Moral Hazard

ECON 40565
Fall 2007

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- 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?

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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?

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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

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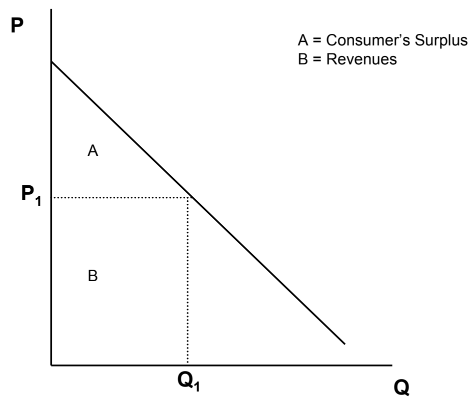

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Some tools of the trade

- **Price elasticity of demand**
  - **$\xi_d = \%\Delta Q / \%\Delta P$**
- **Examples:**
  - **$\xi_d = -0.3$, 10% ↑ price, 3% ↓ in demand**
  - **$\xi_d = -1.75$, 10% ↑ price, 17.5% ↓ in demand**
- **When looking at demand curves on the same scale, the steeper demand curve, the lower elasticity of demand (absolute value)**

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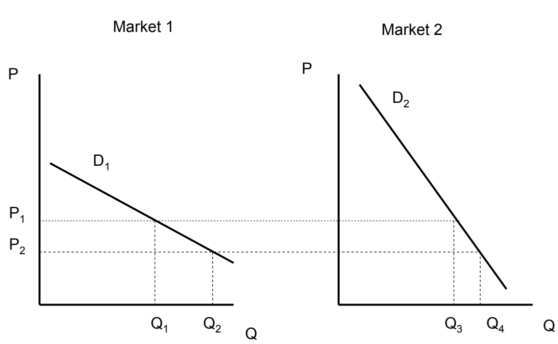

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- **Notice that for the same change in price, Market 1 has a more pronounced change in demand**
- **$| \xi_1 | > | \xi_2 |$**

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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

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- 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)

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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)

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- 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

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- **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**

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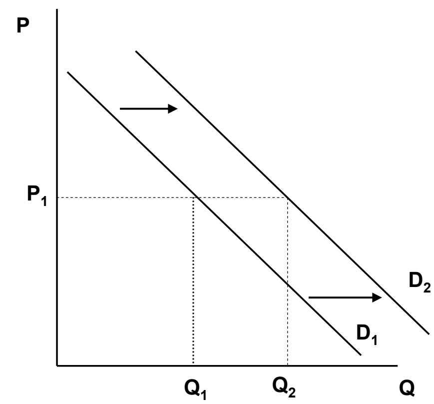

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Income elasticity of demand

- **ή = % ΔQ/%ΔIncome**
- **ή = 0.25**
  - **10% increase in income, 2.5% increase in quantity demanded**
- **ή = 1.5**
  - **10% increase in income, 15% increase in quantity demanded**
- **Normal goods ή>0**
- **Inferior goods ή<0**

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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 more price responsive**

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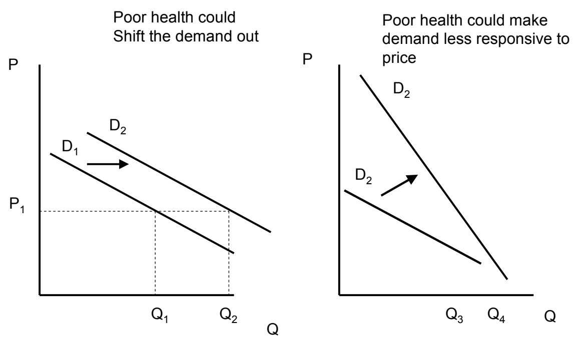

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- **Suppose you are diagnosed w/ high cholesterol**
- **Predictor of heart disease**
- **Increased risk of death**
- **Standard treatment after diagnosis**
  - **Change diet**
  - **Increase exercise**
- **As cholesterol level rises, demand for pharmaceutical solution should rise**
- **The higher the cholesterol level, the more willing you are to pay for drugs**

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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**

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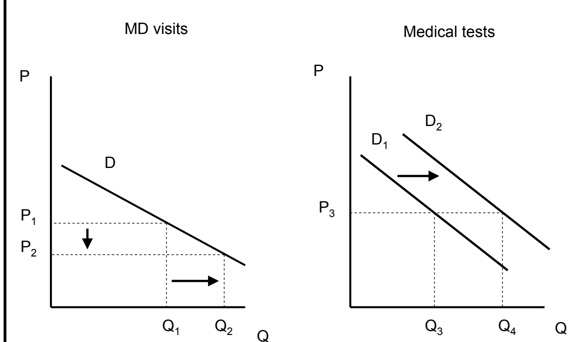

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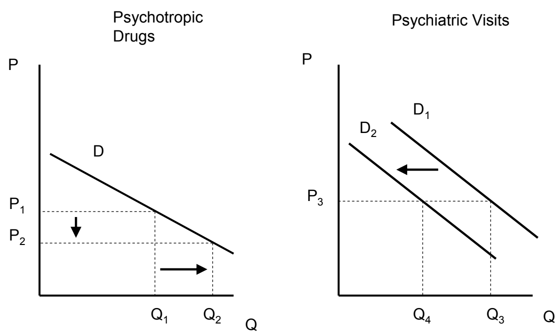

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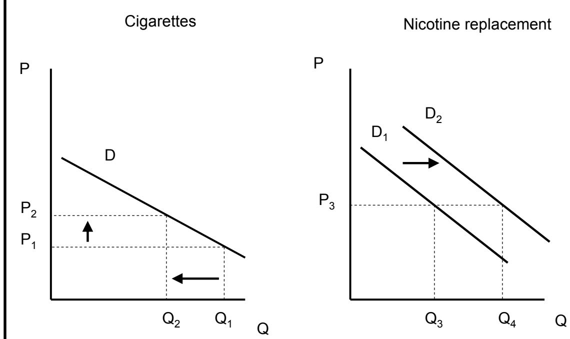

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Cost sharing in insurance

- 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

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Cost sharing in insurance

- Copayment
  - Usually fixed dollar amount per service
- Deductibles
  - Dollar amount you have to pay out of pocket 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

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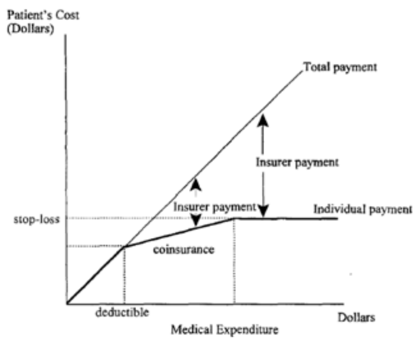

Figure 3. Cost sharing under indemnity insurance.

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Medicare Part D

- $328 Annual premium
- $265 deductible
- Between $265 and $2400 in total costs, coinsurance of 25%
- Between $2400 and $545, coinsurance of 100%

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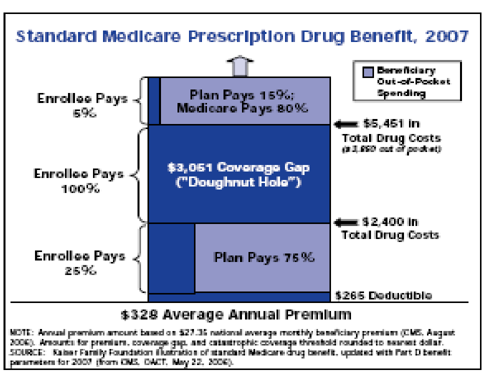

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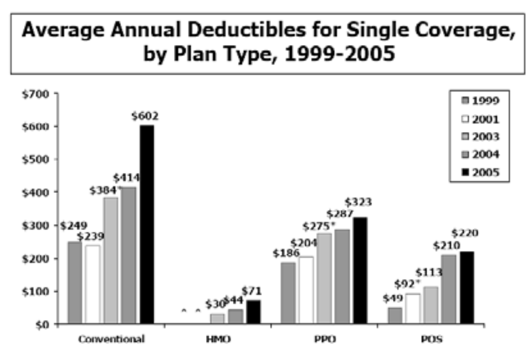

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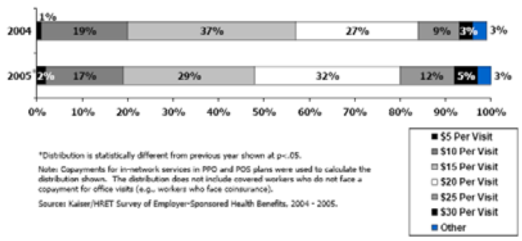
Among Covered Workers Facing Copayments for Physician Office Visits, Distribution of Copayments, 2004-2005



*Distribution is statistically different from previous year shown at p<.05.

Note: Copayments for in-network services in PPO and POS plans were used to calculate the distribution shown. The distribution does not include covered workers who do not face a copayment for office visits (e.g., workers who face coinsurance).

Source: Kaiser/HRET Survey of Employer-Sponsored Health Benefits, 2004 - 2005.

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Distribution of Covered Workers With the Following Types of Cost Sharing for a Hospital Admission, 2005*

	Deductible or Copay Only	*Coinsurance Only*	*Copay and Coinsurance*	*Charge Per Day*	*Annual Deductible*	*None*
HOSPITAL ADMISSIONS						
Conventional Plans	25%	14%	1%	0%	6%	54%
HMO Plans	55	3	1	4	0	37
PPO Plans	26	13	3	1	1	55
POS Plans	46	6	4	4	0	40
ALL PLANS	**36%**	**10%**	**3%**	**2%**	**1%**	**48%**

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

	Average Hospital Deductible/Copay	Average Hospital Coinsurance	Average Hospital Per Diem
All Small Firms (3-199 Workers)	$284	17%	NSD
All Large Firms (200 or More Workers)	224	16	140
ALL FIRM SIZES	$241	16%	$163

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Among Covered Workers Facing Prescription Drug Copayment Amounts, Average Copayments, 2000-2005

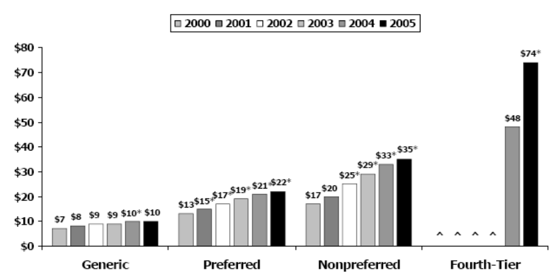

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EXHIBIT 1
Distribution Of Health Expenditures For The U.S. Population, By Magnitude Of Expenditures, Selected Years 1928–1996

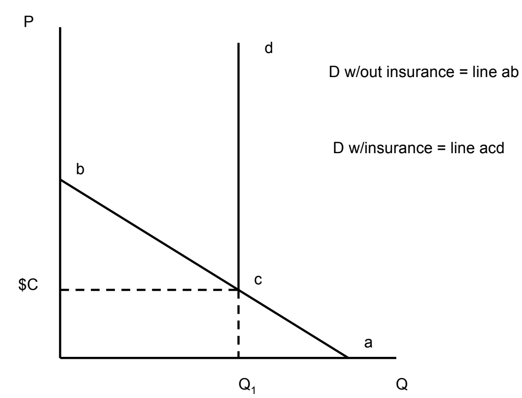
Percent of U.S. population ranked by expenditures	1928	1963	1970	1977	1980	1987 charges	1987 payments	1996 payments
Top 1 percent	–	17%	26%	27%	29%	30%	28%	27%
Top 2 percent	–	–	35	38	39	41	39	38
Top 5 percent	52%	43	50	55	55	58	56	55
Top 10 percent	–	59	66	70	70	72	70	69
Top 30 percent	93	–	88	90	90	91	90	90
Top 50 percent	–	95	96	97	96	97	97	97

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

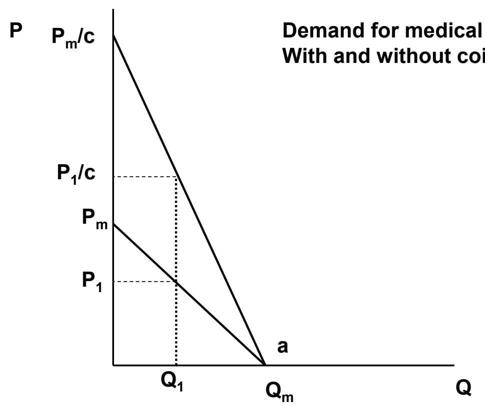
- For next unit consumed by patient
  - consumer pays $P_m c$
  - Insurance pays $P_m(1-c)$
  - Provider receives P_m

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
  - $P_s = cP_s$ 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
  - $P_d = P_s c$
  - 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 $P_s = P_m/c$, $P_d = P_s c = (P_m c)/c = P_m$



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- 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, $P_d = Pc$
- Demand curve with coinsurance
  - $P_d= Pc = 100 – 10Q$
  - $P = 100/c – 10Q/c$

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- P = 100 – 10Q
  - when P_s =0, Q=10 and
  - when P_s = 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

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- **Note that if c=0, when P=\$50, Q=5**
- **With c = 0.5, P=\$50, Q=7.5**

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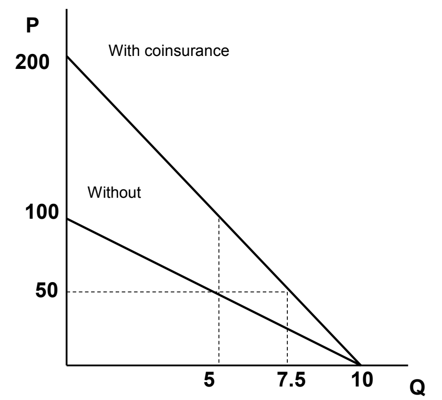

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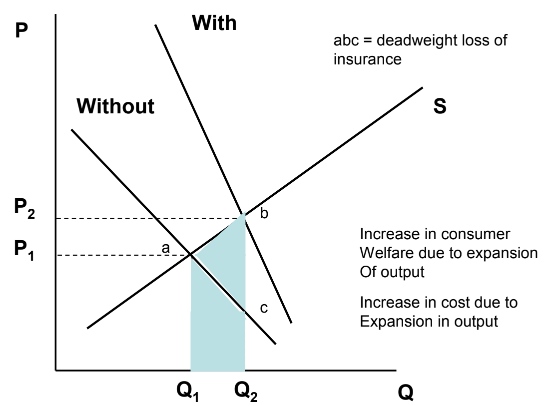

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Deadweight loss of insurance

- **With coinsurance**
  - **Output ↑ from Q_1 to Q_2**
  - **Price ↑ from P_1 to P_2**
- **Recall what height of the demand curve represents**
  - **At Q_2 consumers value the last unit at P_3**
  - **Doctors get P_2**
  - **Patients only pay P_2c**
- **Now there is a wedge between what people value the last unit and what they pay**

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- Because of this wedge, there is use beyond a socially optimal level
- Consumers value the increased consumption at area Q_1acQ_2
- What it cost society to produce this extra output? Area Q_1abQ_2
- Clearly $Q_1acQ_2 < Q_1abQ_2$
- Area (abc) deadweight loss of insurance

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Example

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

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- Demand curve with insurance
  - $P_d=P_sc = 40 – 2Q$
  - 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

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- What do consumers value the last unit consumed?
  - Q = 13
  - P_d= 40 - 2Q = 40 – 2(13) = 14
- DWL= triangle abc
- Area = (1/2)height x base
  - = (1/2)(56-14)(13 – 6)
  - = 140

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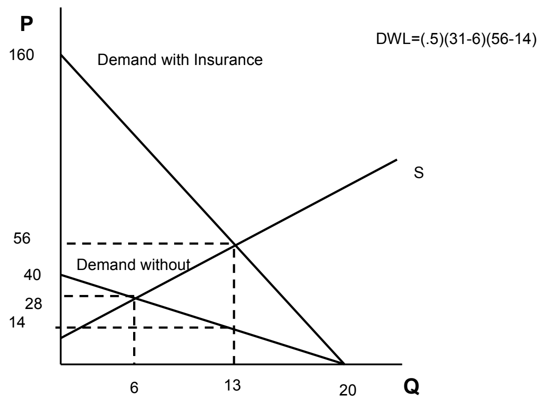

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What is the welfare loss of excess insurance?

- Recall from expected utility section
  - Insurance increases welfare because it reduces uncertainty
  - Consumers are willing to pay a premium to reduce uncertainty
- Because of the structure of insurance, consumers do not pay the full dollar price of service, encouraging them to over use
- What is the welfare loss (or gain) of insurance???

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- Feldman and Dowd
  - Use 1980s data
  - $33 billion to $109 billion loss
  - 9 to 29% of health care spending (mid 80s levels)
- Optimal coinsurance rate?
  - One estimate puts it at about 45%
  - Far above current values

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Estimating the elasticity demand for medical care

- Key parameter in the previous discussion is the elasticity of demand for medical care
- Empirical question. Need to utilize data to estimate the value
- Question is, how does one go about using data for this question?

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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

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- 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. People with high incomes and education have more income and better insurance

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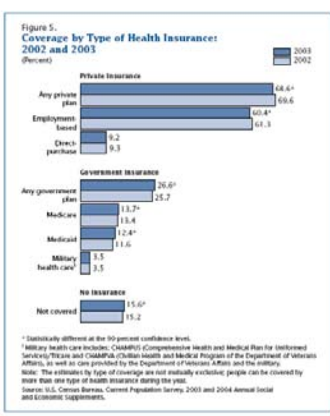

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Table 7
Health Insurance Coverage of Workers, 2003

	Workers (millions)	Percent Distribution by Coverage Type: Private		Public		Uninsured
		Employer	Individual	Medicaid	Other[h]	
Total - Workers[k]	**141.8**	**70.7%**	**5.6%**	**3.8%**	**1.1%**	**18.7%**
Age						
18-34	52.7	60.2%	6.4%	6.1%	0.9%	26.4%
35-54	70.3	76.4%	4.8%	2.8%	1.0%	15.0%
55-64	18.8	78.5%	6.4%	1.5%	2.3%	11.3%
Worker's Annual Income[l]						
<$20,000	45.2	47.6%	7.8%	8.7%	1.8%	34.2%
$20,000 - $39,999	46.5	74.8%	4.6%	2.4%	0.9%	17.2%
$40,000 +	50.1	87.7%	4.5%	0.8%	0.8%	6.2%
Family Poverty Level[c]						
<100%	12.0	21.6%	9.5%	17.9%	1.5%	49.5%
100-199%	22.0	42.7%	6.9%	8.2%	1.5%	40.6%
200-299%	23.0	67.6%	6.0%	3.2%	1.3%	22.0%
300-399%	20.6	79.3%	4.8%	1.4%	1.2%	13.3%
400%+	64.1	87.8%	4.5%	0.7%	0.9%	6.0%
Work Status[f]						
Full-time/Full-year	97.4	77.7%	4.2%	1.9%	0.8%	15.4%
Full-time/Part-year	19.4	55.7%	5.9%	8.0%	1.5%	28.8%
Part-time/Full-year	13.1	58.2%	10.5%	6.1%	2.2%	23.0%
Part-time/Part-year	11.9	51.5%	11.1%	10.5%	2.3%	24.7%
Business Size (# Workers)						
Self-employed[m]	12.8	48.6%	19.6%	2.7%	1.8%	27.4%
<25	29.7	53.3%	7.3%	5.4%	1.4%	32.6%
25-99	17.2	69.8%	4.5%	4.5%	0.9%	20.5%
100-499	16.3	77.0%	2.9%	3.7%	0.7%	15.6%
500-999	6.1	78.0%	3.7%	3.3%	1.1%	13.9%
1000+	39.3	79.4%	3.2%	3.7%	0.9%	12.8%
Public Sector	20.4	86.4%	2.7%	2.3%	1.5%	7.1%

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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

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Example: Doctor visits and self reported health status

Status	% of sample	Annual MD visits
Poor	20.5%	6.9
Fair	32.7%	6.3
Good	38.8%	4.8
Excellent	8.8%	3.3

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- The difference between M_1 and M_2 will be artificially low because healthier people are over-represented in group 1
- As a result, you would understate the elasticity of demand for medical care

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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

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Difference in Difference

	Before Change	After Change	Difference
Group 1 (Treatment)	M_{t1}	M_{t2}	$\Delta M_t = M_{t2} - M_{t1}$
Group 2 (Control)	M_{c1}	M_{c2}	$\Delta M_c = M_{c2} - M_{c1}$
Difference			$\Delta\Delta M$ $\Delta M_t - \Delta M_c$

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- 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

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Random assignment clinical trials

- Considered gold standard for determining causal relationships
- Population is recruited for a study
- Participants are randomly assigned treatment or control
- Compare the outcomes across the two groups
- Let Y_t and Y_c be the average outcomes across the treatment and control groups

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Example

- Introducing a new cholesterol reducing drug
- Recruit population of patients w/ high cholesterol levels
- get baseline cholesterol levels
- Assign half to treatment and half to control
- After fixed period of time, calculate
  - Y_i = change in cholesterol levels for groups t and c
  - $\Delta Y = Y_t - Y_c$ = estimated impact of the new drug

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- Expect people with high cholesterol to have some baseline change in levels
- Subtract Y_c from Y_t
- Why is random assignment not subject to the same criticism that studies using field data are?

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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

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- 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

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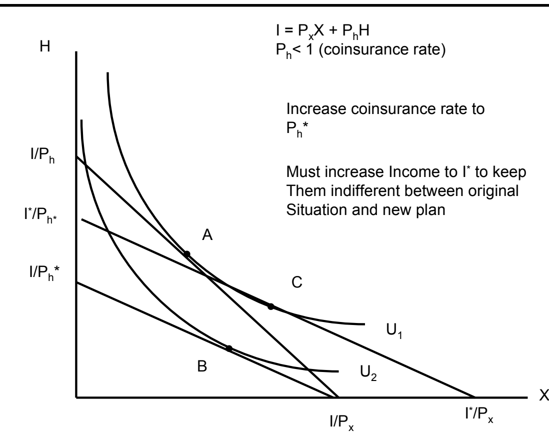

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Annual Per Capita Medical Use

Plan	Visits	Out-pat. $	Hosp Admits	Hosp $	Total $
Free	4.55	$630	0.128	$769	$1410
25%	3.33	$489	0.105	$701	$1160
50%	3.03	$421	0.092	$846	$1078
95%	2.73	$382	0.099	$592	$1016

Real 2005 dollars

Translating results

- Elasticity of demand $\xi = \%\Delta Q / \%\Delta P$
- $\xi = [(Q_2 - Q_1)/Q_1]/[(P_2 - P_1)/P_1]$
- Not accurate if prices are far apart
- Arc elasticity of demand

- $\xi = [(Q_2 - Q_1)/(Q_1 + Q_2)/2]/[(P_2 - P_1)/(P_1 + P_2)/2]$
- 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
- $\xi = [(2.73 - 3.33)/(2.73+3.33)]$
  $/[(0.95-0.25)/(0.95+0.25)] = -0.17$

Elasticities, Going from 25-95% Coinsurance

- Outpatient $
  - Acute -0.32
  - Chronic -0.23
  - Preventive -0.43
- Total outpatient -0.31
- Hospital -0.14
- Total Medical -0.22
- Dental -0.39