Asymmetric Information and Adverse selection
Health Economics
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Introduction
- Intermediate micro – build models of individual, firm and market behavior
- Most models assume actors fully informed about the market specifics
  - Know prices, incomes, market demand, etc.
- However, many markets do not have this degree of information
- Look at the role of ‘imperfect information’

Problem of individual insurance
- Consider market for health insurance
- Who has greatest demand?
  - Not low income
  - Risk averse
  - People who anticipate greater spending
- Problem
  - Firms do not know risk – people do
  - Asymmetric information (AI)
- AI can lead to poor performance in market

- This is more than just ‘uncertainty’ – we’ve already dealt with that issue
- Problem of asymmetric information
  - Parties on the opposite side of a transaction have different amounts of information
  - Ex: Car buyers/house sellers
  - Prospective employees/employers
- Health care ripe w/ problems of asymmetric information
  - Patients know their risks, insurance companies may not
  - Doctors understand the proper treatments, patients may not
This section

• Outline problem of asymmetric information and adverse selection
• Focus on
  – How selection can impact market outcomes
  – ‘How much’ adverse selection is in the market
  – Give some examples
  – How home systems might get around AI/AS

Focus in this chapter will be on the consumer side of AI – how their information alters insurance markets

• Other examples from the supply side we will do later

Market for Lemons

• Nice simple mathematical example of how asymmetric information (AI) can force markets to unravel

• George Akeloff, 2001 Nobel Prize

• Good starting point for this analysis, although it does not deal with insurance

Problem Setup

• Market for used cars
• Sellers know exact quality of the cars they sell
• Buyers can only identify the quality by purchasing the good
• Buyer beware: cannot get your $ back if you buy a bad car
• Two types of cars: high and low quality
  – High quality cars are worth $22,000
  – Low are worth $2000
• Suppose that people know that in the population of used cars that ½ are high quality
  – Already a strong (unrealistic) assumption
  – But even with this strong assumption, we get startling results

• Buyers do not know the quality of the product until they purchase
• Assume firms (buyers) are risk neutral
• How much are they willing to pay?
• Expected value = (1/2)$22K + (1/2)$2K = $12K
• People are willing to pay $12K for an automobile
• Would $12K be the equilibrium price?

• Who is willing to sell an automobile at $12K
  – High quality owner has $22K auto
  – Low quality owner has $2K
• Only low quality owners enter the market
• Suppose you are a buyer, you pay $12K for an auto and you get a lemon, what would you do?

• Sell it on the market for $12K
• Eventually what will happen?
  – Low quality cars will drive out high quality
  – Equilibrium price will fall to $2000
  – Only low quality cars will be sold
• Here AI/AS means that only a market for low quality goods exists
Some solutions?

- Deals can offer money back guarantees
  - Does not solve the asymmetric info problem, but treats the downside risk of asy. Info
- Buyers can take to a garage for an inspection
  - Can solve some of the asymmetric information problem

Rothschild-Stiglitz

- Formal example of AI/AS in insurance market
- Incredibly important theoretical contribution because it defined what would happen in an equilibrium
- Stiglitz shared prize in 2001 w/ Akerlof and Michael Spence – all worked on AI/AS

Graphically illustrate choices

- Two goods: Income in good and bad state
- Can transfer money from one state to the other, holding expected utility constant
- Therefore, can graph indifference curves for the bad and good states of the world

\[
EU_{wi} = (1-p)U(W) + pU(W-d) = (1-P)U(W_1) + PU(W_2)
\]

- \( p \) = the probability of a bad event
- \( d \) = the loss associated with the event
- \( W \) = wealth in the absence of the event
- \( EU_{wi} \) = expected utility without insurance
- \( EU_{wi} = (1-p)U(W) + pU(W-d) \)
What does slope if the IC equal?

• $EU_w = (1-p)U(W_1) + pU(W_2)$

• $dEU_w = (1-p)U'(W_1)dW_1 + pU'(W_2)dW_2 = 0$

• $dW_2/dW_1 = -(1-p)U'(W_1)/[pU'(W_2)]$
  
  – Slope of indifference curve

• $MRS = dW_2/dW_1$

• How much income in the bad state to you have to give up to get $1 in the good state and keep utility constant
• At point F
  - lots of \( W_2 \) and low MU of income in bad state
  - Little amount of \( W_1 \), MU of income of \( W_1 \) is high
  - Need to give up a lot of income in the bad state to get one more $ in the good state and keep utility constant
• At point \( E_n \)
  - lots of \( W_1 \) and little \( W_2 \)
  - MU of \( W_1 \) is low, MU2 is high, don’t need give up much income in the bad state to get $1 in the good state and keep utility constant

Initial endowment

• Original situation (without insurance)
  – Have \( W \) in income in the good state
  – \( W-d \) in income in the bad state
• Can never do worse than this point
• All movement will be from here
• Base case from our section on expected utility
Add Insurance

- $EU_w$ = expected utility with insurance
- pay $\alpha_1$ in premiums for insurance
- $\alpha_2$ net return from the insurance (payment after loss minus premium)

$EU_w = (1-p)U(W-\alpha_1) + pU(W-d+\alpha_2)$

Insurance Industry

- With probability 1-p, the firm will receive $\alpha_1$ and with probability p they will pay $\alpha_2$
- $\pi = (1-p)\alpha_1 - p\alpha_2$
- With free entry $\pi = 0$
- Therefore, $(1-p)/p = \alpha_2/\alpha_1$
- $(1-p)/p$ is the odds ratio
- $\alpha_2/\alpha_1 =$ MRS of $ for coverage and $ for premium – what market says you have to trade money from the bad state to get one more dollar in the good

Thinking ahead -- some intuition

- We have two exchanges
  - What you are willing to exchange money from the good to the bad state
  - What the market says you have to exchange money from the good to the bad state
- An equilibrium will occur when these two are equal

Fair odds line

- People are endowed with initial conditions
- They can move from the endowment point by purchasing insurance – moving income from the good to the bad state
- The amount the market says they have to trade is the fair odds line -- a line out of the endowment with the slope equal to the fair odds
- When purchasing insurance, the choice must lie along that line
We know that with fair insurance, people will fully insure.

Income in both states will be the same.

\( W - \alpha_1 = W - d + \alpha_2 \)

Which means \( W_1 = W_2 \) and \( d = \alpha_1 + \alpha_2 \)

Let \( W_1 \) be income in the good state.

Let \( W_2 \) be income in the bad state.

\[ d \text{EU}_w = (1-p)U'(W_1)\text{d}W_1 + pU'(W_2)\text{d}W_2 = 0 \]

\[ \frac{\text{d}W_2}{\text{d}W_1} = \frac{-(1-p)U'(W_1)}{pU'(W_2)} \]

With fair ins., \( W_1 = W_2 \) and \( U'(W_1) = U'(W_2) \)

So \( \frac{\text{d}W_2}{\text{d}W_1} = -(1-p)/p \) at util. max. point.

What do we know

- With fair insurance
  - Contract must lie along fair odds line (profits=0)
  - MRS = fair odds line (tangent to fair odds line)
  - Income in the two states will be equal

- Graphically illustrate
Consider two types of people

- High and low risk ($P_h > P_l$)
- Only difference is the risk they face of the bad event ($W$ and $d$ the same for both types)
- Firms cannot identify risk in advance
- People know who they are
- Question: Given that there are 2 types of people in the market, will insurance be sold?

Define equilibrium

- Two conditions
  - No contract can make less than 0 in $E(\pi)$
  - No contract can make $E(\pi) > 0$
- Two possible equilibriums
  - Pooling equilibrium
    - Sell same policy to 2 groups
  - Separating equilibrium
    - Sell policies to different groups

Comparing high and low risk

- Intermediate step is necessary
- Hold income and loss from risk constant
- Change probabilities
- Compare indifference curves for high and low risk
- Only difference will be probabilities
- Definitive change in slope
Comparing high and low Risk

- \( EU_h = (1-p_h)U(W-\alpha_1) + p_hU(W-d+\alpha_2) \)
- \( EU_l = (1-p_l)U(W-\alpha_1) + p_lU(W-d+\alpha_2) \)
- \( MRS_h = (1-p_h)U'(W-\alpha_1)/[p_hU'(W-d+\alpha_1)] \)
- \( MRS_l = (1-p_l)U'(W-\alpha_1)/[p_lU'(W-d+\alpha_1)] \)

- Compare \(|MRS_h|\) vs \(|MRS_l|\)
- Since income will be the same for both people, \(U'(W-\alpha_1)\) and \(U'(W-d+\alpha_1)\) cancel
- \(|MRS_h|\) vs \(|MRS_l|\)
- \(|1-p_h|/p_h|\) vs \(|1-p_l|/p_l|\)
- Since \(p_h > p_l\) then can show that \(|MRS_h| < |MRS_l|\)

Recall that \(|MRS_h| < |MRS_l|\)

Will pooling equilibrium exist?

- Price paid in the pooling equilibrium will a function of the distribution of H and L risks
- Let \(\lambda\) be the fraction of high risk people
- Average risk in the population is 
- \(p^* = \lambda p_h + (1-\lambda)p_l\)
- Actuarially fair policy will be based on average risk
- \(\pi = (1-p^*)\alpha_1 - p^*\alpha_2 = 0\)
Will pooling equilibrium exist?

- Given PC assumption, all pooled contracts must lie along fair odds line for $p^*$
- Consider option (c)
- As we demonstrated prior, holding $W_1$ and $W_2$ constant, $|\text{MRS}_b| < |\text{MRS}_L|$
- Consider plan b. This plan would be preferred by low risk people (to the north east). So if offered, low risk would accept.

- High risk would not consider b
- Since b lies below the fair odds line for L, it would make profits
- The exit of the low risk from plan c would make it unprofitable so this will not be offered
- The existence of b contradicts the definition of an equilibrium, so a pooling equilibrium does not exist
Separating equilibrium

• Contract ($\alpha$ and $\beta$) for high and low risk
  – $\alpha$ provides full insurance in PC situation for H
  – while $\beta$ does the same for L.

• Can this situation last?
  • Ask question
    – Would a low risk person want $\alpha$ contract?
    – Would high risk person want $\beta$ contract?

Some solutions

• Gather data about potential clients and price insurance accordingly
  – Correlates of health care use are factors such as age, race, sex, location, BMI, smoking status, etc.
  – ‘Statistical’ discrimination, may be undone by legislation
  – Expensive way to provide insurance – collecting data about health is costly

• Pre-existing conditions
  – Insurers would not cover conditions for a period of time that were known to exist prior to coverage
  – E.g., if have diabetes, would not cover expenses related to diabetes
  – Reduces turnover in insurance.
  – May create job lock (will do later)
  – Has been reduced to some degree by Federal legislation for those continuously with ins.
• Group insurance
  – Gather people (by area, employer, union)
  – price policy by pool risk
  – Require purchase (otherwise, the low risks opts out)
  – Next section of class is about the largest group insurance program – employer sponsored insurance

Insurance Design
• Construct policies that appeal to high and low risk customers
• Their choice of insurance reveals who they are
• Example: suppose there are two policies
  – High price but low deduc. and copays
  – Low price, high deduc. but catastrophic coverage
  – H/L risk people from R/S. Who picks what?

Is adverse selection a problem?
• What is evidence of adverse selection?
• Some studies compare health care use for those with and without insurance
  – Demand elasticities are low
  – Large differences must be due to adverse selection
  – Problem: adverse selection looks a lot like moral hazard. How do you know the difference?

Example: Harvard University
• Offered insurance through Group Insurance Commission (GIC)
• Initially offered two types of plans
  – Costly plan with generous benefits (Blue Cross/Shield)
  – HMO plan, cheaper, lots of cost sharing
• The generous plan costs a few hundred dollars more per person than the HMO
• Enrollment in the plans were stable over time
• Mid 1990s, Harvard faced a budget deficit (10K employees with health insurance)
• In 1994, Harvard adopted 2 cost saving strategies
  – Would now no longer pay the premium difference between generous plan and the HMO – employees must make up the difference
  – Aggressively negotiated down benefits and premiums. Premiums for the HMO fell substantially
  – Out of pocket expenses for generous plan increased

Who do you anticipate left the generous plan?
What happened to the characteristics of the people left in the generous plan?
What do you think happened to premiums in the generous plan?

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>CHANGES IN EMPLOYEE PAYMENTS RESULTING FROM PRICING REFORM, 1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan</td>
<td>Employee payment</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>FPO</td>
<td>HealthPlan Blue</td>
</tr>
<tr>
<td>IPA</td>
<td>BayState</td>
</tr>
<tr>
<td></td>
<td>Pilgrim</td>
</tr>
<tr>
<td></td>
<td>Tufts</td>
</tr>
<tr>
<td>GS</td>
<td>HCP</td>
</tr>
<tr>
<td></td>
<td>HCP</td>
</tr>
<tr>
<td>HMO average</td>
<td></td>
</tr>
</tbody>
</table>

| Policy  | IPA     | BayState | $3228 | $1344 | $2984 | $986 | 32% |
|         | Pilgrim | 3784     | 1092   | 1488   | 456   | 3   |
|         | Tufts   | 3721     | 1090   | 1488   | 456   | 3   |
| GS      | HCP    | 3252     | 653    | 1456   | 753   | 28  |
|         | HCHP   | 3252     | 653    | 1456   | 753   | 28  |

HMO average | $1095 | $277 | $811 | $164 | 84% |

GS is a group/self-funded HMO. HCP is Harvard Community Health Plan. HCHP is Harvard University Health Program. The HMO run by the University. In 1994 there were 450 individual employees. Out of pocket premiums are for an individual with salary between $40,000 and $70,000.
Insurance 'death spiral'

- Adverse selection in health plan raises rates
- Lower risk patients exit due to increased costs
- Which increases costs
- Lather, rinse, repeat
Small Group Reform

- People without EPHI or small firms must purchase insurance in the ‘Small Group’ Market

- Small groups tend to have
  - Higher prices
  - Higher administrative fees
  - Prices that are volatile

- Prices are a function of the demographics
- Concern: prices for some groups too high
- Lower prices for some by “community rating”
- Nearly all states have adopted some version of small group reform in 1990s

What happened?

- Increased the price for low risk customers
  - Healthy 30 year old pays $180/month in PA
  - $420/month in NJ with community ratings

- Low risks promptly left the market
- Which raised prices
- Policy did everything wrong

Lesson

- Idea was correct:
  - Use low risk to subsidize the high risk

- But you cannot allow the low risk to exit the market
Table 1

<table>
<thead>
<tr>
<th>State</th>
<th>Full reform 1994-1996</th>
<th>Partial reform 1994-1996</th>
<th>Rate before</th>
<th>Rate after</th>
<th>Rate before - Rate after</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>47.18</td>
<td>47.04</td>
<td>1995-1996</td>
<td>1995-1996</td>
<td>-0.14</td>
</tr>
<tr>
<td>GA</td>
<td>75.79</td>
<td>73.71</td>
<td>1995-1996</td>
<td>1995-1996</td>
<td>-2.08</td>
</tr>
<tr>
<td>DC</td>
<td>79.61</td>
<td>77.36</td>
<td>1995-1996</td>
<td>1995-1996</td>
<td>-2.25</td>
</tr>
</tbody>
</table>

Source: Survey (2004)

Effect of full reform on Employer-provided ins. rates, CPS

<table>
<thead>
<tr>
<th>Reform</th>
<th>Before</th>
<th>After</th>
<th>Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small</td>
<td>39.36</td>
<td>37.39</td>
<td>-1.97</td>
</tr>
<tr>
<td>ΔΔ</td>
<td>-1.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>75.79</td>
<td>73.71</td>
<td>-2.08</td>
</tr>
<tr>
<td>ΔΔΔ</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ΔΔΔΔ</td>
<td>-2.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Premiums increased by almost $8

Table 4

<table>
<thead>
<tr>
<th>State</th>
<th>Mean (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY</td>
<td>39.36 (37.39-41.34)</td>
</tr>
<tr>
<td>NC</td>
<td>47.18 (45.42-48.94)</td>
</tr>
<tr>
<td>GA</td>
<td>75.79 (73.94-77.64)</td>
</tr>
<tr>
<td>DC</td>
<td>79.61 (77.84-81.38)</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. Bold font indicates significance at least at the p<0.10 level. See footnote 15 for a full explanation of control variables included.