Information and Market lemons, loans, and genetics

With the rise in popularity of certified used or "certified pre-owned" vehicles, many used car ads seem to tout the "certified" name without really living up to the promise of a car that is backed by the manufacturer with an impressive warranty and top-notch dealership experience.

Uh???
Outline

• Information
• Asymmetric information
• The market for used cars
  – Problem: who wants a lemon
  – Solution?
• The market for loans
  – Problem: good borrowers drop out
  – Solution? More information
• The market for insurance
  – Problem: Genetic Testing
  – Solution?
Information

• How is a consumer to have preferences over all possible goods over all possible times of consumption
• How is a worker to have preference over all possible places he could work at and how long to work
• Clearly we are only partly informed
  – Thus decisions involve risk
  – But what we know differs from one individual to the next.
Asymmetric information

• What one party to a transaction knows is different from the other

• AI. Most often one party (the seller) knows more about the good or service being exchanged than the other.

• Consequences:
  – the more informed party wants to take advantage of his/her information
  – The less informed party must beware of what the more informed party wants to do
The market for used cars

• The problem:
  – Used cars have observable characteristics and some unobservable characteristics that the owner of the car learns.
  – The buyer has to worry about the fact that the seller chooses when to replace his car (or whether to replace it or not)

• The model
  – Cars last two periods
  – There are two types of people
    • n who like new cars (value them at $V_n^h$)
    • And n who do not care so much ($V_n^l$)
  – Used cars are either good (with probability $q$) or bad ($1-q$).
    • If good they are worth $p_g$
    • if bad they are worth 0

If all new cars are sold

• This corresponds to no asymmetric information
  – Cars who become clunkers are a surprise to everyone
• Then the buyers (who are risk neutral) are willing to pay $q_p g$
• In equilibrium new cars are bought by the high value individuals, and the low value individuals buy used cars.
• $CS = (1 + d)(nV^h_n - np_n + nq p_g)$.
  – The used car buyers are indifferent all they surplus goes to new car buyers
• Can check that other combinations are worse
The lemons problem

• Suppose the owners of the cars know whether their car is good or bad.
• The owner of bad car
  – Buy a new car get $U_s^b = V_n^h-p_n + qp_g$
  – Keep the good car get $U_k^b = 0$
  – So always sells
• Then the owner of a good car
  – Buy a new car get $U_s = V_n^h-p_n + qp_g$
  – Keep the good car get $U_k = p_g$
  – $U_s < U_k$ iff $V_n^h-p_n < (1-q)p_g$
• If $U_s > U_k$ asymmetric information does not matter
• If $U_s < U_k$ owners of good cars do not sell so no one buys used cars
  – So half the population in each group buys a new car in each period
  – $CS_2 = (1+d) \left( \frac{1}{2}nV_n^h - \frac{1}{2}np_n + \frac{1}{2}np_g \right) + (1+d) \left( \frac{1}{2}nV_n^l - \frac{1}{2}np_n + \frac{1}{2}np_g \right)$
  – $CS_2 = (1+d) \left( \frac{1}{2}nV_n^h + \frac{1}{2}nV_n^l - np_n + np_g \right)$
  – Compare with $CS_{\text{all}} = (1+d)(nV_n^h - np_n + np_g)$.
  – $CS_2 = (1+d) \left( \frac{1}{2}nV_n^h + \frac{1}{2}nV_n^l - np_n + np_g \right) < (1+d)(nV_n^h - np_n + np_g)$.
  – $\left( \frac{1}{2}nV_n^h + \frac{1}{2}nV_n^l \right) < (nV_n^h)$. Market failure makes people worse off.
Solution?

• More Information
• If there is a way for the car seller to signal that the car is good.
• Then the owner of a good car, if use the signal
  – Uses signal and buys a new car gets $U_s = V_n^h - p_n + p_g$
  – Does not use the signal buys a new car get $U_s = V_n^h - p_n + q p_g$
  – So sells and likes the signal
• Buyer now knows that if no signal then car is bad and offers 0
• The owner of bad car
  – Buy a new car get $U_s^b = V_n^h - p_n$
  – Keep the good car get $U_k^b = 0$
  – So always sells
• $CS_3 = q(1+d)(nV_n^h-np_n + np_g)+(1-q)(1+d)(nV_n^h-np_n)$.
• $CS_3 = (1+d)(nV_n^h-np_n + np_g) = CS_{all}$
Unravelling

- A little information that cannot be communicated can create a market failure
- A little information that can be communicated can restore equilibrium
- In fact a more general property
Restaurant grade cards

The Effects of Grade Cards and Disclosure Regulation on Hygiene Scores

Leasing

• In the last two decades there has been a massive increase in the rate of car leases at the higher end of the quality market.

• Part of that involves tax avoidance

• Part of that involves avoiding the market for lemons.
  – The lease holder can buy the car
  – but the contract specifies a price that makes undesirable to do so (much higher than the price at which the dealer is prepare to sell the car)
  – Almost all leases are returned. They get certified and sold at a reasonable price

The market for loans

• Assume borrowers who take a loan $l$,
  – spend it on a project that succeed with probability $p$
  – If success earn $\pi$
  – If fail return $\alpha l$.

• Return to individual $p(\pi-(1+r)l)$
  – Note because individual has limited liability and $\alpha<1$ bank gets everything if fail

• Return to the bank $p(1+r)l+(1-p)\alpha l$

The individual demand for loans

• Individual has a return \( p(\pi-(1+r)l) \) if does not get a loan gets 0.
  
  – \( p(\pi-(1+r)l)>0 \iff p\pi > p(1+r)l \iff \pi/l-1>r \)
  
  – That says for each individual there is a maximum interest rate \( r \) at which they are willing to borrow.
  
  – The max rate does not depend on \( p \) just on \( \pi \) and that as \( \pi \) gets larger so does \( r(\pi) \)

• Gross return (not net of borrowing costs) is \( p\pi+(1-p)\alpha l \).
  
  – Notice that depends on \( p \)
The aggregate demand for loans

• Fix $\alpha$ and $l$. Consider a set of projects $(\pi, p)$ between $(\pi_l, p_l)$ and $(\pi_h, p_i)$ such that the social return is constant \{$p_i = p_l (\pi_l - \alpha l)/(\pi_i - \alpha l)$\}.

• By construction if $\pi_i > \pi_j$ then $r(\pi_i) > r(\pi_j)$. So it is the safer projects (low $\pi$ high $p$) that drop out first when interest rates rise.

• Let there be $n_i$ projects of type $(\pi_i, p_i)$

• Then demand for loans given an interest rate $r$ will simply be

$$N(R) = \sum_{i \in \mathcal{L}(r)} n_i l \quad \text{where } r(\pi_{l_i}(r)) > r \text{ and } r(\pi_{l_i}(r) - 1) < r$$
The supply of loanable funds

• The profits of the bank is $\Pi = p(1+r)l + (1-p)\alpha l$
  – $\Pi = p(1+r-\alpha)l + \alpha l$ because $\alpha < 1$ $\Pi$ is increasing in $p$
  – The bank likes safe projects

• Suppose the supply of funds is such that the bank can fund $m$ loans.

• Can we reach equilibrium

• The problem is that $p(\pi)$ is declining in $\pi$. 
Market failure

• Let $N_j = \sum_{j} n_i$. So $N_i$ is all projects

• Assume $\Pi = \sum_{i} n_i (p_i (1 + r)l + (1 - p_i)al) > 0$

• But $m < N_i$, bank decided to raise interest rates

• What happens?
  – Low risk borrowers drop out and bank profits decline

\[
\Pi(i') = \sum_{i'} n_i (p_i (1 + r)l + (1 - p_i)al) < 0
\]
Loans and Asymmetric information

• Market fails because bank does not know who the borrowers are

• Solution 1: rationing (run a lottery) in this case it efficient why? But it does not maximize profits why?

• Solution 2: a little more information: will always raise profits why?

• Solution 3: change the contract, take an equity position, its efficient why?
When information can hurt

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p<q.

Individual buys insurance every year
The issue is whether to have to have genetic Testing
Does it make the individual better off

Insurance without tests

• Whatever genetic traits cause the difference between p and q are not observable. So in the absence of the genetic information individuals are all offered the same contract
• Population is sick with probability $Gp + (1-G)q$ and the cost of being sick is C.
• Industry is competitive so price of insurance is $(Gp + (1-G)q)C$
  – Someone who is healthy pays $(Gp + (1-G)q)C$
  – Someone who is sick pays $(Gp + (1-G)q)C$ and receives C.
  – Insurance implies that people who get sick are as happy as people who are healthy
  – Insurance company pays C with probability $(Gp+(1-G)q)$ so makes no profit
• So the sick are insured. But the healthy (p) population ‘subsidizes’ the less healthy (q) population
Genetic Testing

• Suppose that to trace some extremely rare disease that can be completely cured at low cost, we mandate genetic testing and can separate the two populations. Insurance companies learns the result of the test.

• Companies will offer different contracts
  – Pooling is not longer an equilibrium
  – Suppose all companies still continue to charge \((Gp+(1-G)q)C\)
  – Then it pays for someone to offer a contract \(pC\) to all those individuals who have received good news on the test. Because \(q>p\) \(Gp+(1-G)q>p\) so \(pC\) is less than \((Gp+(1-G)q)C\) so all the people with good news take the new contract
  – That leaves all the people with bad news with a contract \(qC\)
Risk aversion=> keep genetic test secret

• But now consider the individual just before the test is released

• If tests are not released there is full insurance
  \[ U_s = U(Y - (Gp + (1-G)q)C) \]

• If tests are released there is still insurance for health but now there is genetic risk
  \[ U_r = GU(Y-pC) + (1-G)U(Y-qC) \]

• Here the market IS the problem
Information (conclusion)

- Information is really important
- Sophisticated people must act on their information
  - Choice of buy or sell used car, what contract to offer
- Even more sophisticated people realize that others may be better informed than they are
  - This may lead markets to shut down