

# Principles of Microeconomics-II

## L5: Asymmetric Information

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# What underlies economic transactions?

- Getting a loan from a bank
- Buying health insurance
- Online purchases
- Applying for jobs
- Trading (or gambling!)

**Information:** how much to pay? whom to hire? whether to purchase?

# Difference in Type

- A buyer does not know the quality of the good sold;
- An employer does not know the ability of prospective employees.

Ability, quality, trustworthiness are **unobservables** in real life. In the absence of information, **expectations** are created. Expectations can be updated by observing **signals**.

# Adverse Selection

Information asymmetry about **type**.

- Risk-prone individuals are more likely to purchase insurance.
- Buyers of second-hand cars are unable to distinguish between quality.
- An employer offering a single-wage cannot observe job applicant ability.

⇒

- Insurers raise premia, driving away healthier people. More risk-prone individuals now buy insurance.
- Buyers are not willing to pay a lot, driving away sellers of good quality second-hand cars.
- The employer is not willing to pay too high a wage, driving away high-ability workers.

# A Model of Adverse Selection in Labour Markets

## Preliminaries

- There are two types of workers: High ability (H) and Low ability (L)
- On hiring an H-type, employer profit = \$12,000
- On hiring a L-type, employer profit = \$6,000
- H-type workers ( $Q^H$ ) are willing to work at higher wages than L-type workers ( $Q^L$ ). In particular:
  - ①  $w = 2000 + 20Q^H$
  - ②  $w = 2000 + 10Q^L$

# A Model of Adverse Selection in Labour Markets

If the employer could observe ability:

- Pay H-type worker \$12,000. Hire:  $Q^H = \frac{12,000 - 2,000}{20} = 500$ .
- Pay L-type worker \$6,000. Hire  $Q^L = \frac{6,000 - 2,000}{10} = 400$ .

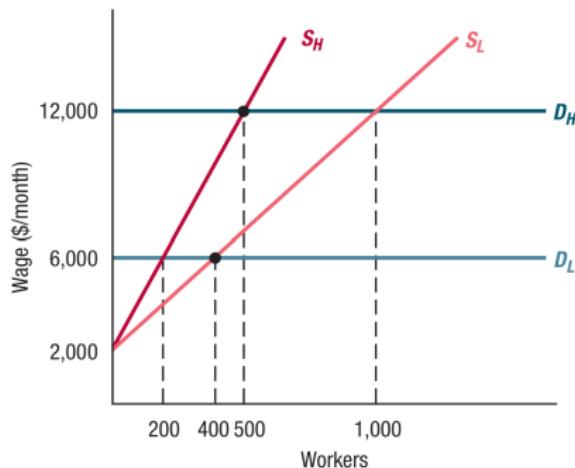


Figure: When ability is observed. Source: Bernheim & Whinston (2009)

# A Model of Adverse Selection in Labour Markets

Ability cannot be observed:

- What is the probability that the employer hires a H-type worker?

$$\frac{Q^H}{Q^H + Q^L} = \frac{1}{3}$$

- The probability that the employer hires a L-type worker =  $\frac{1}{3}$ .

- Type is not observed, and one wage must be offered.

- What is the expected profit from hiring a worker?

$$(\frac{1}{3} \times 12,000) + (\frac{2}{3} \times 6,000) = 8,000$$

- At  $w = 8,000$ ,  $Q^H = 300$  and  $Q^L = 600$ .

# A Model of Adverse Selection in Labour Markets

Due to imperfect information, too few H-type workers and too many L-type workers hired.

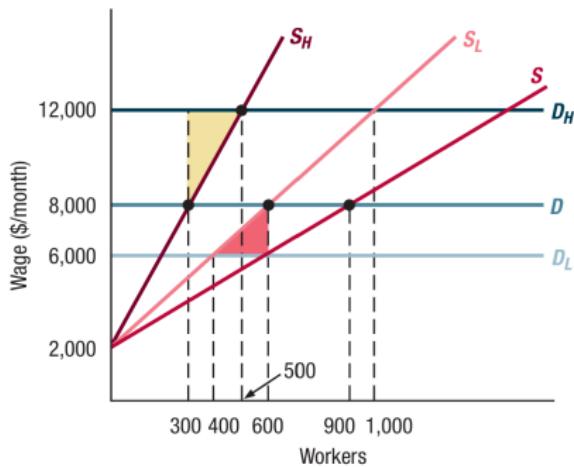


Figure: Adverse Selection. Source: Bernheim & Whinston (2009)

# Imperfect Information can Unravel the Market

**Unraveling:** Information asymmetries drive out attractive players from the market. The market cannot distinguish between them.

- Suppose as  $w$  falls, the probability of hiring a L-type worker rises.
- In the diagram below, there are different reservation wages for H- and L-type workers.

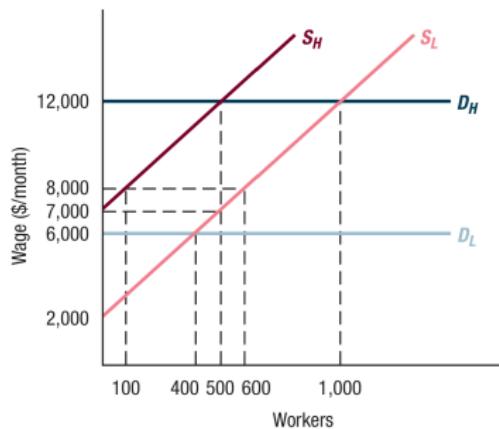


Figure: Unraveling. Source: Bernheim & Whinston (2009)

# Market Equilibrium with Unraveling

Low ability workers chase out high ability workers!

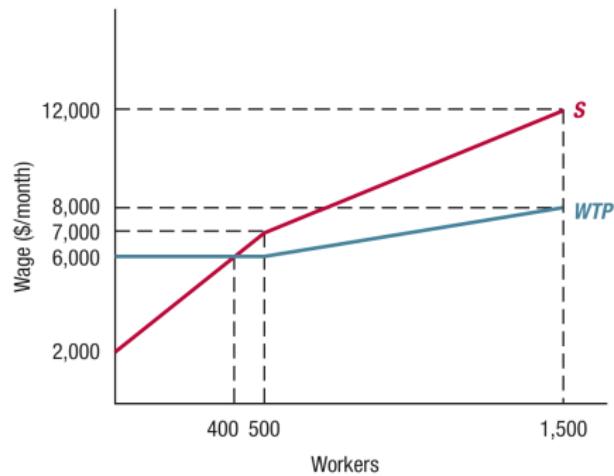


Figure: Market Equilibrium. Source: Bernheim & Whinston (2009)

# Signaling

One way of reducing asymmetries

- ① Warranties
- ② Degrees
- ③ Advertisement

# Spence's Job Market Signaling Model

## Preliminaries

- There are H-ability and L-ability workers with probability distribution  $(p, 1 - p)$ .
- Utility of each worker is positively correlated with the wage ( $w$ ) and given wage, is negatively correlated with additional education ( $E$ ) beyond the compulsory minimum (say, 10).
- IC of H-type flatter: greater value for  $E$ .
- **Assume:** Education is costly and has no impact on productivity.
- Value of MP of H-type = \$50, L-type = \$20.
- The labour market is competitive.
- Ability is known to workers; unobserved by the employer

# Spence's Job Market Signaling Model

Suppose ability was observable (First-Best).

- ① Employer pays \$50 to H-type workers and \$20 to L type workers.
- ② Both type of workers attain 10 years of education.

# Spence's Job Market Signaling Model

Ability not observed by employer. What signal do workers send?

- ① Pooling Equilibrium: All types send the same signal.
- ② Separating Equilibrium: All types send a different signal.

# Signaling: Separating Equilibrium

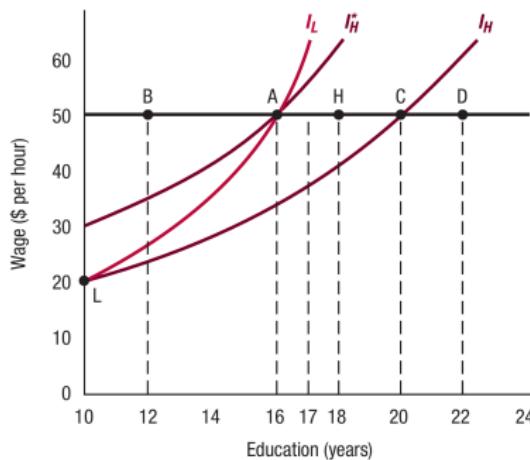


Figure: Signaling. Source: Bernheim & Whinston (2009)

# Features of the Separating Equilibrium

- ① Employers rely on workers to self-select into observably differentiated groups.
- ② Education is correlated with productivity but not causally associated.
- ③ The separating equilibrium is pareto inefficient.

# Screening Models

The agent at informational disadvantage has an incentive to collect information.

**Screening:** An uninformed party offers the informed party with options, and gleans information based on their choices.

# A Model of Workplace Responsibilities

## Preliminaries

- There are H-ability and L-ability workers, distributed as  $(p, 1 - p)$ .
- Utility of each worker is positively correlated with income ( $Y$ ) and given income, is negatively correlated with the number of tasks to be performed ( $T$ ).
- IC of H-type flatter: tasks are less tedious.
- Value of MP of H-type = \$10, L-type = \$5 (per-task).
- The labour market is competitive.



Figure: Preference Structure. Source: Bernheim & Whinston (2009)

# A Model of Workplace Responsibilities

Suppose ability is observed by the employer.

- H-type worker paid \$10, L-type worker paid \$5.
- Number of tasks chosen by tangency of budget line and ICs.

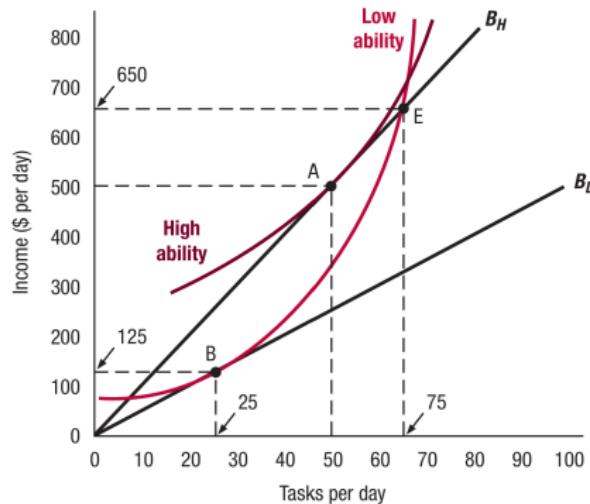


Figure: When ability is observed. Source: Bernheim & Whinston (2009)

# A Model of Workplace Responsibilities

The employer does not observe ability until revealed through actions.

- Suppose the employer offers two kinds of jobs: \$125 for 25 tasks and \$500 for 50 tasks. Of course, both L- and H-type workers will choose the latter. (see ICs)
- However, the L-type worker only has productivity of \$5 per task. The firm loses money.
- Ideally, the employer would like L-type workers to sort themselves into the less productive job and the H-type worker to sort themselves into the more productive job.
- That is, we need to find a **separating equilibrium!**
- In fact, this model has no pooling equilibria.

# A Model of Workplace Responsibilities

## A separating equilibrium

- Two offers given:  $T_H$  tasks at  $\$Y_H$  per task;  $T_L$  tasks and  $\$Y_L$  per task.
- Competitive equilibrium  $\implies$  zero-profits  $\implies Y_H = 10T_H$  and  $Y_L = 5T_L$ .
- H-type end up on  $B_H$  and L-type end up on  $B_L$ .
- But what points on these lines can sustain as a separating equilibrium while continuing to satisfy the zero-profit condition?

# A Model of Workplace Responsibilities

## Constructing a separating equilibrium

- We show that points B and E sustain as the (and in fact, only!) zero-profit separating equilibrium.
- H-type have to signal ability by agreeing to higher tasks (E) and Low-type stay at point B.
- There is no other type of job that *both* attracts L and H type workers and satisfies the zero-profit condition.

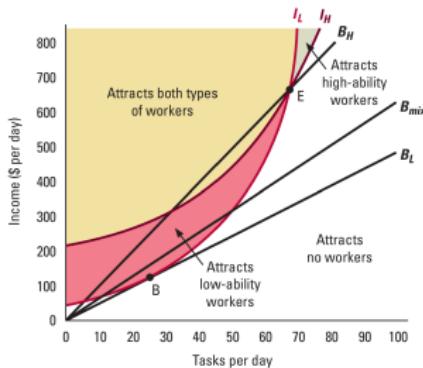


Figure: Separating Equilibrium. Source: Bernheim & Whinston (2009)

## Moral Hazard

- One party to a transaction takes actions that a trading partner cannot observe, and that affects the benefits that the partner receives from trade.
  - The uninformed party wants to ensure that favourable actions are taken.
  - Incentive schemes.

# A Model of Incentive Pay

- A Principal-Agent problem.
- The Principal: Owner of a car dealership; the Agent: Salesperson.
- Salesperson may slack off, owner cannot monitor  $\implies$  a moral hazard problem!

# A Model of Incentive Pay

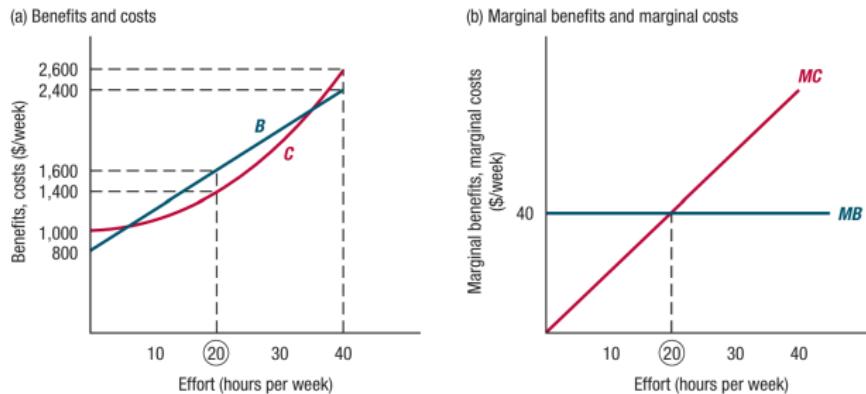
## Preliminaries

A car-dealership owner hires a salesperson to sell her cars. Greater the hours ( $H$ ) put in by the salesperson, greater the cars sold and more the benefit to the dealer. The salesperson has a cost of effort  $C(H) = 1000 + H^2$  (therefore, Marginal Cost =  $2H$ ), and every car sold generates a profit of \$ 1000. Every hour of work is associated with a 4% chance of selling a car.

The owner gets a benefit of \$800 when no hours of work are put in. Thus, in the baseline, every hour of work put in generates a profit of  $0.04 \times 1000 = 40$ .

# A Model of Incentive Pay

## Incentives of the Principal and the Agent



**Figure:** Effort is Observed. *Source:* Bernheim & Whinston (2009)

A fixed-wage contract does not work in the absence of observable effort.

# A Model of Incentive Pay

Compensation linked to sales performance.

- Base + Bonus pay, not all profit shared with agent.
- Agent does not internalise owner's trade-offs on the margin.
- Less effort put in than social optimum.

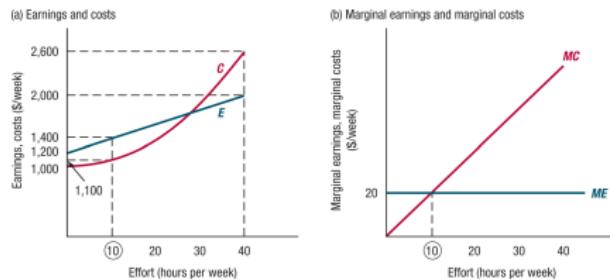


Figure: Performance-based Contract with Profit Sharing. Source: Bernheim & Whinston (2009)

# A Model of Incentive Pay

Marginal trade-off faced by agent same as that faced by owner; owner appropriates all profits.

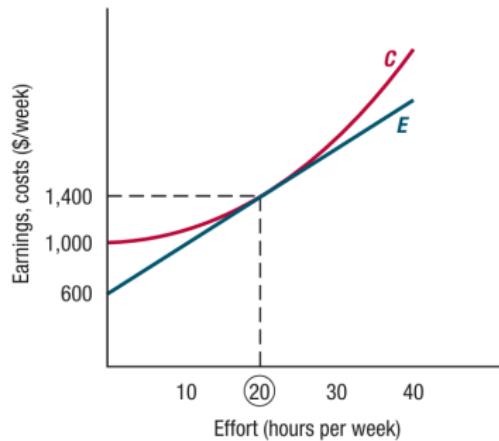


Figure: Efficient Incentive Contract. Source: Bernheim & Whinston (2009)