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Ecn 200C − Micro Theory − Professor Giacomo Bonanno

SOLVING THE ADVERSE SELECTION PROBLEM

1. Piece Rates

There are ways for the firm to solve the adverse selection problem. The fact that the workers know their own type turns out to be the solution. All the firm has to do is arrange things so that high-productivity workers want to apply for the job, while low-productivity workers don't. This is called **self-selection**. One way to achieve this is by means of a **piece rate** compensation scheme. Instead of paying workers a fixed wage, the firm pays them a certain amount for each unit of output they produce. Suppose that high-productivity workers can produce x_H units of output and low-productivity workers can produce x_L units, with $x_H > x_L$. Each unit of output generates a net revenue to the firm of R dollars. The workers can earn w_0 working for the alternative employer. The firm pays the workers using the piece rate \$$b$, so that workers who produce x units of output get a total compensation of \$$bx$. Is there a piece rate that will induce self selection? In other words, is there a value of b that allows high-productivity workers to earn more than w_0 but would make low-productivity workers earn less than w_0? H-workers will apply if and only if

$$b\,x_H > w_0$$

while L-types will not apply if and only if

$$b\,x_L < w_0$$

Thus for self-selection to be possible we need

$$\frac{w_0}{x_H} < b < \frac{w_0}{x_L}.$$

The only remaining issue is whether a piece rate in the above range is in the firm's interest. The firm has two choices: (1) offer a fixed wage slightly above w_0, thereby attracting both high- and low-productivity workers or (2) offer a piece rate in the above range, thereby attracting only high-productivity workers. Let p be the proportion of high-productivity workers in the population. Recall that the firm earns a net revenue of R from each unit of output. If the firm chooses option (1) then its expected revenue per worker is $\left[px_H + (1-p)x_L\right]R$ and the profit per worker is slightly less than

$$\left[px_H + (1-p)x_L\right]R - w_0$$

If the firm chooses option (2) then only high-productivity workers apply and the profit per worker is

$$x_H R - bx_H\,.$$

Thus option (2) is better if and only if $x_H R - b x_H > [p x_H + (1-p) x_L] R - w_0$ which can be written as

$$p < 1 - \frac{x_H b - w_0}{R(x_H - x_L)}.$$

To summarize, the firm will choose a piece rate *b* if and only if the following two conditions are satisfied:

$$\begin{cases} \dfrac{w_0}{x_H} < b < \dfrac{w_0}{x_L} \\ \quad \text{and} \\ p < 1 - \dfrac{x_H b - w_0}{R(x_H - x_L)} \end{cases}$$

For example, if $x_H = 12,\ x_L = 8,\ w_0 = \$24$ and $R = \$6$ then the first condition requires that \$2 < *b* < \$3 and the second condition requires that $p < 2 - \frac{b}{2}$. For example, if *b* = 2.5 and $p = \frac{1}{2}$ then both conditions are satisfied $\left(2 - \frac{2.5}{2} = \frac{3}{4}\right)$.

2. Probationary Contracts

A second way that the firm can induce workers to self-select is through probationary contracts. A typical probationary contract works as follows. When workers are hired, they must first go through a probationary period of specified length. If they pass the probationary period, they are allowed to continue working and are given a raise. If they do not pass the probationary period, they are fired and must find employment elsewhere.

We illustrate this with an example. Suppose that a firm is hiring workers who will stay with the firm for a total of 3 years if they pass the probation period.

Probationary period: 3 months

Salary during probationary period: \$3,500 / month

Expected duration of employment: 3 years

Salary if confirmed (after three months): \$5,000 / month

Assume no discounting. High productivity workers generate \$5,500 per month in net revenue for the firm, and low-productivity workers generate \$3,200 in net revenue per month. **Three-fourths of all workers are low-productivity.** The probationary period lasts three months. During that time the new workers earn \$3,500 per month. If they pass the probationary period, they earn \$5,000 per month for the remainder of the three years. **If they go to work for the alternative employer instead, they earn \$4,200 per month.** High-productivity workers almost always pass the probationary phase, and low-productivity workers almost never do, but sometimes the firm makes mistakes in classifying the workers. More specifically, high-

productivity workers are correctly identified, pass probation, and continue with the firm with probability 0.95, and low-productivity workers are correctly identified and fired with probability 0.95. In other words, **the firm correctly classifies workers 95 percent of the time and makes mistakes 5 percent of the time.** Thus, there is a 5 percent chance that a low-productivity worker will be able to continue with the firm and a 5 percent chance that a high-productivity worker will be fired.

We want to know whether high-productivity workers prefer this contract to working for the alternative employer and whether low-productivity workers prefer the alternative employer. If both of those conditions are met, the contract induces the workers to self-select and solves the adverse selection problem. Begin with the decision faced by high-productivity workers. If they work for the alternative employer, they get **$4,200 per month for 36 months, or $151,200.** If, instead, they work for the firm in question, they earn $3,500 per month for the 3-month probationary period, and then with probability 0.95 they earn $5,000 per month for the remaining 33 months and with probability 0.05 they are fired and so go to the alternative employer for the remaining 33 months. Their total expected pay is:

$$3(\$3{,}500) + 33(0.95 \times \$5{,}000 + 0.05 \times \$4{,}200) = \$174{,}180$$

High-productivity workers find the probationary contract worthwhile because the expected pay of $174,180 exceeds the $151,200 they could earn from the alternative employer.

Low-productivity workers also make $151,200 at the alternative employer. If they choose to work for the firm in question, they are paid $3,500 per month for the first three months, and then with probability 0.95 they are correctly identified as low-productivity workers and fired, in which case they work for the alternative employer for the remaining 33 months. But there is a 5 percent chance that they will be mistakenly identified as high-productivity workers and can remain with the firm making $5,000 per month for the remaining 33 months. Their expected pay is

$$3(\$3{,}500) + 33(0.95 \times \$4{,}200 + 0.05 \times \$5{,}000) = \$150{,}420$$

Because their expected pay is less than it would be with the alternative firm, the low-productivity workers do not apply for a job at this firm. The probationary contract induces self-selection, and only high-productivity workers take jobs at the firm.

This raises a subtle question. The purpose of the probationary contract is to distinguish between the high- and low-productivity workers so that the firm can get rid of the latter. When the probationary contract is designed properly, however, only high-productivity workers take the job. Because there are no low-productivity workers to fire, the only ones who are fired are the unlucky 5 percent of the high-productivity workers who are incorrectly labeled as low-productivity. If the firm knows that the probationary contract is designed correctly so that no low-productivity workers apply, why does it still fire these unlucky high-productivity workers?

The answer is that it has to. If the firm assumes that any worker labeled as low-productivity must really be a high-productivity worker, no one is fired. Then the low-productivity workers will find the job attractive because they now have a 100 percent chance of passing the probationary period. The probationary contract would no longer serve its purpose, and workers would not be induced to self-select.