

Imperfect information

- Up to now, consider only firms and consumers who are perfectly informed about market conditions:
 1. prices, range of products available
 2. characteristics or relative qualities of available products
 3. consumers' preferences, demand functions
- Specific models where firms and/or consumers have imperfect information: How is imperfect information resolved? How does imperfect information affect firm behavior (pricing, advertising)?
 1. Adverse selection: “lemons” (used car) markets
 2. Moral hazard: insurance markets
 3. Price uncertainty: search markets

Two important types of imperfect information

Adverse selection: individuals have different, but unobserved types. “Hidden information”.

1. Used cars: only seller knows true quality of car
2. Similar in spirit to 2-degree price discrimination (airline pricing)

Moral hazard: individuals can take unobserved actions which affect market outcome. “Hidden action”.

1. Insurance markets: insured people may not take necessary precautions — raises the avg. payment of insurance company and, therefore, average premium
2. Labor markets: when employees work in teams where individual effort not observable, each employee has incentive to “free-ride”

These markets characterized by *asymmetric information*: firms and consumers are differentially informed. Adverse selection: information is asymmetric when transactions are made. Moral hazard: information becomes asymmetric *after* transactions are made.

Additional examples?

Adverse selection 1

Example: the used car market

- Two types of used cars: “good” and “bad”, providing utility of u_G and u_B . Proportion p are “bad”.
- In competitive market, with perfect information: $p_b = u_B$, $p_G = u_G$.
- Consider asymmetric information: only seller knows car type, buyer doesn't know.
- “Average” used car in the market yields expected utility $\tilde{u} \equiv (1 - p) * u_G + p * u_B$. Buyer is willing to offer \tilde{u} for any given car; by doing so, break even “on average”.
- At \tilde{u} : only owners of bad cars willing to sell, since $u_b < \tilde{u}$. Owners of good cars stay out of market, since $u_G > \tilde{u}$.
- Outcome: buyer offers u_B , and only bad cars in the market. “Lemons market”. Market outcome “selects” only the bad cars: adverse selection.
- Endemic problem in many situations. “No trade” problem in financial markets; “Winner’s Curse” in auctions.

Adverse selection 2

- What is the problem? Buyer can set only one price. How can relaxing this solve the problem?
- 2-degree price discrimination. In practice, discrimination is possible: third party certifications, for example.
- Example: Buyer pays different price depending on whether or not a used car is certified (p_C , p_{NC}). Works if certification is substantial more costly for bad cars (i.e., high required repairs for bad cars), so that buyer can set (p_C , p_{NC}) so that only good cars are certified.
- Furthermore, problem mitigated if buyer/seller differ in intrinsic valuation of used car.

Additional examples:

- Ability signaling via expensive education. Only hi-ability individuals willing to spend \$\$\$ on education: Explains high cost of MBA degrees? “Burning Money”.
- Conspicuous consumption, advertising

Moral hazard 1

Example: incentives of individuals with home insurance to install preventive device.

Main idea: insurance reduces the incentives of policy-holders to take necessary precautions

- Probability of fire with prevention is p , without prevention is p^* , so that $p^* > p$. It costs C to install prevention device.
- Individual decides first whether or not to purchase fire insurance, then decides whether or not to install prevention measures
- Individual has income M . Pays K_1 premium for insurance, loses K_2 in case of fire. W/insurance, individual paid K_2 in case of fire.
- Insurance is “fair”, so that insurance company makes zero expected profit:

$$K_1 - pK_2 = 0 \implies K_1 = pK_2$$

Assume: insurance company cannot know whether individual takes necessary precautions (“hidden action”)

Moral hazard 2

Individual's payoffs summed up by following matrix, where $U(\cdot)$ is her utility function

Outcome	No fire	Fire
Insurance/No prevention	$U(M - K_1) = U(M - pK_2)$	$U(M - K_1) = U(M - pK_2)$
No insurance/No prevention	$U(M)$	$U(M - K_2)$
Insurance/Prevention	$U(M - pK_2 - C)$	$U(M - pK_2 - C)$
No insurance/Prevention	$U(M - C)$	$U(M - K_2 - C)$

Moral hazard 3

- Insured individuals will install prevention measures if

$$EU(\text{Insur/Prev}) > EU(\text{Insur/No prev})$$

- For fair premium:

$$EU(\text{Insur/Prev}) = U(M - pK_2 - C)$$

$$EU(\text{Insur/No prev}) = U(M - pK_2)$$

So never take preventive measures.

- Similar outcome as in “lemons market”: insured never take precautions, so that in long run insurance company will not break even if it sets “fair” premium.
- Problem: Perfect insurance makes individual indifferent about whether a fire occurs or not, since she gets same utility whether or not a fire occurs. Strengthen incentives by removing this indifference. One way is to offer only incomplete insurance.

Moral hazard 4

- Offer a deductible $D < K_2$: so that in event of fire, individual only recovers $K_2 - D$. Now:

$$EU(\text{Insur/Prev}) = p * U(M - pK_2 - C - D) + (1 - p) * U(M - pK_2 - C)$$

$$EU(\text{Insur/No prev}) = p^* * U(M - pK_2 - D) + (1 - p^*) * U(M - pK_2)$$

- Graph. In some cases (depending on shape of $U(\cdot)$, deductible will be enough to make $EU(\text{Insur/Prev}) > EU(\text{Insur/No prev})$, so that insured people also take preventive measures.
- Interpretation: Strengthen incentives by imposing risk on individual (i.e., remove indifference between states of the world).

Price uncertainty: Tourist-trap model 1

Now consider different type of uncertainty: consumers are aware that firms charge different prices, but don't know what the price each firm charges.

Simple model: Each consumer demands one unit; starts out at one store, incurs cost c to search at any other store. Consumer only knows prices at stores that she has been to, and buys from the canvassed store with the lowest price.

Utility u from purchasing product: demand function is

$$\begin{cases} \text{purchase if } p \leq u \\ \text{don't purchase otherwise} \end{cases}$$

Questions: what will prices be in equilibrium? Single or multiple prices?

Price uncertainty: Tourist-trap model 2

When will equilibrium arise where all stores charge u (assumed larger than marginal production cost)

Show that if all other firms charge u , not profitable for any firm to deviate.

1. If $p > u$, demand (and sales) fall to zero
2. If $p < u$ and $u - p < c$, consumers realize that possible price discount is less than search cost: no loss in demand, just loss in sales.
3. Only profitable if $p < u$ and $u - p > c$. Does additional search generate enough additional demand to make this profitable? Magnitude of additional demand depends on search costs c and number of firms. Less likely to be profitable if large number of firms, or high search costs.
4. Implies price cuts only profitable if consumers can easily identify low-price stores: explanation for advertising??

Price uncertainty: Tourist-natives model 1

How would equilibrium price-dispersion arise? Focus on one reason: heterogeneity informedness

Two types of consumers: “natives” are perfectly informed about prices, but “tourists” are not.

Main point: If proportion of uninformed consumers is high, free-entry equilibrium with both high- and low-price firms can exist.

- Tourists and natives, in proportions $1 - \alpha$ and α . L total consumers (so αL natives, and $(1 - \alpha)L$ tourists).
- Tourists buy one unit as long as $p < p^u$, but natives always shop at the cheapest store.
- Each of n identical firms has U-shaped AC curve
- Each firm gets equal number of tourists $\left(\frac{(1-\alpha)L}{n}\right)$; natives always go to cheapest store.
- Consider world in which all firms start by setting $p^c = \min_q AC(q)$.
- Note that deviant store always wants to price *higher*. Demand curve for a deviant firm is kinked (graph). Deviant firm sells exclusively to tourists.

Price uncertainty: Tourist natives model 2

Deviant firm will always charge p^u . Only tourists shop at this store. If charge above p^u , no demand. If below p^u , then profits increase by charging p^u .

1. First case: many informed consumers (α large)
 - Number $q^u \equiv \frac{(1-\alpha)L}{n}$ of tourists at each store so small that $p^u < AC(q)$.
 - In free-entry equilibrium, then, all firms charge p^c , and produce the same quantity L/n .
 - If enough informed consumers, competitive equilibrium can obtain (not surprising)
2. Second case: few informed consumers (α small)
 - Assume enough tourists so that $p^u > AC(q^u)$.
 - In order to have equilibrium: ensure that given a set of high-price firms (charging p^u) and low-price firms (charging p^c), no individual firm wants to deviate. Free entry ensures this.

Price uncertainty: Tourist-natives model 3

Free entry equilibrium characterized by n firms, with a proportion β being low-price firms.

- Each high-price firm charges p^u and sells an amount

$$q^u = \frac{(1 - \alpha)L(1 - \beta)}{n(1 - \beta)} = \frac{(1 - \alpha)L}{n}$$

- Each low-price firm charges p^c and sells

$$q^c = \frac{\alpha L + (1 - \alpha)L\beta}{n\beta}$$

- In equilibrium, enough firms of each type enter such that each firm makes zero profits. Define q^a as the quantity such that $AC(q^a) = p^u$. In equilibrium, number of firms n must be such that:

$$q^a = q^u \frac{(1 - \alpha)L}{n}$$

- Similarly, q^A is the quantity at which $AC(q^c) = p^c$. In equilibrium, n and β must be such that

$$q^A = q^c \frac{\alpha L + (1 - \alpha)L\beta}{n\beta}$$

Price uncertainty: Tourist-natives model 4

- Solving the two equations for n and β yields

$$n = \frac{(1 - \alpha)L}{q^a}$$

and

$$\beta = \frac{\alpha q^a}{(1 - \alpha)(q^A - q^a)}$$

- Weakness of model: arbitrary which firms become high or low price. Doesn't specify process whereby price dispersion develops.

Conclusions

- Adverse selection: “lemons” outcome. Impediment to trade in many market settings.
- Moral hazard: Fire insurance. Perfect insurance increases possibility of bad outcome.
- Price uncertainty
 - (Tourist-trap model): With homogeneous consumers, price dispersion unlikely in equilibrium. Single-price equilibrium, if it exists, is the monopoly equilibrium
 - (Tourist-native model): With both informed and uninformed consumers, equilibrium price dispersion can exist if there are a lot of uninformed consumers.