Asymmetric Information and Adverse selection

Health Economics
Bill Evans

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?
  - 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
• 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 \( \frac{1}{2} \) 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 = \((1/2) \times 22K + (1/2) \times 2K = 12K\)
• 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 for 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 asym. 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

- $p =$ 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
- $EU_{wi} = (1-p)U(W) + pU(W-d)$

- 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
- $EU_{wi} = (1-p)U(W) + pU(W-d)$
  $= (1-p)U(W_1) + pU(W_2)$
As you move NE, Expected utility increases

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

\[ d\text{EU}_w = (1-p)U'(W_1)dW_1 + pU'(W_2)dW_2 = 0 \]

\[ \frac{dW_2}{dW_1} = \frac{-1}{\frac{pU'(W_2)}{U'(W_1)}} \]

- Slope of indifference curve

\[ \text{MRS} = \frac{dW_2}{dW_1} \]

- How much you have to transfer from the bad to the good state to keep expected utility constant

What does slope equal?

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

- \[ d\text{EU}_w = (1-p)U'(W_1)dW_1 + pU'(W_2)dW_2 = 0 \]

- \[ \frac{dW_2}{dW_1} = \frac{-1}{\frac{pU'(W_2)}{U'(W_1)}} \]

- Slope of indifference curve

- \[ \text{MRS} = \frac{dW_2}{dW_1} \]

- What does it measure?
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

- At point F
  - lots of W₁ and low MU of income in bad state
  - Little amount of W₂, MU of income of W₁ is high
  - Need to transfer a lot from good to the bad state to keep utility constant
- At point Eₐ
  - lots of W₁ and little W₂
  - the amount you would need to transfer from the bad state to hold utility constant is not much: MU of good is low, MU of bad state is high
Add Insurance

- $EU_w = \text{expected utility with insurance}$
- 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, $\frac{(1-p)}{p} = \frac{\alpha_2}{\alpha_1}$
- $\frac{(1-p)}{p}$ is the odds ratio
- $\frac{\alpha_2}{\alpha_1} = \text{MRS} \text{ of } \$$ \text{ for coverage and } \$$ \text{ for premium}--\text{what market says you have to trade}$

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.

\[ W - \alpha_1 = W - \alpha_2 \]

So \( \alpha_1 + \alpha_2 \)

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

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

\[
\begin{align*}
\text{d} E U_w &= (1-p)U'(W_1)dW_1 + pU'(W_2)dW_2 = 0 \\
\frac{dW_2}{dW_1} &= -(1-p)U'(W_1)/[pU'(W_2)] \\
\text{With fair ins., } W_1 &= W_2 \text{ and } U'(W_1) = U'(W_2) \\
\text{So } \frac{dW_2}{dW_1} &= -(1-p)/p \text{ at util. max. point}
\end{align*}
\]

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
- 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 $+ E(\pi)$
- Two possible equilibriums
  - Pooling equilibrium
    - Sell same policy to 2 groups
  - Separating equilibrium
    - Sell policies to different groups

$$EU_h = (1-p_h)U(W-\alpha_1) + p_hU(W-d+\alpha_2)$$
$$EU_l = (1-p_l)U(W-\alpha_1) + p_lU(W-d+\alpha_2)$$
$$MRS_h = (1-p_h)U'(W-\alpha_1) \left/ \left( p_hU'(W-d+\alpha_1) \right) \right.$$  
$$MRS_l = (1-p_l)U'(W-\alpha_1) \left/ \left( p_lU'(W-d+\alpha_1) \right) \right.$$  

- 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 $|\text{MRSH}| < |\text{MRSL}|$

- 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
  \[ \pi = (1-p^*) x_1 - p^* x_2 = 0 \]
Pooling equilibrium

- 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, $|\text{MRS}_h| < |\text{MRS}_l|$
- Consider plan b. This plan would be preferred by low risk people (to the north east). So if offered, low risk would accept.

Separating equilibrium

- Contract ($\alpha_h$ and $\beta$)
  - $\alpha_h$ provides full insurance in PC situation for H, while $\beta$ does the same for L.
  - But H would prefer $\beta$
  - Insurers would lose money pricing $\beta$ for L and getting H customers
  - Not possible equilibrium – cannot have separating equilibrium
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 I

<table>
<thead>
<tr>
<th>Plan</th>
<th>Old policy</th>
<th>New policy</th>
<th>Change</th>
<th>Share of enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPO</td>
<td>$273</td>
<td>$355</td>
<td>$827</td>
<td>16%</td>
</tr>
<tr>
<td>HMO</td>
<td>$157</td>
<td>$239</td>
<td>$296</td>
<td>16%</td>
</tr>
<tr>
<td>HMO average</td>
<td>$390</td>
<td>$277</td>
<td>$114</td>
<td>84%</td>
</tr>
<tr>
<td>PPO</td>
<td>$285</td>
<td>$294</td>
<td>$282</td>
<td>$273</td>
</tr>
<tr>
<td>HMO</td>
<td>$394</td>
<td>$229</td>
<td>$240</td>
<td>$198</td>
</tr>
</tbody>
</table>

*PPO is a point-of-service plan. HMO is a Harvard University Health Plan. HMO's offer no other policies and only family plans among full-time employees. Out-of-pocket premiums are for an individual with salary between $4,000 and $70,000.

### Figure 3

**Figure 3: Real Family Premiums at Harvard**

- Sharp rise is OOP For PPO
- Big increase in PPO premiums
- And drop in enrollment
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>
<thead>
<tr>
<th>State</th>
<th>Full reform (yr)</th>
<th>Partial reform (yr)</th>
<th>Bare bones (yr)</th>
<th>State</th>
<th>Full reform (yr)</th>
<th>Partial reform (yr)</th>
<th>Bare bones (yr)</th>
</tr>
</thead>
</table>

Source: authors (2010)
### Effect of full reform on Employer-provided ins. rates, CPS

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
<th>Δ</th>
<th>ΔΔ</th>
<th>ΔΔΔ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reform Small</td>
<td>39.36</td>
<td>37.39</td>
<td>-1.97</td>
<td>-1.83</td>
<td>-2.00</td>
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<tr>
<td>No ref. Small</td>
<td>47.18</td>
<td>47.04</td>
<td>-0.14</td>
<td></td>
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<tr>
<td>Reform Large</td>
<td>75.79</td>
<td>73.71</td>
<td>-2.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No ref. Large</td>
<td>79.61</td>
<td>77.36</td>
<td>-2.25</td>
<td>0.17</td>
<td></td>
</tr>
</tbody>
</table>

Premiums increased by almost $8

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**Table 4.** OLS results, establishment level: the impact of full reform

<table>
<thead>
<tr>
<th></th>
<th>Mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premiums</td>
<td>26.06 (4.2)</td>
</tr>
<tr>
<td>Employee contrib.</td>
<td>28.05 (2.3)</td>
</tr>
<tr>
<td>Decision to offer</td>
<td>26.86 (6.4)</td>
</tr>
<tr>
<td>Coverage rate</td>
<td>47.08 (4.2)</td>
</tr>
</tbody>
</table>

Standard errors in parentheses. Bold font indicates significance at least at the p<0.10 level. See footnote 10 for a full explanation of control variables included.