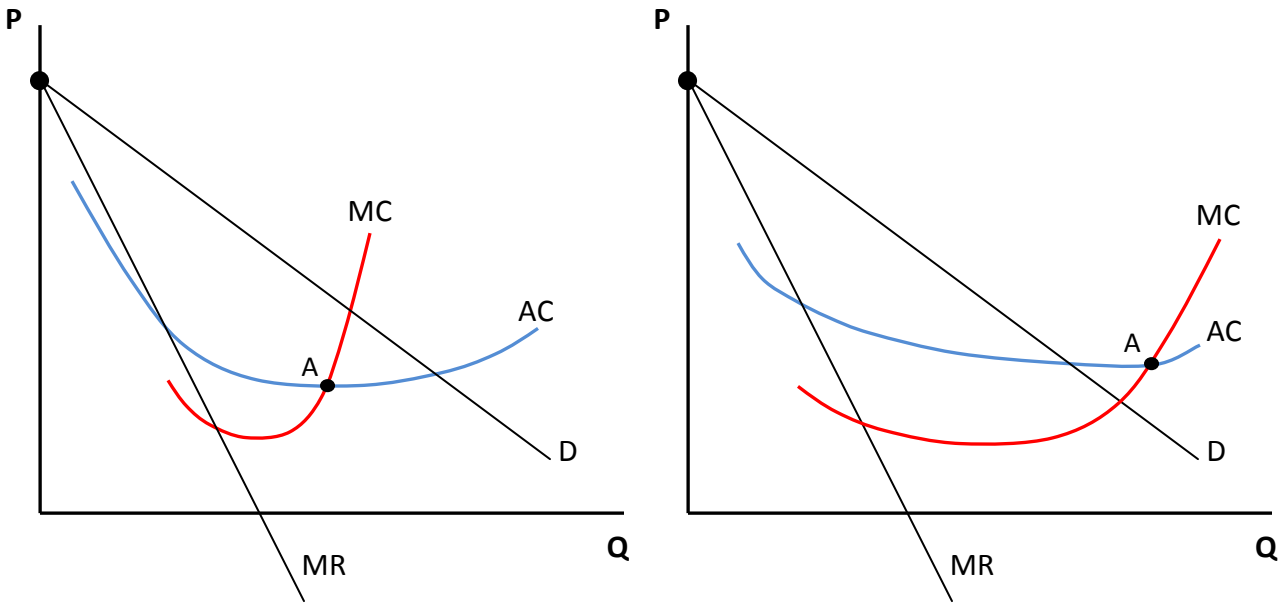
Rate Regulation with a Natural Monopoly
Econ 201/Haworth

When a monopolist embarks upon maximizing profit, that firm has a variety of pricing approaches it can take to get there. One such approach is called linear pricing, or what we could also call "one price for each unit sold". It works like this. The firm produces at the point where MR = MC, uses that resulting output level (Q*) with the demand curve to determine price (P*), and then calculates profit.

This handout looks at that process when implemented by a natural monopoly. What's a natural monopoly? We define natural monopoly as a monopoly with average costs (AC) that decrease through what we call some relevant range of market output. What that means in more basic language is that you have a monopoly firm with falling AC. Here are two examples where we observe falling AC. Note that falling AC is not necessarily a difficult standard, but that to have falling AC through a larger range of market output will apply to a smaller subset of firms.



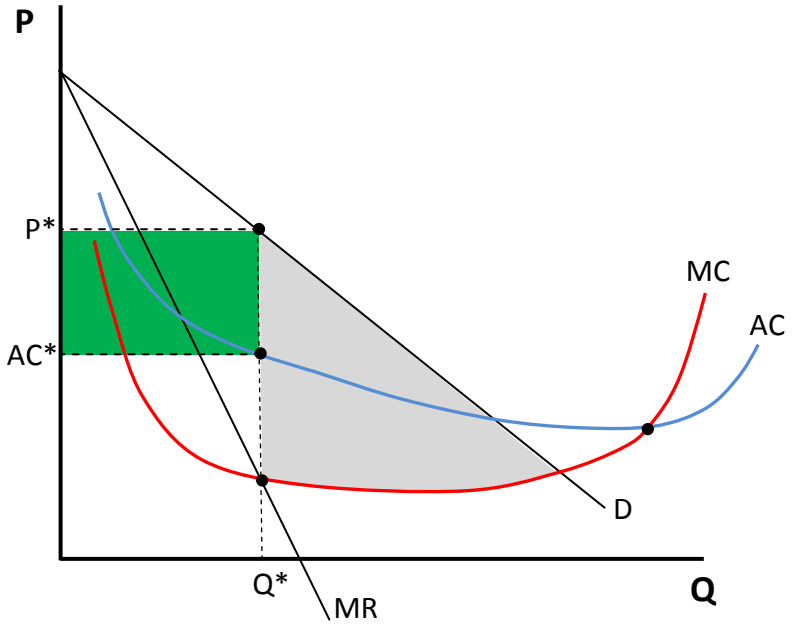
In both cases, we have a monopoly firm. Note that AC decreases through pt A on the graph, which is the minimum point on AC. Note as well that this minimum point is where AC and marginal cost (MC) intersect. On the left-side graph, AC decreases to a minimum point that falls inside the demand curve (D). On the right-side graph, AC decreases to a minimum point that falls outside the demand curve. While this monopoly may experience falling AC for most of the output they'd ever produce on the left-side graph, the monopoly on the right will always produce with falling AC since AC decreases past the point where AC crosses demand. The graph on the left isn't too far from what we might describe as a natural monopoly, but it's closer to

what we'd call a "temporary natural monopoly". For a firm to be a true natural monopoly, we would expect AC to decrease to a point that's much closer to, or beyond the demand curve. Therefore, the graph on the right is what we think of with a natural monopoly.

What causes the AC curve to decrease as it does for a natural monopoly? Remember that the AC curve reflects both variable and fixed costs, and that the average fixed cost curve (AFC) is a negatively sloped curve that decreases forever. When fixed costs take a prominent role in determining AC, the AC curve will look more like the AFC curve.

What are fixed costs? We typically think of capital as a fixed factor, and so capital costs would be a likely fixed cost. When a firm has very large capital costs (e.g. the first uses large, very expensive machines to produce output), then the first is more likely to have an AC curve that decreases for a very large range of output (i.e. looks closer to the right-hand graph above). Some examples of these type of firms would be utility companies. E.g., electric power or water.

Let's consider the linear pricing example we mentioned above, but put it within the context of a natural monopoly firm (e.g. an electric utility company or water company).



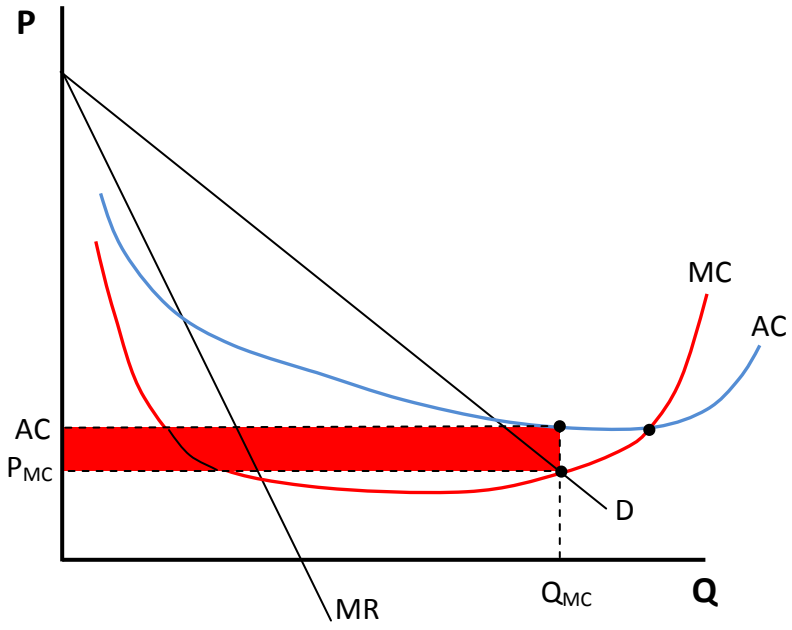
Let's note a few things before we move on. First, the green area on the graph between P* and AC* is profit. The gray area below demand and above the MC curve is called deadweight loss, and it results from having a price that's greater than marginal cost.

One question we want to ask is whether this outcome satisfies just the firm, or society as a whole. We already have that answer when we recall that there is some deadweight loss. If P >

MC, then deadweight loss will exist, and the firm will produce an output level that's below what society would prefer (as society prefers P = MC).

If government would like to see this firm produce an output level that society prefers (which would not be too surprising if this firm is producing a good like water or electricity, goods that are relatively important to society), then the government could require the firm to produce a specific output level using rate regulation. What is rate regulation? This is where the government decides to set the price of the firm, rather than allow the firm to do so. When using rate regulation, the government will seek to set a price that maximizes society's net benefit. That price is always one where P = MC, because that price eliminates any deadweight loss. If the government pursues rate regulation and sets P = MC, we call this Marginal Cost Pricing (or **MC pricing**).

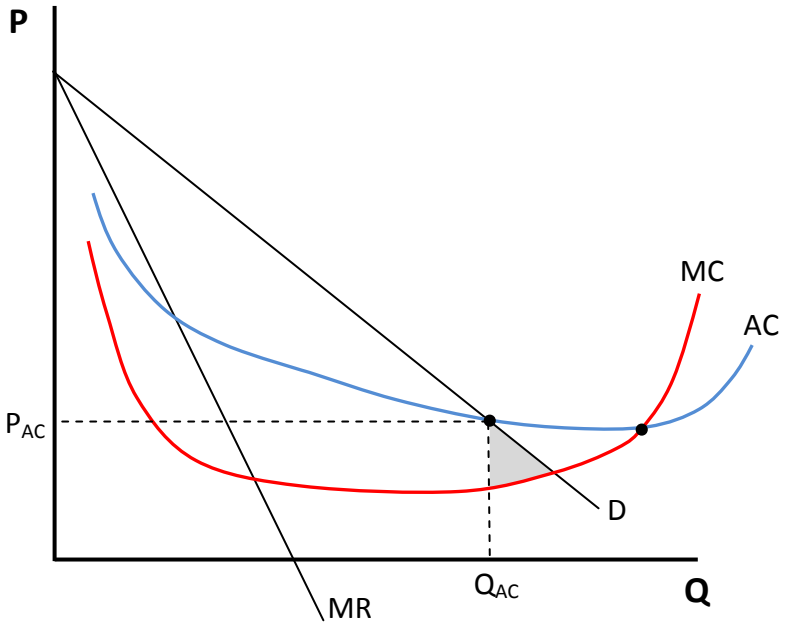
Here's what happens when the government engages in MC pricing. The government sets P = MC, which means setting a price that corresponds with the point where MC crosses the demand curve (at P_{MC}) to get the firm to produce Q_{MC}. If we determine the profit earned at this price, then we discover that the firm must make a loss (the red area below), because the price is below AC. In other words, although MC pricing eliminates the deadweight loss and helps Society overall, MC pricing also leads the natural monopoly firm to earn a loss, because the natural monopoly has an AC curve that's above the MC curve all the way through the point where AC and MC cross the demand curve. When any firm earns a loss, we know they will consider exiting the market in the long run.



If MC pricing leads to this firm earning a loss, then MC pricing is probably not a good way to impose rate regulation unless government is willing to subsidize the monopolist for that loss.

One alternative to MC pricing is Average Cost Pricing (or **AC pricing**), where the government sets the price to allow the firm to earn zero economic profit (i.e. earn a return that's as good as the firm's next best investment). This price would obviously be greater than the price above (where P = MC), since the basic problem above is that the price was a bit too low for the firm. Of course, setting a slightly higher price will also cause at least some deadweight loss to exist, since only P = MC allows for no deadweight loss.

If the government imposes AC pricing, then we get the following below, where the government sets P = AC, which means setting a price that corresponds with the point where AC crosses the demand curve. As a result, we get the price P_{AC} and output of Q_{AC}, with the resulting gray area of deadweight loss. Once again, profit would be zero since P = AC now.



What effect does this type of pricing approach have on the firm and market? When setting P = AC and telling the firm that they will earn economic profit of zero, the government is telling the firm that the firm will earn a specific return. I.e., a return that's the same as the next best investment for the firm. We can think of this as guaranteeing the firm a return on effort. Consider what can happen when we start guaranteeing a specific return on effort. E.g., what would be the effect of guaranteeing the class that they will get a B for their final grade, no matter what happens on the final exam? Effort would obviously fall. We can expect the firm to behave no differently. The firm may not be as concerned with minimizing costs, or in keeping cost down over the long run if the firm earns the same return either way.

We also know that if the firm increases their fixed cost, the AC curve will shift up but the MC curve will remain in the same place. A higher AC leads the firm to request a rate increase (i.e.

ask the government to raise the price), but when that happens, the deadweight loss also increases (since there would be a bigger gap between the price and MC).

Note that whether we use MC pricing or AC pricing, we do not get government intervention in this situation without at least encountering some sort of problem to overcome. With MC pricing, the problem is that we may force the firm to earn negative economic profit, which means exit in the long run. With AC pricing, we realize that the firm could start changing their behavior, behavioral changes that could lead to the firm becoming less efficient and create even greater deadweight loss for society.