Price Discrimination

Economics 302 - Microeconomic Theory II: Strategic Behavior

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(with thanks to Anke Kessler)
1. Understand direct (first-degree and third-degree) price discrimination and know how to compute prices, quantities, profits, consumer surplus, etc. under the above pricing schemes.

2. Understand second-degree price discrimination, know how to set up the monopoly’s maximization problem, including the IC and IR constraints.

3. Know when each of the above pricing schemes works best.
Asymmetric Information

- When one side of the market knows more than the other.
- Hidden actions (e.g. employment, insurance).
- Hidden characteristics (e.g. product, insurance, ability).
- Often means that, like with market power, the **socially optimal outcome is not achieved**.
- It is useful to compare the best that the uninformed side can do in reality to the best that it could do with full information.

1. An economic agent’s **first best** is her **best possible outcome given full information**.
2. An economic agent’s **second best** is her **best possible outcome considering the limited information**.
We start with an example of hidden characteristics: firms don’t observe their customers’ willingness to pay.

We focus on the simplest such case: monopoly. (So both market power and asymmetric information are present.)

We’ve assumed that monopolies must charge a constant per-unit price to everyone.

Makes sense if there’s a resale market: arbitrage.

But otherwise, monopolists may do better by using different pricing strategies.

We study first-degree (perfect), third-degree (direct) and second-degree (indirect/quantity) price discrimination.
You are a monopoly facing a downward sloping demand curve.

Suppose that you can observe exactly the willingness to pay of each customer. How do you maximize your profit?

You grab the whole social surplus!

This is socially efficient. However, it’s terrible for consumers, whose surplus is zero.

First-degree price discrimination - charging everyone their willingness to pay - is the firm’s first best since it has full information.

Here, it is clear that the firm’s profit would be lower if it doesn’t have all this information. With asymmetric information, the uninformed side’s first best often cannot be achieved.
Now suppose that the monopoly doesn’t know each customer’s willingness to pay.

But suppose that an observable characteristic that relates to willingness to pay allows the monopoly to separate its customers into groups.

(Also assume that no consumer is willing to buy more than one unit of the good and that it is not possible to offer different versions of the good, so that 2nd-degree PD is not possible.)

The firm can increase its profit by serving each group separately, as the following example shows.
Suppose for simplicity that the firm has no costs.

Group A has inverse demand $P = 2 - Q$

Group B has inverse demand $P = 3 - Q$

Profit from serving them separately: $1 + 2.25 = 3.25$

Profit from serving them together: $1.25(0.75 + 1.75) = 3.125$

What is the firm’s **second-best** profit? Its **first-best** profit?
Important: the observable characteristic must relate to willingness to pay.

Here’s an example where it doesn’t, and the two groups are identical, except for size.

- Group A has inverse demand $P = 2 - Q$
- Group B has inverse demand $P = 2 - 2Q$
- If you try serving them separately, you’ll find $P = 1$ for both groups, so obviously profit doesn’t increase.
- Arbitrarily dividing groups doesn’t help.
Third-Degree Price Discrimination (IV)

- Very common in the real world: student/military/senior discounts.
- Certain groups have lower willingness to pay and/or are more price-sensitive.
- Firm increases profit by charging these groups less than regular customers → 3rd-degree PD tends to benefit the poor and hurt the rich.
- Works best for non-transferrable goods and services (e.g. restaurant meals, museum tickets).
- Doesn’t work well for goods that can easily change hands (e.g. electronics) - that’s why many educational discounts for computers come with limitations on quantities/resale.
With full information, the firm engages in first-degree price discrimination. Bad for consumers. Not very realistic.

Third-degree price discrimination: condition price on an observable characteristic that correlates with willingness to pay.

But can the firm do better than uniform pricing even without observable characteristics?

Sometimes yes: second-degree price discrimination.
Second-Degree Price Discrimination

- Idea: Make customers reveal information about their willingness to pay by giving them a menu of options.
- Examples: bulk discounts, first-class plane tickets, etc.
- Second-degree PD also called quantity PD or monopolistic screening.
- Only possible if the firm can vary the quantity or quality across customers.
Tim Hortons faces two types of customers, split 50/50:

1. Hungry (H): value first sandwich at $7 and second at $4
2. Less hungry (L): value first sandwich at $6 and second at $2

Each sandwich costs $3 to make.

First best:

- Charge H $11 for two sandwiches (and make $5 from H)
- Charge L $6 for one sandwich (and make $3 from L)
- Average profit = $4
Simple Example (First Best is not Achievable)

- But if seller doesn’t know buyer’s type, H will instead choose to buy 1 sandwich for $6.
- In that case, profit from H drops to $3, so average profit drops to $3.
- This is the best Tim Horton’s can do if it charges a fixed price per sandwich.
- Is this Tim Hortons’ second best? Or can Tim Hortons do better with another scheme?
Idea: give customers choices, let them sort themselves.

Want H type to buy 2 sandwiches ($q_H = 2$) for $P_H$ and L type to buy 1 sandwich ($q_L = 1$) for $P_L$.

Need to make sure each type is willing to buy: **individual rationality (IR) constraints**.

The prices must make it *rational* for each type to buy.

- $IR_L$: L’s utility from buying $= 6 - P_L \geq 0 = L$’s utility from not buying
- $IR_H$: H’s utility from buying $= 11 - P_H \geq 0 = H$’s utility from not buying
Also need to make sure each type buys their own bundle rather than the other type’s: **incentive compatibility (IC) constraints.**

Each type’s *incentives* must be *compatible* with choosing its own bundle (rather than another type’s bundle).

- \( IC_L \): L’s utility from own bundle = \( 6 - P_L \geq 8 - P_H \) = L’s utility from H’s bundle
- \( IC_H \): H’s utility from own bundle = \( 11 - P_H \geq 7 - P_L \) = H’s utility from L’s bundle
Simple Example (Solution)

- The four limits on prices are:
  1. \( P_L \leq 6 \)
  2. \( P_H \leq 11 \)
  3. \( P_L \leq P_H - 2 \)
  4. \( P_H \leq P_L + 4 \)

- Condition 2 is not needed because it is implied by 1 and 4.
- The firm wants to set \( P_H \) as high as possible, so \( P_H = P_L + 4 \).
- This means that condition 3 is not needed, and only 1 is left.
- The firm wants to set \( P_L \) as high as possible, so \( P_L = 6 \).
- With \( P_L = 6 \) and \( P_H = 10 \), the firm’s average profit is 3.5: less than in the first best, but more than with a uniform price.
Type $L$ gets no surplus.

Type $H$ gets some surplus, since otherwise they would pick type $L$’s bundle. This is called an information rent.

Obviously, hard to enforce if $q$ is quantity and $\frac{P_H}{q_H} > \frac{P_L}{q_L}$. When $\frac{P_H}{q_H} < \frac{P_L}{q_L}$, we see bulk discounts.

But if $q$ is quality, OK if $\frac{P_H}{q_H} > \frac{P_L}{q_L}$. Example: business class.

Note: In the second best, $q_L$ is usually lower than in the first best. (This didn’t happen in our example only because we constrained quantities to be integers.) Reducing $q_L$ (while keeping type $L$’s surplus at zero) makes bundle $(q_L, P_L)$ less attractive to type $H$ due to type $H$’s greater willingness to pay. Thus, the firm’s profit from type $H$ increases. The profit from type $L$ decreases (because $q_L$ moves away from the first best), but this decrease is smaller than the increase if $q_L$ is close enough to the first best.