

SEMINARS IN GAME THEORY

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LECTURE NOTES SET 9: JOB SIGNALING

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JOB SIGNALING (Spence, QJE, 1973; Spence, JET, 1974)

General characteristics of the model:

- An **employer** is looking to hire a **worker** (employee)
- Workers can be of
 - Low productivity
 - High productivity
- A worker **knows** his “type” (i.e., high or low productivity).
- The employer **does not know** the type of the worker
 - Once a worker is hired, it will take considerable time for his true ability to be revealed.
 - The employer must try to infer the type of the worker prior of hiring one.
- The employer can try to guess the type based on observable characteristics of the worker:
 - **Signals** → characteristics under the control of the applicant (like education, the way he dresses, etc.)
 - **Indexes** → characteristics which cannot be modified by the applicant (e.g. sex, race, etc.).

JOB SIGNALING (*Spence, QJE, 1973; Spence, JET, 1974*)

General characteristics of the model:

- The employer is considering **education** as the most relevant signal (i.e., the employer believes that education and productivity are positively related).
- The employer will offer higher salaries to those who have acquired more education.
- A worker is facing the problem of communicating his unobservable qualities (i.e., productivity) to the employer by using some signal (i.e., educational level).
- When choosing a signal the worker is considering:
 - **signaling costs** → the cost of acquiring more education

JOB SIGNALING (*Spence, QJE, 1973; Spence, JET, 1974*)

Two main assumption of the model:

- Signaling costs are negatively correlated with productive ability.
 - Acquiring more education requires more effort by those of low productivity compared to those of high productivity
- Education does not affect productivity.
 - This assumption is relaxed in Spence's second paper (1974).

Two main results of the model:

- there may be multiple equilibria (and even an infinite number of them)
- equilibria may be or may be not Pareto inefficient.

The model

High productivity H , with probability q

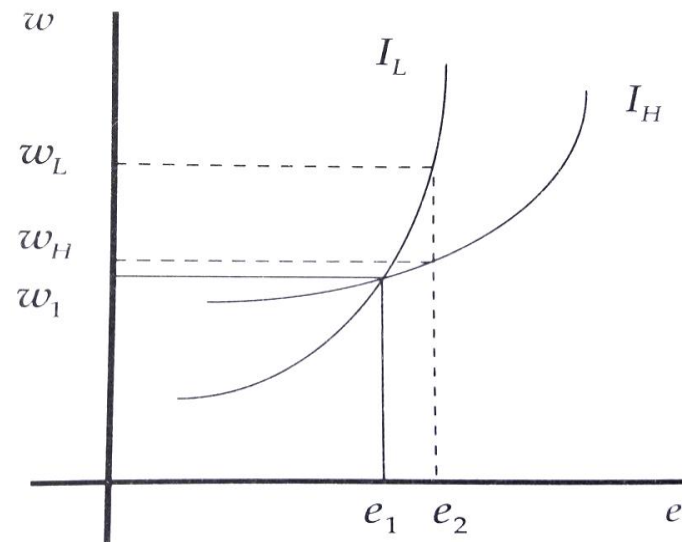
- η : type 
- Low productivity L , with probability $1 - q$

- Worker chooses education $e \in [0, \infty)$ in order to maximize

$$u_W(w, e | \eta) = w - c(\eta, e)$$

where $c(\eta, e)$ is the cost of acquiring education with

- $c_e(\eta, e) > 0$ (i.e., the cost of acquiring more education is increasing) and
- $c_e(L, e) > c_e(H, e)$ (i.e., it is more costly for the low productivity worker to acquire additional education)
 - the latter condition is the single-cross property



The model

- Since the type is not known by the firm, the wage offered would depend on firm's beliefs about the worker's type given the education (signal) the worker has chosen
 - When observing a signal (i.e. educational level of the worker), the employer updates her beliefs about the type of the worker she is facing
 - $\mu(H|e)$ is the employer's belief that, given educational level e , the worker is of high productivity.
 - $\mu(L|e)$ is the employer's belief that, given educational level e , the worker is of low productivity.
- The employer will offer the worker a wage equal to his expected productivity

$$w(e) = \mu(H|e)y(H, e) + [1 - \mu(H|e)]y(L, e)$$

where $y(\eta, e)$ is the productivity of type $\eta \in \{H, L\}$

Example – productivity is not affected by education

Consider the job signaling where a worker's type $\eta = H$ appears with probability q . Assume that structure of the game is described by the following equations

$$y(L) = 1$$

$$y(H) = 2$$

$$c(L, e) = e$$

$$c(H, e) = e/2$$

$$\mu(H|e) = \begin{cases} 1 & \text{if } e \geq e^* \\ 0 & \text{otherwise} \end{cases}$$

1. What is the wage schedule the employer will adopt?
2. What are the optimal responses of the two types?
3. Define the separating equilibrium.
4. Can the separating equilibrium be Pareto Efficient (against an equilibrium where the employer pays a wage based on average productivity)?