Econ142: Probabilistic Microeconomics

Problem Set 5

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1 Question 1

λ part of the population is high risk (with probability p_H) and $1-\lambda$ of the population is low risk (with probability p_L). Show that if A is a point on the budget line generated by the price $q = p = \lambda p_H + (1-\lambda)\, p_L$ (p_H is the high risk probability and p_L is the low risk probability) and everyone buys the contract A, then the profits of the insurance firms are on average zero.

1.0.1 Answer

The profit that an insurance company receives from a given individual (per dollar of insurance) is equal to the amount they receive from the individual (insurance premium) minus the expected amount they will have to pay out (probability of bad event). That is, the profits the firm receives from a high risk individual are $\pi_H \equiv q - p_H$. The profits the firm receives from a low risk individual are $\pi_L \equiv q - p_L$.

In this question, we know that the price the firm is charging as an insurance premium is $q = \lambda p_H + (1-\lambda)\, p_L$. Therefore, the firm loses money on the high risk individuals: $\pi_H < 0$ and makes money on the low risk individuals: $\pi_L > 0$.

In professor Segal's solutions, he supposed that the population of the world was K. We know that λK people are high risk and $(1-\lambda)\, K$ people are low risk. For simplicity (without loss of generality), I will assume $K = 1$. Since there is only one contract available, we know that everyone is buying the same amount of insurance. It suffices, then, to examine the per-dollar profits.

When $q = \lambda p_H + (1-\lambda)\, p_L$, the per-dollar profits are given by:

$$\begin{aligned}
\pi &= \lambda K \pi_H + (1-\lambda)\, K \pi_L \\
&= \lambda \pi_H + (1-\lambda)\, \pi_L \text{ since I assumed } K = 1 \\
&= \lambda\,(q - p_H) + (1-\lambda)\,(q - p_L) \\
&= \lambda q - \lambda p_H + (1-\lambda)\, q - (1-\lambda)\, p_L \\
&= \lambda q + (1-\lambda)\, q - \lambda p_H - (1-\lambda)\, p_L \\
&= (\lambda + 1 - \lambda)\, q - (\lambda p_H + (1-\lambda)\, p_L) \\
&= q - (\lambda p_H + (1-\lambda)\, p_L) \\
&= q - q \text{ since } q = \lambda p_H + (1-\lambda)\, p_L \\
&= 0
\end{aligned}$$

2 Question 2

In the model discussed in class, what point A represents zero profit full insurance pooling contract?

2.0.2 Answer

As discussed in question 1, any pooling contract in which $q = \lambda p_H + (1 - \lambda) p_L$ is a zero profit insurance contract. The set of all possible zero-profit pooling insurance contracts is denoted in Figure 1 by the darkly shaded area I have labeled A.

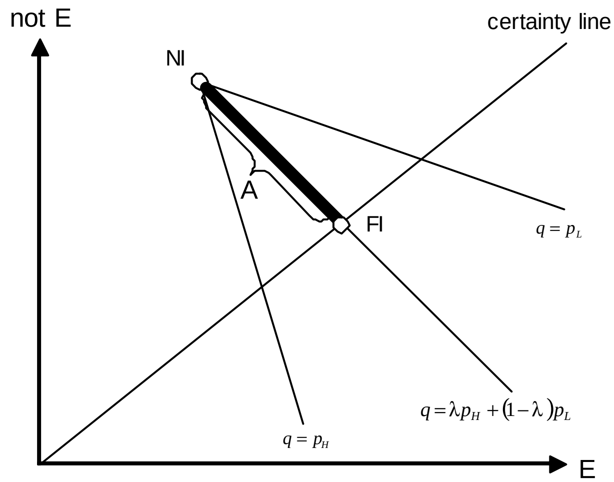

Figure 1: Zero profit pooling insurance contracts

As discussed in class, any contract along the certainty line is a contract of full insurance. Therefore, the point I have labeled FI is a zero profit full insurance pooling contract.

3 Question 3

Is the point A of the last question a stable equilibrium?

3.0.3 Answer

No, it is not. As shown in Figure 2, a competitor can offer the profitable contract C which is preferred by the low type to the contract FI but not to the high type. Therefore, this is not a stable equilibrium.

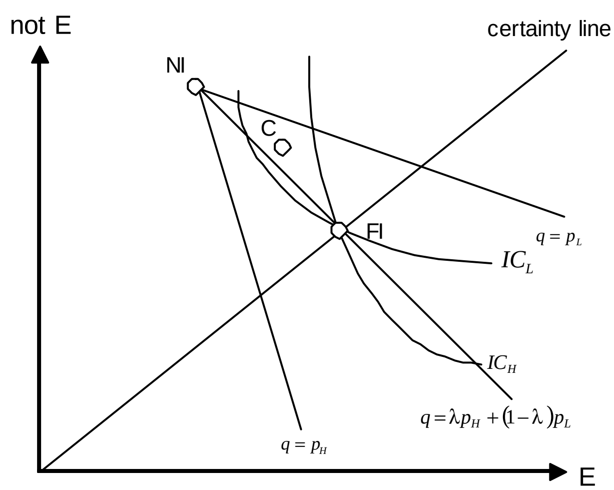

Figure 2: Instability of contract

The result of such a contract will be that all low types purchase contract C and all high types purchase contract FI. The firm which offers contract FI will go out of business since it will be making negative profits for each dollar of insurance sold (since the low types no longer balance out the high types). Eventually, all the high types will purchase contract C since FI will no longer be offered and drive the entrant firm out of business, since the contract C yields negative profit as a pooling contract.

4 Question 4

Discuss each of the following possible solutions to an adverse selection situation. In each case, try to see if there are markets where this solution is useful, and markets (or situations) where it is not.

4.1 Part (a)

Force everyone to buy insurance at the price $q = p$ (p is defined as above).

4.1.1 Answer

I suppose if one could force consumers to purchase a given contract, then the notion of equilibrium is rather inconsequential.

4.2 Part (b)

Encourage low risk people to prove that they are low risk.

4.2.1 Answer

According to Professor Segal, this is a problem since it elicits information that people deem to be private. That is, information that one knows that no one else "should" know. Since if all the low risk people can "prove" they are low risk, they can indirectly "prove" that everyone else is high risk. This is definitely problematic if privacy is valued in a society.

It is my opinion, however, that as long as the information is not forcefully taken from an individual, there is no problem with encouraging people to provide proof that they are low risk. Of course, if it were easy to provide proof of being low risk (if indeed, a person is low risk), then the information asymmetry probably would not have existed in the first place. A potential problem with this approach is that a market for deceit and forgery may arise, but this is beyond the scope of the question.

4.3 Part (c)

Have a set of separating contracts, and then use the information from the selection there to determine who is who. Then offer full insurance contracts to all, based on their types.

4.3.1 Answer

According to Professor Segal, the high risk people would purchase both types of contracts at first and then get the "good" deal and dump the bad contract to get around the rules. I don't agree with this assessment, though. I believe that, depending on the rules, this could actually be a good idea.

First of all, if the insurance contracts are sufficiently costly to hold, it would probably not be a good idea to hold two different contracts for an extended period of time. Therefore, if the required length of holding a contract is sufficiently long, this will deter someone from purchasing two contracts.

This would still leave the opportunity for a "high type" to purchase only the type of contract designed for the "low type" for the waiting period. However, for each time period the "high type" must hold this contract, he/she loses utility in the sense that he/she would be better off holding the contract designed for the high type. Therefore, by making the required length of holding long enough to deter this behavior, I think this might eliminate the problem.

4.4 Part *(d)*

Force everyone to reveal his type.

4.4.1 Answer

Once again, when the word "force" enters into the equation, I find it hard to believe that we should even care about the notion of equilibrium. Of course if you can "force" everyone to reveal his/her type at, say, gunpoint, then we would be living in a world with no private information and hence no adverse selection problem. This is absurd, however.

4.5 Part *(e)*

Have only one insurance company.

4.5.1 Answer

By eliminating competition, we eliminate the problem of entry of other firms. Therefore, the contract presented in question 2 would be a full insurance pooling contract equilibrium. Since there is no entry, the zero-profit condition need not necessarily hold.

This also opens up the possibility of having a profitable full insurance pooling contract equilibrium.