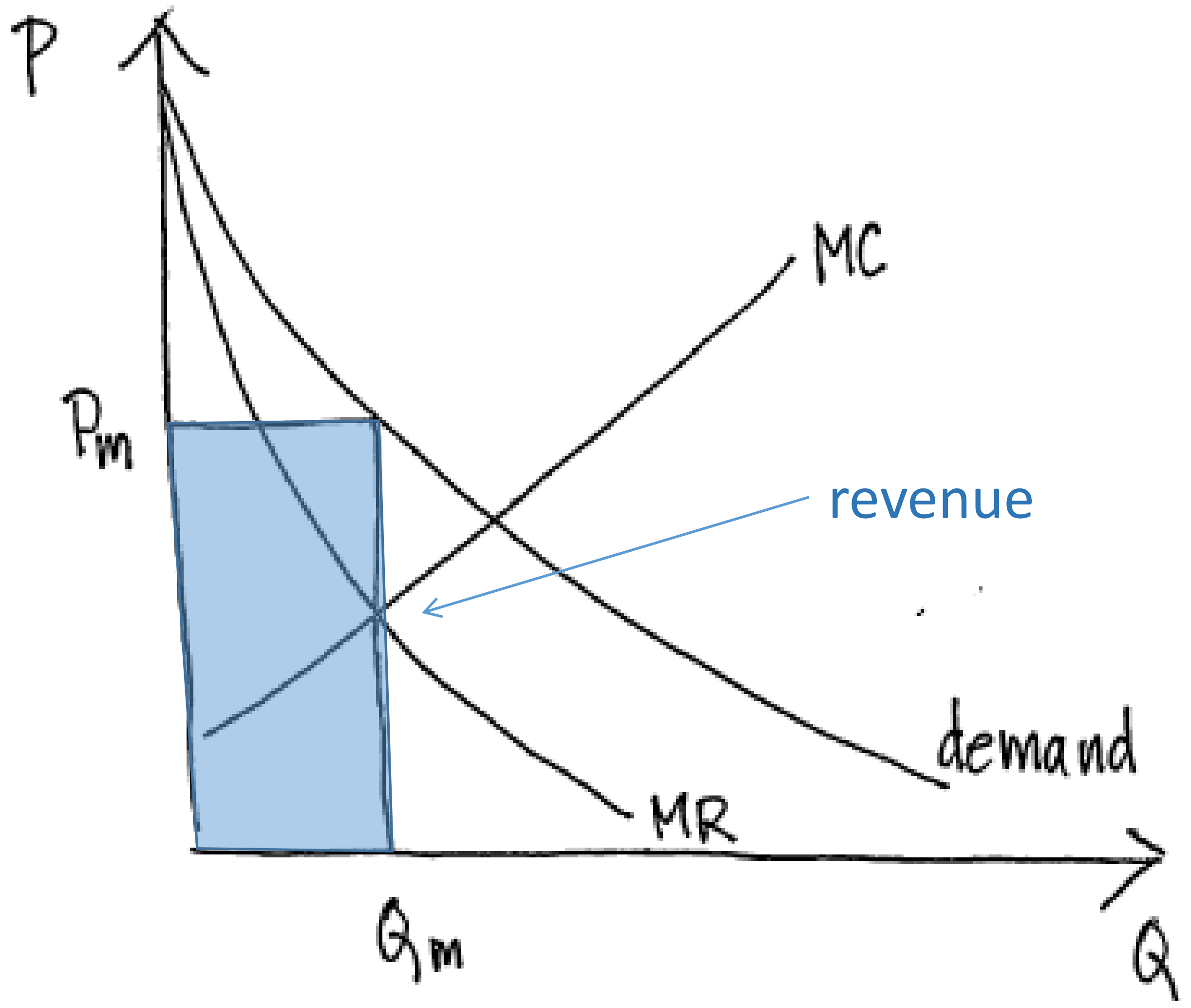
The monopolist chooses quantity such that $MC = MR$ and then prices according to what demand will allow for that quantity.



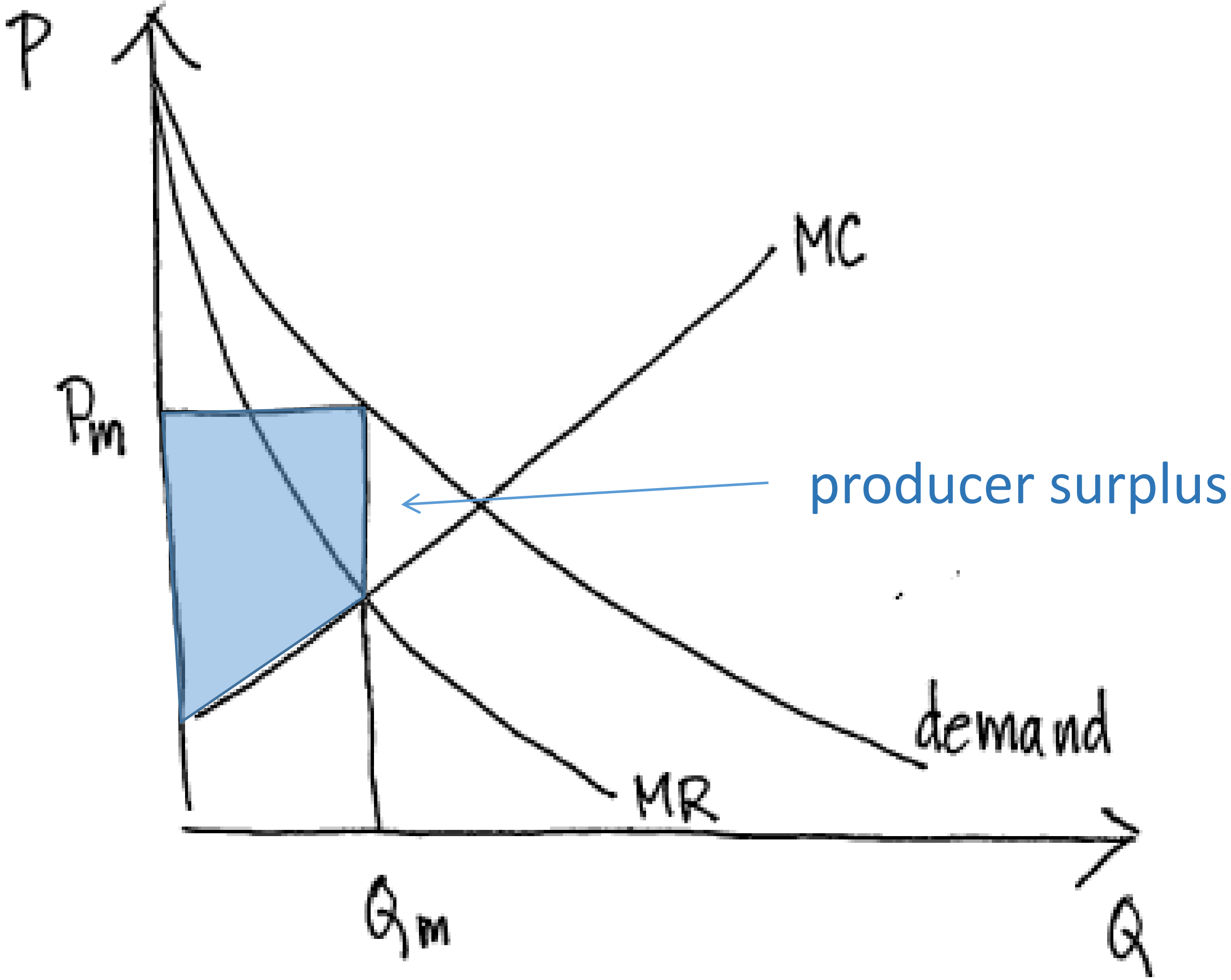
Here is consumer surplus.



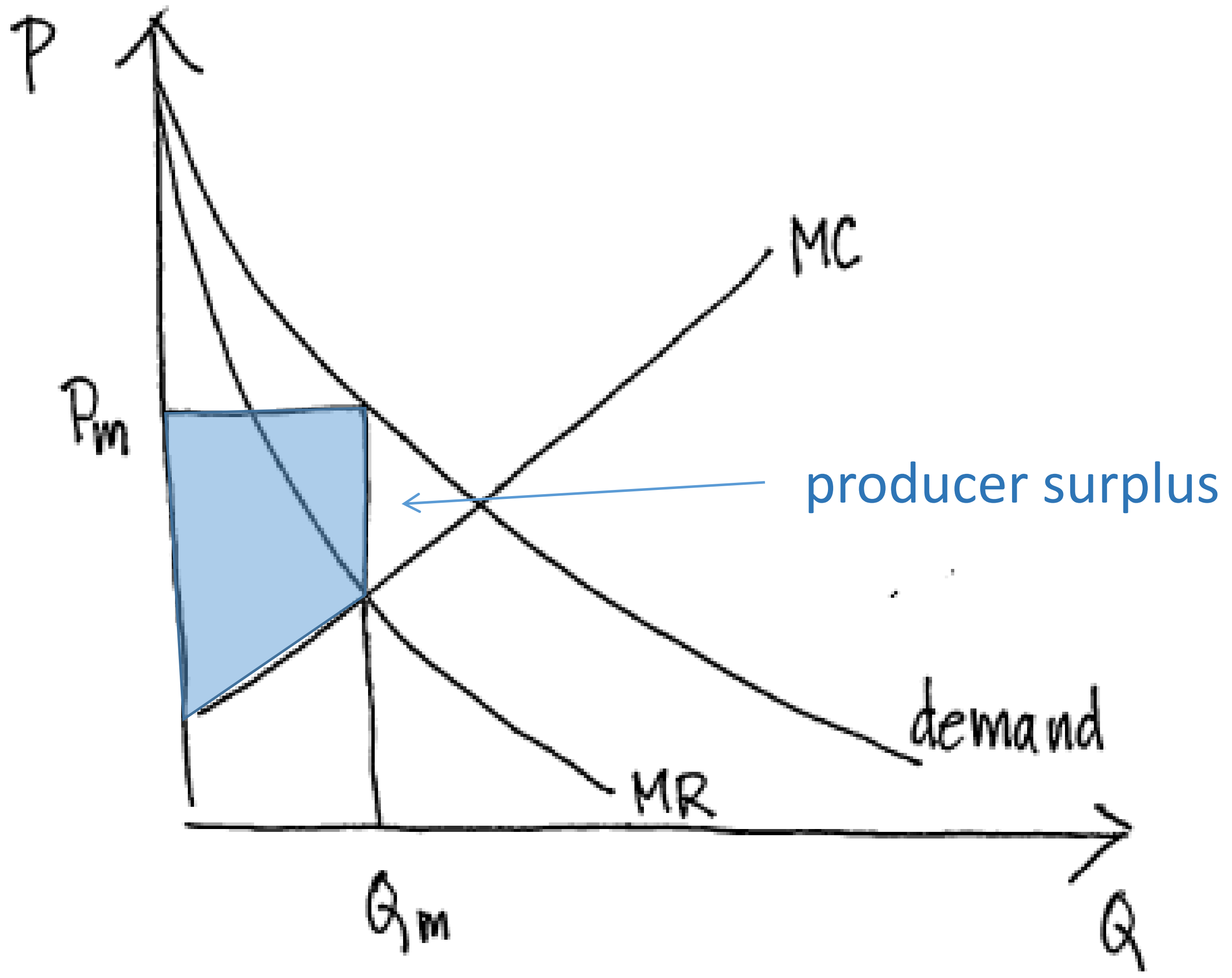
Total revenue is PQ.



And producer surplus is revenue minus the integral under the marginal cost curve.

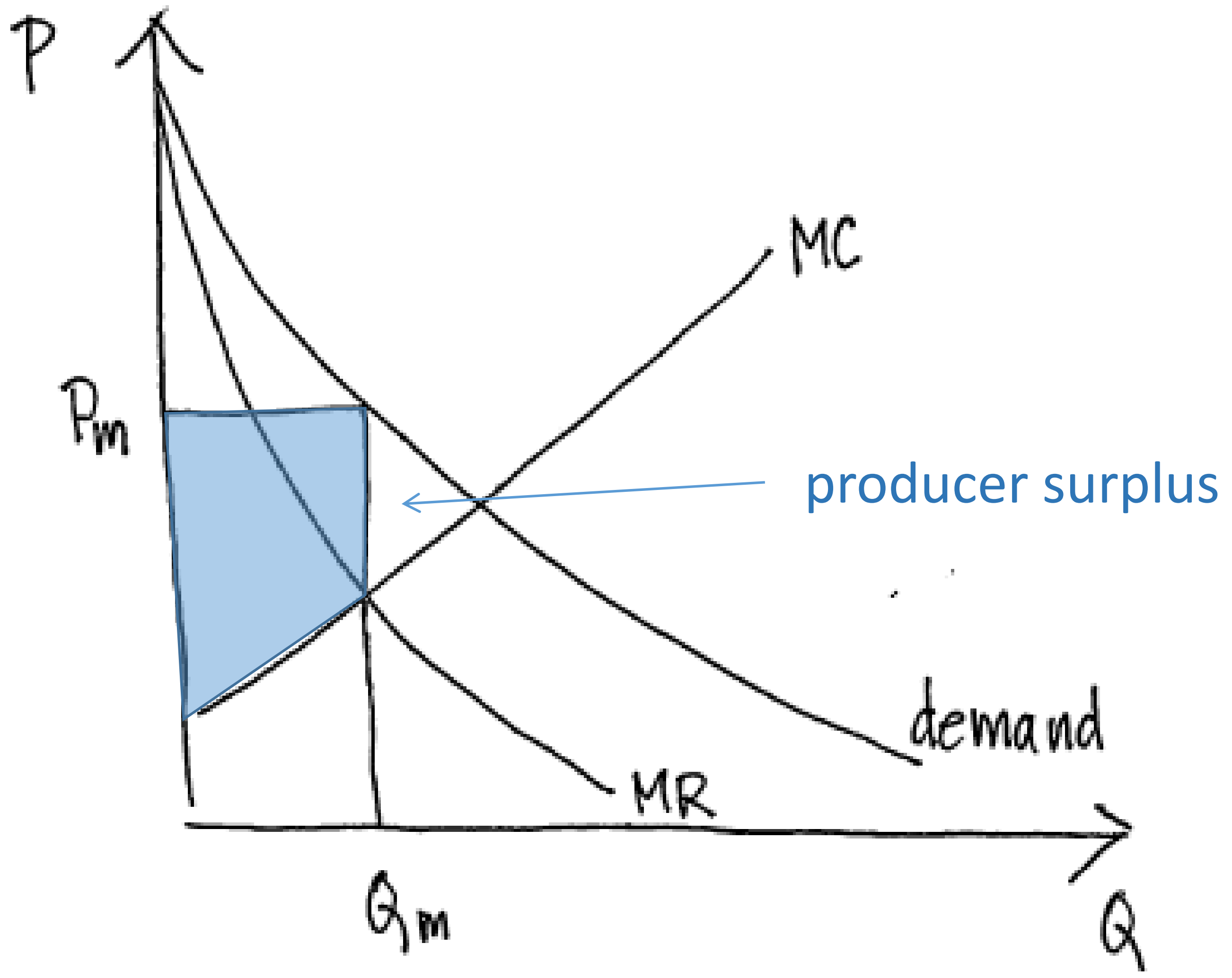


Is this the same as profit?

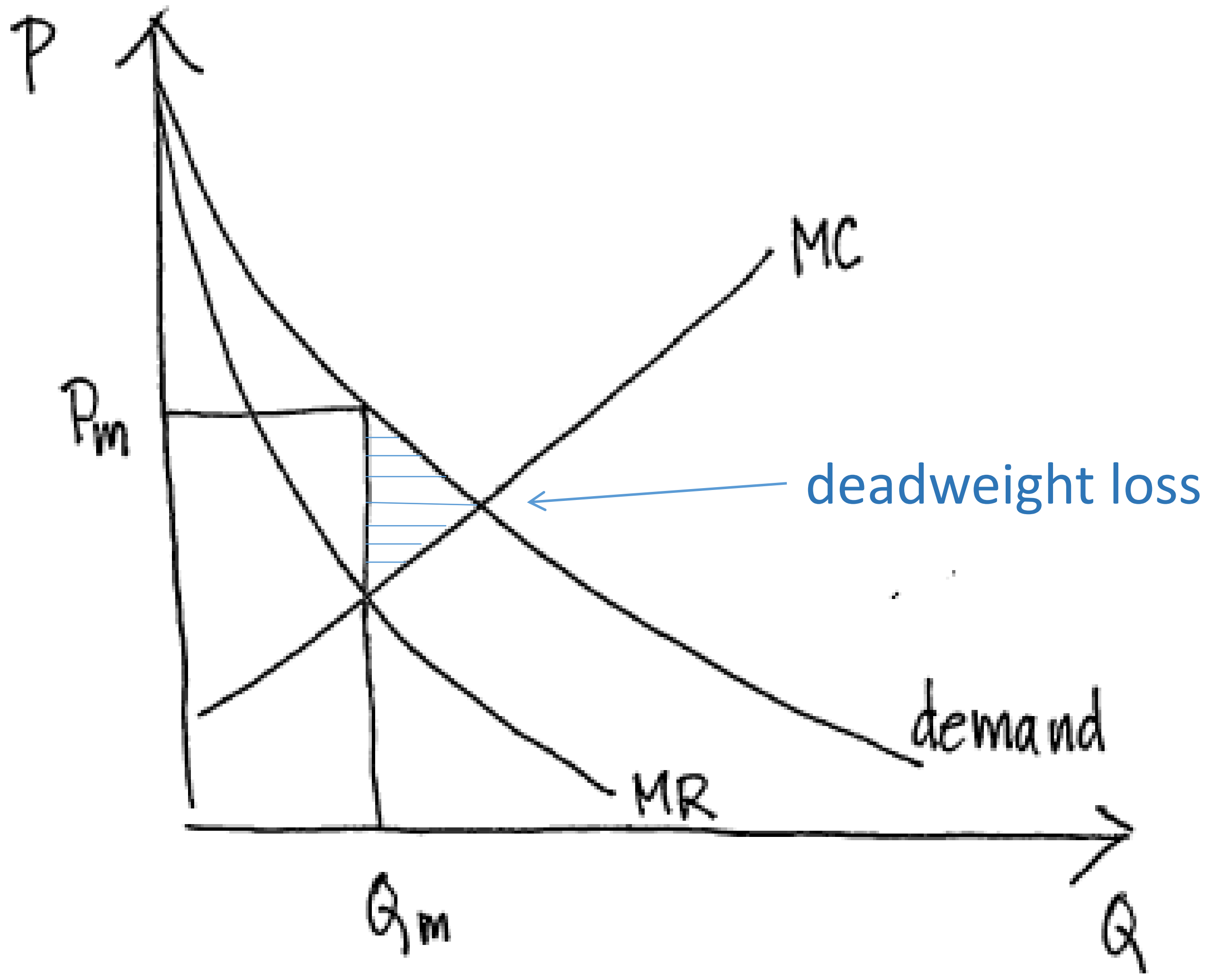


Is this the same as profit?

No---don't forget about fixed costs. Producer surplus minus fixed costs is profit.



And, finally, here is deadweight loss, rearing its ugly head.



The monopoly problem

- Comments
  - The FOC tells us that a monopolist will price so that her marginal revenue is equal to her marginal cost.
  - Since she faces a downward sloping demand (typically), the amount she can charge to sell one more good goes down as Q goes up. Furthermore, as we assume that she is selling the good to all consumers at the same price, she is losing revenue on all of her *inframarginal* consumers as well.
  - It is the fact that she loses revenue on all of the inframarginal consumers in order to grab an additional marginal consumer that prevents her from going all the way down to $P=C'(Q)=MC$.
  - MR becomes negative beyond some point, in particular where revenue is maximized. (Monopolist prices to maximize profit, though, not revenue.)

The monopoly problem, another look

- Recall our FOC:

$$P'(Q)Q + P(Q) - C'(Q) = 0$$

The monopoly problem, another look

- We can rewrite it as follows:

$$\frac{P(Q) - C'(Q)}{P(Q)} = \frac{-QP'(Q)}{P(Q)}$$

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Does this look familiar?

The monopoly problem, another look

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$$= \frac{-1}{\epsilon} \text{ (where } \epsilon = \frac{P}{Q}\frac{\partial Q}{\partial P}\text{)}$$

This is the demand elasticity.

The monopoly problem, another look

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$$\frac{P(Q)-C'(Q)}{P(Q)} = \frac{-QP'(Q)}{P(Q)}$$

We call this the Lerner Index, which descri
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$$= \frac{-1}{\epsilon} \ (\text{where } \epsilon = \frac{P}{Q}\frac{\partial Q}{\partial P})$$

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The monopoly problem

- Comments
  - Price does not depend on fixed costs, only marginal.
  - Elasticities determine markups, and they're higher when demand is inelastic.
  - As we saw before, there are consumers who would be willing to pay more than they have to for the good---the sum over this increment is consumer surplus.
  - There are consumers who are not being served but would be willing to pay more for the good than it would cost to produce it---the sum over their foregone surplus is the deadweight loss of monopoly.
  - To calculate the total welfare accruing to market participants, we would add the consumer surplus and the monopoly profit (i.e., welfare = consumer surplus + producer surplus – fixed cost).

The monopoly problem

May seem counterintuitive, but it's true.

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The monopoly problem

- In short, this is a very powerful and important result. It will serve as a benchmark for how firms behave when they wield market power and/or do not have strategic considerations. Much of it will become shorthand for us:
    - Price elasticities discipline markups
    - Monopoly power results in deadweight loss
    - Firms price with marginal costs in mind
    - etc.