

# Microeconomic Theory

## Lecture 8: Imperfect Competition and Rent Seeking

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**Readings:** Varian, Chapters 14 and 16.

### 1. Monopoly

So far we have assumed that firms and consumers take prices as given. This may be a fair approximation for households and for small producers such as subsistence farmers and microenterprises. But it does not sound right for large firms or firms that serve a protected market (e.g., niche market, market isolated by government policy – quota – or by distance). These firms typically set prices.

The simplest model of price fixing is the monopoly model. In this model, a firm is assumed to face the entire market for its product. There are no competitors. The profit maximization problem of the monopolist depends on our assumptions regarding what pricing strategies are feasible. The simplest model is the one in which the monopolist must charge the same price for everyone. It is usually justified by arguing that if the monopolist sold to different buyers at a different price, a secondary resale market for the good would emerge that would arbitrage price differences. As a result, consumers asked to pay a lot would refuse to purchase from the monopolist and would buy from the resale market instead. Example: people buying cars on the continent because they are cheaper than in the UK. [As this example illustrates, if transactions costs must be incurred in order to access the resale market, the monopolist may be able to extract a higher price from some buyers. But the price difference would be lower than without resale. Many countries – and the EU – have laws that ban price discrimination.]

#### 1.1. The simple monopoly model

If we assume that the monopolist must charge a single price to all, profit maximization can be written:

$$\max_{p,y} py - c(y) \text{ subject to } D(p) \geq y$$

where  $y$  is output,  $c(y)$  is the cost function, and  $D(p)$  is the demand function. The constraint is an inequality in case the monopolist decides to produce nothing. But we do not allow rationing: any buyer who is willing to purchase at price  $p$  must be served. An equivalent model exists when the producer is the single buyer of an input. This latter model is called a monopsony.

The standard trick in this category of models is to define the inverse demand function  $y = D(p)$ :

$$p(y) \equiv D^{-1}(y)$$

With this trick, profit maximization becomes:

$$\max_y p(y)y - c(y)$$

The first and second order conditions are:

$$\begin{aligned} p(y) + p'(y)y &= c'(y) \\ 2p'(y) + p''(y)y - c''(y) &\leq 0 \end{aligned}$$

The first order condition for the monopolist differs from the first order condition for the perfect competitive firm, which is:

$$p(y) = c'(y)$$

Since  $p'(y) < 0$  (price would fall if more quantities are sold), we see that the price charged by the monopolist is higher than marginal cost. The monopolist gets a monopoly rent.

## 1.2. Rents

Loosely speaking, a rent is any payment that does not serve to reward someone for their contribution to society, either as workers or entrepreneurs. Economists have a very negative attitude towards rent. First of all, rents are inefficient in a static sense. This is quite clear in the monopolist model: price is not set equal to marginal cost, which implies that social welfare could be increased by lowering price and increasing output. Put differently, monopoly pricing is not potentially Pareto efficient: consumers would be willing to pay a side payment<sup>1</sup> to the monopolist that is greater than the value of the rent. Illustrate with a graph: rent, consumer surplus, and deadweight loss.

Rents are also inefficient in a dynamic sense. The existence of rents is bound to attract entrepreneurs who will spend real resources trying to secure them (e.g., time, effort, lobbying action, strike, blockade). This further detracts from social welfare. Think, for instance, of border patrols, road blocks, and other ways of wasting everybody's time when the only purpose is to enforce prohibition on imports or exports. The cost of border patrols and the time wasted by economic agents further subtract from economic welfare. But they are individually rational for rent seekers, that is, entrepreneurs who seek to create and maintain artificial monopolies or monopsonies.

Rents are also objectionable on ethical grounds. This is because they do not reward economic agents for doing things that are useful to others – for contributing to global welfare. Embedded in economics is a set of values according to which individuals should benefit from contributing to the welfare of others. In a perfect competitive economy, this is precisely what is achieved by the market. Think again of the example of the shoemaker and the farmer in Adam Smith's parable. In this parable, self-interest ensures that agents act in the public good. Not so in the presence of rents.

## 1.3. Rent seeking

Possibly the most interesting application of monopoly theory to development has to do with rents, domestic protection, lobbying, and corruption. Take a civil servant who has the authority to deliver birth certificates, for instance. This is a public service over which this person has a monopoly. There is no substitute to an official birth certificate – e.g., for obtaining a passport, getting married, etc. Economic theory suggests that one possible efficient outcome is for the civil servant to charge the marginal cost for the service. The absence of competition makes this outcome unlikely, unless the government intervenes to set the price. If the state does not monitor the civil servant – or has lost the loyalty of the civil servant because wages have been

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<sup>1</sup>Not a price but a lump sum that is independent of the quantity produced.

eroded by inflation or are not paid at all – regulation will not work. The civil servant will charge a price for his or her service.

One possibility is for the civil servant to set a monopoly price identical for all. As we have seen, this solution is inefficient. Another solution is for the civil servant to set a different price for each individual, seeking to establish each customer’s willingness to pay. This solution is feasible since there can be no resale market in birth certificates. With this system, the rich and those who most need the certificate pay more, the poor and those who need the certificate the least pay less. As we will see in a minute, this outcome is efficient, although it is likely to anger the rich who end up paying more. It favors the poor since they end up paying less – the poorest person pays as little as the marginal cost of the service. Forcing the civil servant to charge the same price to all – without ensuring that the price equals the marginal cost – results in a less efficient (fewer certificates issued) and less equitable outcome among consumers (the rich benefit, the poor lose), but reduces the rent to the producer.

Deep suspicion about rent seeking and the numerous abuses of power that abound in the developing world are behind the so-called Washington consensus: cutting back government intervention is seen as the only way to ‘de-fang’ the state, to make it harmless. The basic premise behind this idea is that any public office will be abused and any government intervention will become a source of rents. Given this premise, reducing government intervention is thus the best way (the only way?) to reduce rents and increase economic efficiency. Because of the relationship economists make between rents, incentives, and effort, the debate has strong ‘moral’ (moralizing?) undertones.

## 2. Discriminating monopolist

In some circumstances, a monopolist may be able to charge different prices to different consumers. Typically this requires some restriction on the development of a resale market. Personal services – a lawyer’s fee, a haircut – are examples of markets where resale is not feasible. In such markets, the producer may be able to charge a different price to each buyer. Varian calls this situation first-degree price discrimination.

### 2.1. First degree price discrimination

This situation can be represented as a bilateral bargaining model with each buyer in which the monopolist has all the bargaining power. For simplicity, assume that  $c(y) = cy$ . Define the utility of potential buyer  $i$  as  $u_i(y) - p$ : this is a transformation of a standard utility so that the utility the consumer derives from consuming  $y$  is expressed in money terms.<sup>2</sup> In this context,  $p$  does not represent the unit price but the combined price charged for  $y$  units of the good.

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<sup>2</sup>If you worry about the relationship between this utility function and the standard consumer model, here it is. Assume a consumer has to choose between consuming  $y_i$  at total cost  $p_i$  or consuming 0. This is a discrete choice so we cannot use differentiation, first order conditions, and the like. We need to compute the utility with  $y_i$ , the utility without it, and compare them. Let  $P$  stand for the vector of other prices and let  $m$  stand for the consumer’s budget. If the consumer consumes  $y_i$  at cost  $p_i$ , her utility maximization problem is:

$$\max_{c_i} u(c_i, y_i) \text{ subject to } Pc_i = m - p_i$$

By analogy with conditional profit functions which we discussed briefly in the first lecture, this yields a conditional indirect utility function of the form  $V(P, m - p_i, y_i)$ .

If the consumer does not consume  $y_i$ , her utility maximization is:

$$\max_{c_i} u(c_i, 0) \text{ subject to } Pc_i = m$$

Function  $u_i(y)$  represents  $i$ 's willingness to pay for good  $y$ . This is because if the price charged for  $y$  units is  $u_i(y)$ , then the potential buyer is indifferent between buying and not buying. The consumer would buy for any price below  $u_i(y)$ . The maximum price that can be charged is thus  $u_i(y)$ . If  $u_i(y)$  exceeds  $p$ , the buyer profits from the transaction.

With these assumptions, the monopolist's profit is maximized if:

$$\max_{p_i, y_i} p_i - cy_i \text{ subject to } u_i(y_i) \geq p_i$$

where  $p_i$  and  $y_i$  are the combined price and quantity offered to buyer  $i$ , respectively. The buyer has the right to accept or refuse the offer, but not to make a counter-proposition. The constraint internalizes the fact that the buyer will only accept an offer such that the price does not exceed his or her willingness to pay. Since there is no reason for the monopolist to charge a price below the maximum price, the constraint is always binding.

The problem thus simplifies to  $\max u_i(y_i) - cy_i$ . The first order condition is:

$$u'_i(y_i^*) = c \text{ which determines } y_i^*$$

Price for quantity  $y_i^*$  is given by  $u_i(y_i^*) = p_i$ . The buyer is charged exactly his or her willingness to pay. We also see that the consumer's marginal willingness to pay  $u'_i(y_i)$  is set equal to production cost  $c$ . This implies that efficiency is achieved. To see that this is the case, imagine that the consumer could decide himself how much to consume and incur the marginal production cost. The utility maximization problem is:

$$\max_{y_i} u_i(y_i) - cy_i$$

which is the same as that of the discriminating monopolist and has the same first order condition

$$u'_i(y_i) = c$$

The same would be true in case the producer is a perfect competitive firm: it would also set  $p_i = p = c$ . Of course, in the utility maximization and perfect competitive cases, the consumer would get a surplus. Not so in the perfectly discriminating monopolist case: all the surplus goes to the monopolist; the buyer is indifferent between buying or not. The rent made by the monopolist is even larger than in the non-discriminating monopoly case.

This example serves to illustrate that monopoly can achieve static efficiency. But the existence of the rent continues to be a threat to dynamic efficiency because it incites agents to waste real resources to secure the rent. If anything, perfect discrimination exacerbates rent seeking since the rent is larger.

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The corresponding conditional indirect utility function is  $V(P, m, 0)$ . The consumer chooses to consume  $y_i$  as long as

$$V(P, m - p_i, y_i) \geq V(P, m, 0)$$

Unfortunately, the difference between the two indirect utility functions has no useful interpretation; we need a money-metric concept. This is easily provided by defining the amount of money  $u_i(y_i)$  (net of cost  $p_i$ ) that would have to be given to the consumer to make her indifferent between  $y_i$  and 0 (an equivalent-compensating variation type of concept):

$$u_i(y_i) - p_i \equiv e(P, V(P, m - p_i, y_i), y_i = 0) - e(P, V(P, m, 0), y_i = 0)$$

It follows that whenever  $u_i(y_i) - p_i \geq 0$ , the utility from consuming  $y_i$  is larger than not consuming  $y_i$ . Hence the interpretation of  $u_i(y_i)$  as the willingness to pay for  $y_i$ .

## 2.2. Third-degree price discrimination

In practice, it may be difficult for a monopolist to sell to each individual at a different price. But it may be possible to discriminate by location – e.g., country – or by category – e.g., students, elderly. To see how this works, consider a monopolist who can sell in two distinct markets at a different – but constant – price. His profit maximization problem is:

$$\max_{x_1, x_2} p_1(x_1)x_1 + p_2(x_2)x_2 - c(x_1 + x_2)$$

yielding first order conditions:

$$\begin{aligned} p_1(x_1) + p_1'(x_1)x_1 &= c \\ p_2(x_2) + p_2'(x_2)x_2 &= c \end{aligned}$$

If we let  $\varepsilon_i$  denote price elasticity of demand in market  $i$ , the above can be rewritten:

$$\begin{aligned} p_1(x_1) \left[ 1 - \frac{1}{|\varepsilon_1|} \right] &= c \\ p_2(x_2) \left[ 1 - \frac{1}{|\varepsilon_2|} \right] &= c \end{aligned}$$

from which it follows that  $p_1 > p_2$  if  $|\varepsilon_1| < |\varepsilon_2|$ : the market with the more elastic demand is charged a lower price.

A good example of this is the price of AIDS therapy in Europe versus Africa. Say countries agree to cooperate to combat re-export, making it possible for drug companies to price discriminate between regions of the world. It is reasonable to assume that demand for AIDS therapy is more price elastic in Africa because people are poorer and cannot afford an expensive drug: for a price over a certain level, demand falls to zero. In contrast, in Europe and North America demand for the drug is probably highly inelastic, with most of the cost of treatment borne by public or private insurance systems. If the drug company cannot discriminate by region, it would probably choose to sell at a high price – so high in fact that virtually no one in Africa could afford it. But if the drug company can discriminate by region, and the marginal production cost is low enough, then it may choose to set a low price in Africa (and other parts of the developing world, such as India, etc) and a high price in Europe and North America.

This is an example of *cross-subsidization*: allowing different prices means that rich people (in this context, those with a low price elasticity) pay a high price so that poor people (here those with a high price elasticity) can pay a low price. If the monopolist is forced to sell at a single price, poor people may be priced out of the market. This simple principle explains student discounts as well.

It is also possible to find examples where the relationship between price elasticity and income does not hold and where differences in price elasticity have other causes. Consider the price of cars in the UK. (This example works better if you go back in time by, say, 20 years. But last time I checked it still appeared true.) Because of left-hand driving, it is inconvenient to drive in the UK cars sold for the continent. This enables car manufacturers to price discriminate – simply by selling left-hand drive cars only in the UK. Further suppose that because the UK market is smaller than the continental market, many car makers do not incur the fixed cost of manufacturing their models for left-hand drive. This means that competition in the UK is less intense, and thus that there are fewer substitution opportunities. This in turn means that car demand in the UK is less price elastic. The above model predicts that, as a result, car prices in

the UK will be higher than on the continent. The facts indeed suggest that this is the case, and has been for a long time.

Varian provides an interesting discussion of the implications of third-degree discriminating monopoly on total welfare in the potential Pareto efficiency sense (producer surplus + all consumer surplus). The bottom line is that moving from simple monopoly to discriminating monopoly raises welfare if it ensures that a segment of the market ignored under monopoly is served under discriminating monopoly – which is basically the case for AIDS therapy. See Varian for details.

Note that because the poor pay little, their measured consumer surplus is small. But the utility gain for them may be quite large. This is another illustration of the pitfalls of the potential Pareto efficiency concept when discussing welfare: because it is cheap to make the poor better off, their welfare weighs little in total consumer surplus.

### 3. Oligopoly

A well known extension to the monopoly model is the oligopoly, that is, the situation with a small number of dominant firms in the same market. There are two main types of oligopoly models: the Cournot model, which assumes that firms compete by setting quantities, and the Bertrand model which assumes that firms compete by setting prices. The two models yield dramatically different equilibria.

#### 3.1. The Cournot model

We assume a market with two firms, 1 and 2. Total output  $Y = y_1 + y_2$ . The inverse demand function  $p(Y) = p(y_1 + y_2)$ . Each firm has a cost function  $c_i(y_i)$ . The profit maximization problem of firm 1 is written:

$$\max_{y_1} p(y_1 + y_2)y_1 - c_1(y_1)$$

where  $y_2$  is treated as given and unaffected by the choice of  $y_1$ . A similar optimization problem characterizes the choice of production 2. The first order conditions are:

$$\begin{aligned} p(y_1 + y_2) + p'(y_1 + y_2)y_1 &= c'_1(y_1) \text{ for producer 1} \\ p(y_1 + y_2) + p'(y_1 + y_2)y_2 &= c'_2(y_2) \text{ for producer 2} \end{aligned}$$

Together they form a (non-linear) system of two equations with two unknown. Provided that an interior solution exists (that is that the cost functions are not too different so that both producers want to produce), the system can be solved to yield the Cournot equilibrium. This can be shown graphically by treating the first equation as determining  $y_1^*$  given  $y_2$  and the second equation as determining  $y_2^*$  given  $y_1$ . These relationships are called reaction functions because they portray the way a Cournot oligopolist 'reacts' to the quantity produced by its sole competitor. The point at which the reaction functions intersect is the solution to the above system of equations.

It is not difficult to see that the Cournot model does not yield a Pareto efficient outcome: price is not equal to marginal cost. But the distortion is less than in the monopoly case. This can be seen by comparing the two first order conditions. If the two oligopolists acted as a single monopolist, they would set price such that:

$$\max_{y_1, y_2} p(y_1 + y_2)(y_1 + y_2) - c_1(y_1) - c_2(y_2)$$

$$\begin{aligned}
c'_1(y_1) &= p(y_1 + y_2) + p'(y_1 + y_2)(y_1 + y_2) \\
&< p(y_1 + y_2) + p'(y_1 + y_2)y_1 \\
c'_2(y_2) &= p(y_1 + y_2) + p'(y_1 + y_2)(y_1 + y_2) \\
&< p(y_1 + y_2) + p'(y_1 + y_2)y_2
\end{aligned}$$

which is the case in the oligopoly case. This implies that a monopolist would have a lower marginal cost, i.e., produce less (marginal cost increases with output).

The Cournot model has attracted a lot of attention in the industrial organization literature. It has provided the initial insight for the Nash equilibrium in the theory of games. Historically, it is a very important model. Its practical relevance is limited, however, by the existence of the Bertrand model to which we now turn.

### 3.2. The Bertrand model

The only difference between the Bertrand and the Cournot model is the assumption regarding what each firm regards as given. In the Cournot model, the quantities produced by the other firm are taken as given. In the Bertrand model, the price of the other firm is taken as given.

With these assumptions, an equilibrium is immediately obtained. There is no need to write down an optimization model to determine the oligopoly equilibrium. Just go through the following reasoning. For simplicity, assume constant marginal cost and suppose that  $c_2 > c_1$ . The producer with the lowest price gets all the demand. If producers set the same price, they share the market equally.

Now suppose that one producer sets a price  $p > c_2$ . Then the other producer can respond by setting a price just below  $p$  but above  $c_2$ . So doing this producer captures the whole market and makes a profit while the other producers sells nothing and makes zero profit. From this we see that the only equilibrium price is for producer 1 to set  $p_1 = c_2 - \varepsilon$  with  $\varepsilon$  a small number. At this price, producer 2 makes no profit but producer 1 still makes a unitary profit of  $p_1 - c_1 > 0$ . Producer 2 produces nothing.

In this model, the less efficient producer represents a threat of entry: if the more efficient producer sets too high a price, producer 2 will enter. This process limits the price that producer 1 can charge. In terms of efficiency, the equilibrium is more efficient than in the Cournot equilibrium – the price is set equal to the marginal cost of the least efficient producer – but full efficiency is not achieved. This would require setting  $p = c_1$ , the true marginal cost used in production.

### 3.3. Regulation and competition

The literature on competition and oligopoly has had a profound influence on the thinking about the anticipated effects of privatization, trade liberalization, and opening up to foreign investors. It has also influenced the debate of competition/private sector development versus regulation/government intervention.

If there are increasing returns, firms are large. If the local market is protected either by trade barriers or by transport costs, competition may be limited by the size of the market. Hence oligopoly obtains. Keeping fixed costs the same across countries, we see that poor countries, because they have a small market, have a smaller number of large firms. This restricts competition and creates a business environment in which it is easy for a small group of people to capture monopoly rents – e.g., croony capitalism.

#### **4. Coda: Schumpeterian competition and technology**

There is a whole dimension of competition we have not discussed – the relationship between competition and technological innovation. In models of Schumpeterian competition, firms compete by using technological innovation to capture temporary monopoly rents. In such models, monopoly is good because without it firms have no incentive to invest in innovation – and without innovation the economy does not grow.

While Schumpeter was writing in the first part of the 20th century, the formalization of Schumpeterian competition models had to wait until the early 1990's with papers by Aghion and Howitt and by Grossman and Helpman. Time and uncertainty play key roles in these models, so they are quite a bit harder and we have not yet discussed dynamics. But I would like to immediately point out that Schumpeterian competition models have policy implications that are often at odds with more standard prescriptions based on the theory of monopoly and oligopoly.