On Adverse Selection: Akerlof and Spence Models

Imagine an economy in which the currency consists of gold coins. The holder of a coin is able to shave a bit of gold from it in a way that is undetectable without careful measurement. The gold so obtained can then be used to produce new coins. Imagine thta some of the coins have been shaved while others have not. Then someone taking a coin in trade for goods will assess positive probability that the coin being given her has been shaved and thus less will be given for it than if it was certain not to be shaved. The holder of an unshaved coin will therefore withhold the coin from trade and only shaved coins will ever circulate. This unhappy situation is known as Gresham's law: bad money drives good money out.

Replace "good money" and "bad money" with "good cars" an "bad cars" and have Akerlof's model.

An example of how information problems can have horrible consequences on the correct functioning of markets is provided by George Akerlof with his analysis of the market for lemons. Let's consider the used car market and imagine that there are two types of used cars: those in good condition (good deal for those who buy them) and those in poor condition (the lemons).

Obviously, sellers are perfectly informed about cars conditions and therefore know whether they are a deal or a lemon. Buyers, on the other hand, can only have incomplete information on a car real condition: they cannot discriminate (separate, single out, recognize ...) good deals from lemons.

Let us suppose, for the sake of simplicity, that potential buyers are totally uninformed and therefore totally unable to tell a good deal from a lemon. It is easy to show that under these conditions the market cannot work efficiently.

Let's see it with an example. Suppose there are two types of cars: those of type A (the good deals) and those of type B (the lemons). Sellers are willing to sell a type A car at a price of at least €2.500 and a type B car at a price of at least €1.000. Buyers are willing to pay a maximum price of €3.000 for a type A car and €2.000 for a type B car. Let's assume competitive markets. It is straightforward to realize that in the case of complete information, the two markets will have an equilibrium price respectively:

$$2.500 \leq p_A \leq 3.000$$
$$1.000 \leq p_B \leq 2.000$$

In particular, assuming freedom of entry and exit on the supply side and therefore zero profits in the long run, the long-term equilibrium prices will be respectively:

$$p_A = 2.500$$
$$p_B = 1.000$$

Let us now suppose that neither the sellers nor the buyers are informed about the type of car, but everyone knows that in total two out of three cars are of type B while one in three is of type A. In this case each seller can claim to own a car which in expected value (assuming for simplicity neutrality with respect to risk) is:

$$\frac{1}{3}2.500 + \frac{2}{3}1.000 = 1.500$$

whereas each buyer thinks that the car (s)he is about to buy has an expected value equal to:

$$\frac{1}{3}3.000 + \frac{2}{3}2.500 = 2.333,33$$

It follows that in this case the market can work as well and a single equilibrium price can be established which, assuming freedom of entry on the supply side, will be equal in the long run to €1.500. So far so good: even a possible lack of information does not create any problems for the functioning of the market, as long as the information is equally incomplete for sellers and buyers, or, in jargon, *symmetrical*. On the other hand, things get radically complicated if sellers and buyers have different levels of information, or if the information is asymmetrical. To better grasp what happens, let's consider the extreme case of utterly asymmetrical information: sellers are perfectly informed (they can perfectly tell an A from a B), while buyers are totally uninformed and therefore have no way of knowing the type of car that is being offered to them. Let's see what happens in this case.

Let's first consider the supply side. The supply curve as the price p changes is given by:

$$0 \leq p < 1.000 \quad \text{no car is being offered}$$
$$1000 \leq p < 2.500 \quad \text{only lemons are being offered}$$
$$p \geq 2.500 \quad \text{both A and B are being offered}$$

Let us now turn to the demand side:

- if $p \geq 2500$, buyers know that all the cars are being offered and therefore each buyer knows that he will buy a car that is only worth €2333.33 Euro in expected value (less than the purchase price). So demand will be zero.

- if $1000 \leq p < 2500$, buyers know with certainty that only lemons will be offered so they are willing to buy only if $p \leq 2000$

Result is that only the worst quality cars (type B ones) are offered, while the market for the best ones disappears due to information asymmetry. This phenomenon is called "adverse selection" as it translates into an exit from the market of better quality goods (those that consumers would prefer), in favor of those of worse quality.

Is it possible to avoid or eliminate these problems deriving from information asymmetry? Obviously it would be in the interest of owners of Type A cars to do so because they are the ones who suffer the consequences. However, note that "lemon sellers" have no interest in disclosing the type of car they own, and therefore to the question "What type is your car?" every sellers, even those of lemons, would answer "Type A" , and therefore the asymmetry would not be eliminated. A possible solution can be provided by an activity such as "signalling": let's see what it is with an example.

Let's imagine that used car owners can offer a guarantee to buyers, for example by pledging for X years from purchase to cover all the costs necessary to repair it in the event of a breakdown. A guarantee of this type will certainly be more onerous for lemon sellers, as by definition a bin has a much higher probability of failing than a type A car. It is easy to understand that as the level of coverage offered by the warranty (for example by extending its duration or by extending the type of faults expected) will reach a too burdensome level for the sellers of type B cars (all their surplus would be spent on repairs to honor the warranty) but still sustainable by the sellers of high quality car. This contract would therefore serve to indicate that whoever offers it is necessarily the seller of a type A car, since it would not be profitable for a type B seller to offer it.

More generally, we call a signal an activity that is more expensive for those who offer lower quality goods. The example shows that thanks to this cost differential, it is possible that a signal effectively separates the different types of bidders as only the best types can find it economically advantageous to produce the signal.

Signalling is aimed at transmitting private information regarding its characteristics through "signals". A signal must be:

1. Observable (you don't have to pay a cost to observe it);

2. Credible, that is, it must be too expensive for agents with worse characteristics to send the same signal as the best agents.

Let's see an example of signalling derived from Spence model (1970).

An employer has to decide who to hire from a group of potential workers. There are two types of workers: type A is very productive (high quality workers), while type B is not very productive (low quality workers).

The employer would be willing to pay up to 50 a type A worker and a maximum of 20 a type B worker.

The employer is unable to distinguish between type A and B. Nor does it obviously make sense for the principal to ask the potential worker for his type: everyone would claim to be type A in order to obtain the highest remuneration.

Type A and B workers can get a degree (i.e. acquire education) at costs C_A and C_B per year of study, respectively.

The study does not change their respective productivity.

We also assume that it is C_A ¡C_B as the higher quality worker can study with less effort (because he is more capable, more disciplined, more motivated, etc.).

Let's imagine, for simplicity, that there are only two possible levels of education: a "low" level which involves E_B years of study and a "high" level which requires E_A years of study, obviously with $E_A > E_B$.

Finally, suppose that the employer considers the level of education as a perfect signal of the quality of the worker. Therefore the principal will offer a remuneration equal to 50 to a candidate who studied E_A years and a remuneration of 20 to a candidate who studied E_B years. Let's check under what circumstances the study level is actually a correct signal. Now, with this data, a type A worker will have the following net benefits:

- $50 - C_A E_A$ if he studies for E_A years;
- $20 - C_A E_B$ if he studies E_B years

A type B worker will have the following net utilities:

- $50 - C_B E_A$ if he studies for E_A years;
- $20 - C_B E_B$ if he studies E_B years

For the signal to effectively work, worker A must choose to study E_A years and worker B E_B years. This happens when the following two inequalities are simultaneously satisfied :

1. $50 - C_A E_A > 20 - C_A E_B$
2. $20 - C_B E_B > 50 - C_B E_A$

For example, if $C_A = 10$ and $C_B = 20$ the values $E_A = 2$ and $E_B = 0$ satisfy the two inequalities and are a perfect signal.