Moral Hazard

ECON 40447
Fall 2009

First day of class, listed five unique characteristics of the health care sector

- Uncertainty
- Large role for federal govt
- Agency problem
- Non-profit sector

Medical care is however a product purchased in markets

Given the unique characteristics of medical care, what adjustments to the standard economic models of demand do we need to make?

Question for this section

- How can we model the demand for medical care/services given these unique characteristics?
- Does medical care/services follow traditional models (i.e., downward sloping demand)? How do we test this hypothesis?

Quick review of demand curves

- Things you need to know
  - What does the height of the demand curve represent
  - What is consumer’s surplus
  - Differences between the movement along and movement in the demand curve
Some tools of the trade

- **Price elasticity of demand**
  - \( \xi_d = \frac{\%\Delta Q}{\%\Delta P} \)
- **Examples:**
  - \( \xi_d = -0.3, 10\% \uparrow \text{ price}, 3\% \downarrow \text{ in demand} \)
  - \( \xi_d = -1.75, 10\% \uparrow \text{ price}, 17.5\% \downarrow \text{ in demand} \)
- When looking at demand curves on the same scale, the steeper demand curve, the lower elasticity of demand (absolute value)

- Notice that for the same change in price, Market 1 has a more pronounced change in demand
  - \( |\xi_1| > |\xi_2| \)
Factors that determine elasticity of demand

- Services for more acute conditions should have lower elasticity of demand
  - You need care at that moment, cannot wait for treatment
  - Emergency room visits low elast. of demand
- Availability of substitutes
  - When they are plentiful, greater elasticity of demand
    - many type of mental health treatments, therefore, high elast. for each
    - Few alternatives for AIDS drugs, so low elast.
    - Generic vs name brand drugs

- Preventive services should have higher elast.
  - Less time sensitive, can substitute over time
- Larger fraction of income, greater elast of demand
  - Have to think twice about cost
  - Long term care/assisted living is expensive, high elast of demand (and many substitutes, like informal care)

Demand for medical services

- Like any other good, medical services are consumed on a per unit basis
  - Doctor visits, Prescriptions, X-rays, etc.
  - Some ‘units’ are easier to measure
- Each has a price attached to it
- What is different for medical care is that often, the price paid by the patient is not the price of the good (insurance)

- The demand for medical services slopes down just like any other product
- The position of the demand curve can however change radically based on external conditions
- Example: demand for a particular drug is highly dependent on your current state of health
Some factors that may shift the demand curve
- Medical state
- Socioeconomic status (income and education)
- Price of other medical services

Example: Compliments
- As price falls for good 1, people are willing to demand more of good 2 at any price

Income elasticity of demand
- $\eta = \frac{\% \Delta Q}{\% \Delta \text{Income}}$
- $\eta = 0.25$
  - 10% increase in income, 2.5% increase in quantity demanded
- $\eta = 1.5$
  - 10% increase in income, 15% increase in quantity demanded
- Normal goods $\eta > 0$
- Inferior goods $\eta < 0$

Shifts in demand due to health state
- Demand for medical services is state-dependent
- When health is poor, demand may be greater
  - At any price, you demand more
- Change in health status could have two effects
  - Shift demand
  - Make less/more price responsive
Shifts due to price of other medical goods

- Strong inter-relationship between different medical services. Some are substitutes, some are compliments
- Price of one procedure can therefore impact the demand for another
- Compliments: Doctors visits and medical tests
- Substitutes: Psychotropic drugs and psychiatric visits

- Suppose you are diagnosed w/ high cholesterol
- Predictor of heart disease
- Increased risk of death
- Standard treatment after diagnosis
  - Change diet
  - Increase exercise
- As cholesterol level rises, ability to control with behavior modification declines
- Therefore, demand for pharmaceutical solution should rise
Cost sharing in insurance

- Insurance is designed to reduce the welfare loss due to uncertainty
- Insurance can however generate ‘moral hazard’
- Can reduce moral hazard by cost-sharing
- In most cost sharing plans, the costs of using medical care by policy holders is however reduced, encouraging use

Cost sharing in insurance

- Copayment
  - Usually fixed dollar amount per service
- Deductibles
  - Dollar amount you have to pay out of pocket (OOP) before insurance will start paying
- Coinsurance
  - Fixed percent paid by the policy holder for every dollar spent
- Stop loss
  - A point where if OOP expenditures exceed a particular value, coinsurance rates go to 0
Medicare Part D

- $448 Annual premium
- $295 deductible
- Between $295 and $2700 in total costs, coinsurance of 25%
- After $2700 in total costs, coinsurance rate is 100% (donut hole)
- Once out of pocket expenses (not total expenses) reach a “catastrophic level” of $4350, coinsurance falls to 5%
### Distribution of Covered Workers With the Following Types of Cost Sharing for a Hospital Admission, 2005*

<table>
<thead>
<tr>
<th>HOSPITAL ADMISSIONS</th>
<th>Direct/DMO or Copay Only</th>
<th>coinsurance Only</th>
<th>By Age</th>
<th>By Coverage</th>
<th>Annual Deductible</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Plan</td>
<td>29%</td>
<td>10%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>54%</td>
</tr>
<tr>
<td>HMO Plans</td>
<td>55%</td>
<td>3%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td>40%</td>
</tr>
<tr>
<td>PPO Plans</td>
<td>26%</td>
<td>3%</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
<td>55%</td>
</tr>
<tr>
<td>POS Plans</td>
<td>45%</td>
<td>6%</td>
<td>4%</td>
<td>4%</td>
<td>0%</td>
<td>40%</td>
</tr>
<tr>
<td>ALL PLANS</td>
<td>36%</td>
<td>10%</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
<td>68%</td>
</tr>
</tbody>
</table>

*Estimates are statistically different from estimates for the previous year shown by plan type (p < .05). Note: Average annual health plan deductibles for HMOs, PPO plans, and HDHP/HD/OS are for full-time workers, Source: Kaiser-HRET Survey of Employer-Sponsored Health Benefits, 2006-2008.*

### Among Covered Workers with Separate Hospital Cost Sharing, Average Cost Sharing, 2005*

<table>
<thead>
<tr>
<th>ALL Small Firms (1-99 Full-Time Employees)</th>
<th>At Admittance</th>
<th>At Discharge</th>
<th>Per Enrollee</th>
</tr>
</thead>
<tbody>
<tr>
<td>3242</td>
<td>10%</td>
<td>17%</td>
<td>$613</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ALL Large Firms (100 or More Employees)</th>
<th>At Admittance</th>
<th>At Discharge</th>
<th>Per Enrollee</th>
</tr>
</thead>
<tbody>
<tr>
<td>3241</td>
<td>10%</td>
<td>17%</td>
<td>$613</td>
</tr>
</tbody>
</table>

*Estimates are statistically different from estimates for the previous year shown by plan type (p < .05). Source: Kaiser-HRET Survey of Employer-Sponsored Health Benefits, 2006-2008.
Among Covered Workers Facing Prescription Drug Copayment Amounts, Average Copayments, 2000-2005

EXHIBIT 1

1% of people represent ¼ of all HC spending
Top 5% represent ½ of all spending
Top 30 percent represent 90% of all spending

Copayments

- How do copayments impact demand?
- Example: suppose you pay a $10 copay for each prescription (Rx)
  - If the Rx is $50, you pay $10, insurance pays $40
- Note that
  - If P<$10, you pay the price
  - if P>$10, you only pay $10
- What does this do to your demand

- Suppose there is a copayment rate of $C
- Without insurance, demand is line (ab)
- At a price of $C, people will demand $Q_1$
- With a copay of $C$, any price in excess of $C$ generates out of pocket price of only $C$, so demand is vertical at $Q_1$
- Demand with a copay is therefore line (acd)
Coinsurance

- \( P_m \) be price of medical care
- \( C \) is the coinsurance rate

- For next unit consumed by patient
  - consumer pays \( P_m C \)
  - Insurance pays \( P_m (1 - C) \)
  - Provider receives \( P_m \)

How coinsurance changes demand

- \( Q_d = f(P) \) where \( P \) is price paid by the consumer
- Coinsurance changes this. Now there is a wedge between what the MD gets and the patient pays
- Let
  - \( P_s \) the price received by suppliers (providers)
  - \( P_d \) the price paid by the demanders (patient)

- In our supply and demand graph world, the price axis will represent the price received by sellers (\( P_s \))
- Without coinsurance
  - \( P_d = P_s \)
- With coinsurance
  - \( P_d = cP_s \) so
  - \( P_d / c = P_s \)
• Consider graph on the next slide

• Without coinsurance
  – When \( P_s = 0 \), \( Q_d = Q_m \)
  – When \( P_s = P_m \), \( Q_d = 0 \)

• With coinsurance
  – \( P_d = P_c \)
  – When \( P_s = 0 \), \( P_d \) still \( = 0 \), \( Q_d = Q_m \)
  – (demand curve rotates at point a)
  – \( P_s \) would have to rise to \( P_m / c \) to eliminate demand
    - since if \( P_s = P_m / c \), \( P_d = P_c = (P_m / c) / c = P_m / c \)

• Without insurance, at price \( P_1 \), patients would be willing to consume \( Q_1 \)
• With insurance, in order for consumers to demand \( Q_1 \), the price received by sellers would have to rise to \( P_1 / c \)
  – Doctor charges \( P_1 / c \)
  – Consumer pays \( (P_1 / c) / c = P_1 \)
  – Consumer is only concerned with the price after coinsurance

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Example

• Demand curve without coinsurance
  – \( P_d = 100 - 10Q \)

• Coinsurance rate of \( c \)
  – With coinsurance, \( P_d = P_c \)

• Demand curve with coinsurance
  – \( P_d = P_c = 100 - 10Q \) / 10
  – \( P = 100 / c - 10Q / c \)
• P = 100 – 10Q
  – when P = 0, Q = 10 and
  – when P = 100, Q = 0
• Let c = 50%
• P = 100/c – 10Q/c = 200 – 20Q
  – when P = 0, Q = 10 and
  – when P = 200, consumers pay 100 and Q = 0

• Note that if c = 0, when P = $50, Q = 5
• With c = 0.5, P = $50, Q = 7.5
Deadweight loss of insurance

• With coinsurance
  – Output ↑ from Q₁ to Q₂
  – Price received by sellers ↑ from P₁ to P₂
• Recall what height of the demand curve represents
  – At Q₂ consumers value the last unit at P₃
  – Doctors get P₂
  – Patients only pay P₂c
• Now there is a wedge between what people value the last unit and what they pay

Because of this wedge, there is use beyond a socially optimal level
• Consumers value the increased consumption at area Q₁acQ₂
• What it cost society to produce this extra output? Area Qᵋ₁abQ₂
• Clearly Q₁acQ₂ < Q₁abQ₂
• Area (abc) deadweight loss of insurance

Example

• Pₚ = 40 – 2Q
• Pₛ = 4 + 4Q
• c = 0.25
  – Patients pick up 25%
  – Insurance picks up 75%
• Market solution without insurance
  – Pₛ=Pₛ
  – 40-2Q=4+4Q; 36=6Q
  – Q=6, P=28

Demand curve with insurance
• Pₛ=Pₛc = 40 – 2Q
• P = 40/c – 2Q/c = 40/.25 = 2Q/.25
• P = 160 – 8Q
• Market solution with insurance
  – Supply = Demand
  – 4 + 4Q = 160 – 8Q
  – 156 =12Q
  – Q = 13
  – P = 56
• What do consumers value the last unit consumed?
  – $Q = 13$
  – $P_d = 40 - 2Q = 40 - 2(13) = 14$
• DWL = triangle abc
• Area = $\frac{1}{2}$height x base
  – $= \frac{1}{2}(56-14)(13 - 6)$
  – $= 140$

The tradeoffs?
(Why people hate economists)

• Recall from expected utility section
  – Insurance increases welfare because it reduces uncertainty
  – Consumers are willing to pay a premium to reduce uncertainty
• But -- the structure of insurance is such that consumers do not pay the full dollar price of service, encouraging them to over use, which generates a deadweight loss

• Feldman and Dowd
  – Use 1980s data
  – $33$ billion to $109$ billion loss
  – 9 to 29% of health care spending (mid 80s levels)
  – (9 – 29% of hc spending in 2007 is $198 - $638 billion)
• Optimal coinsurance rate?
  – Estimate puts it at about 33-45%
  – Far above current values
Estimating the elasticity demand for medical care

• Key parameter in the previous discussion is the elasticity of demand for medical care
• Empirical question.
• Question is, how does one go about estimating a model with real world data?

Typical study

• Suppose you have variation across people in the price they pay for medical care
• Can examine whether use is negatively related to price
• Price is determined by the generosity of insurance
• End up comparing people with more or less generous health insurance

• Insurance is not randomly assigned. People with particular characteristics may end up with more or less generous insurance
• Positive selection
  – People with the greatest demand for medical care
  – Those who are the sickest
    • with low income, low education
    • History of illness
• Negative selection
  – Insurance is a normal good.
  – Tax preferred vehicle. People with high incomes and education have more income and better insurance
How selection screws up the analysis

• Suppose there are two groups
  – Group 1: Generous insurance (lower price)
  – Group 2: Less generous insurance (higher price)

• Suppose we compare the use of medical services for people in these two groups
  – Call these variables $M_1$ and $M_2$

• Suppose there is negative selection
  – Those with highest income/education have better insurance
  – These groups also have the lowest use of medical services because they are healthier

Example: Doctor visits and self reported health status

<table>
<thead>
<tr>
<th>Status</th>
<th>% of sample</th>
<th>Annual MD visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>20.5%</td>
<td>6.9</td>
</tr>
<tr>
<td>Fair</td>
<td>32.7%</td>
<td>6.3</td>
</tr>
<tr>
<td>Good</td>
<td>38.8%</td>
<td>4.8</td>
</tr>
<tr>
<td>Excellent</td>
<td>8.8%</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Solution: Quasi-Experimental Variation

- Two groups. Very similar initial conditions (insurance quality and medical services)
- Suddenly, for a particular reason, the price of insurance is changed in one group (treatment)
  - The treatment group may have had a change in use
  - However, use in the group may have changed for a particular reason anyway
- The group that has not experienced a change forms a 'control' group – how would medical care usage change over time if policies are held constant

Difference in Difference

<table>
<thead>
<tr>
<th></th>
<th>Before Change</th>
<th>After Change</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 (Treatment)</td>
<td>$M_1$</td>
<td>$M_2$</td>
<td>$\Delta M_t = M_2 - M_1$</td>
</tr>
<tr>
<td>Group 2 (Control)</td>
<td>$M_{c1}$</td>
<td>$M_{c2}$</td>
<td>$\Delta M_c = M_{c2} - M_{c1}$</td>
</tr>
<tr>
<td>Difference</td>
<td></td>
<td></td>
<td>$\Delta \Delta M = \Delta M_t - \Delta M_c$</td>
</tr>
</tbody>
</table>

- Does not suffer from the same problems as the analysis where we compared outcomes in a cross-section across groups
- Have a comparison sample to ask the counterfactual – what would use be in the absence of the intervention?
- Concern? What if the ‘natural’ experiment was happening for a reason – e.g., higher expected costs in the future.
- We would expect some portion of $\Delta M_t > 0$ because of rising health care costs

Experimental design: RAND

- 2000 families
- Four sites
  - Dayton, Seattle, MA, SC
- Four coinsurance rates
  - 0, 25, 50 and 95%
- Also HMO comparison w/ 0% coinsurance
- Various ‘caps’ on ‘maximum dollar expenditures’
  - Did not want families to go bankrupt in the experiment
- Covered most services except services like braces
- Enrolled for 3-5 years
- Non-Medicare (<63) eligible
- Participant given cash subsidy to enroll
  - Maximum expected loss from participating
  - Less likely to enroll if the already had insurance
  - Goal: enrolling should make them no worse off
- Claims filed with experiment

### Annual Per Capita Medical Use

<table>
<thead>
<tr>
<th>Plan</th>
<th>Visits</th>
<th>Outpat. $</th>
<th>Hosp Admits</th>
<th>Hosp $</th>
<th>Total $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free</td>
<td>4.55</td>
<td>$630</td>
<td>0.128</td>
<td>$769</td>
<td>$1410</td>
</tr>
<tr>
<td>25%</td>
<td>3.33</td>
<td>$489</td>
<td>0.105</td>
<td>$701</td>
<td>$1160</td>
</tr>
<tr>
<td>50%</td>
<td>3.03</td>
<td>$421</td>
<td>0.092</td>
<td>$846</td>
<td>$1078</td>
</tr>
<tr>
<td>95%</td>
<td>2.73</td>
<td>$382</td>
<td>0.099</td>
<td>$592</td>
<td>$1016</td>
</tr>
</tbody>
</table>

Real 2005 dollars

### Translating results

- Elasticity of demand $\xi = \%\Delta Q / \%\Delta P$
- $\xi = [(Q_2 - Q_1)/(Q_1 + Q_2)] / [(P_2 - P_1)/(P_1 + P_2)]$
- Not accurate if prices are far apart
- Arc elasticity of demand
  - $\xi = [(Q_2 - Q_1)/(Q_1 + Q_2)] / [(P_2 - P_1)/(P_1 + P_2)]$
  - The /2's cancel
  - $\xi = [(Q_2 - Q_1)/(Q_1 + Q_2)] / [(P_2 - P_1)/(P_1 + P_2)]$
• Look at moving from 25% to 95% coinsurance rate. $P_2$ is 0.95 and $P_1$ is 0.25
• Visits fall from 3.33 to 2.73
• $\xi = \frac{(2.73 - 3.33)/(2.73 + 3.33)}{(0.95-0.25)/(0.95+0.25)} = -0.17$

### Elasticities, Going from 25-95% Coinsurance

<table>
<thead>
<tr>
<th></th>
<th>MEPS 2005</th>
<th>Rand HIE 2005 $ Free Care</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total spending, &lt;65</strong></td>
<td>$2686</td>
<td>$1410</td>
</tr>
<tr>
<td>Inpatient</td>
<td>$743</td>
<td>$769</td>
</tr>
<tr>
<td>% with any inpatient</td>
<td>0.058</td>
<td>0.103</td>
</tr>
<tr>
<td>Prescription drugs</td>
<td>$551</td>
<td>$106</td>
</tr>
<tr>
<td>Outpatient</td>
<td>$273</td>
<td>$630</td>
</tr>
</tbody>
</table>