

Moral Hazard

**ECON 40447
Fall 2009**

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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

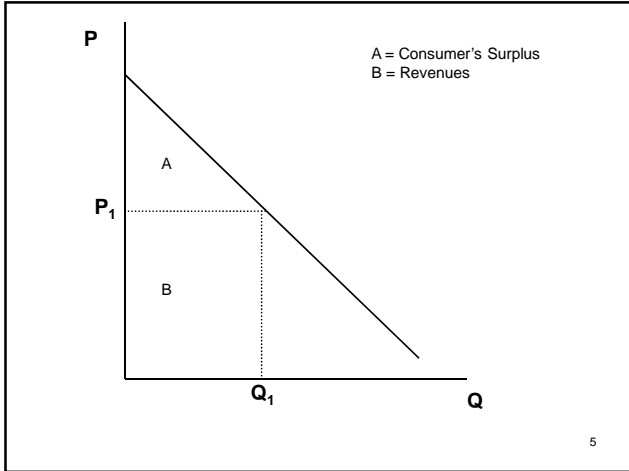
- **How can we model the demand for medical care/services given these unique characteristics?**
- **Does medical care/services follow traditional models (i.e., downward sloping demand)? How do we test this hypothesis?**

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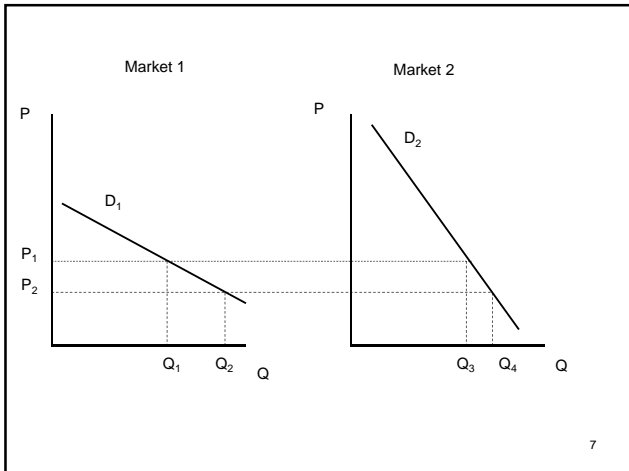
Quick review of demand curves

- **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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- ### 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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- 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)**

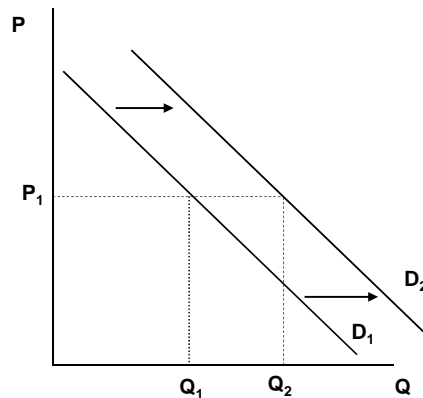
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- **The demand for medical services slopes down just like any other product**
- **The position of the demand curve can however change radically based on external conditions**
- **Example: demand for a particular drug is highly dependent on your current 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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Income elasticity of demand

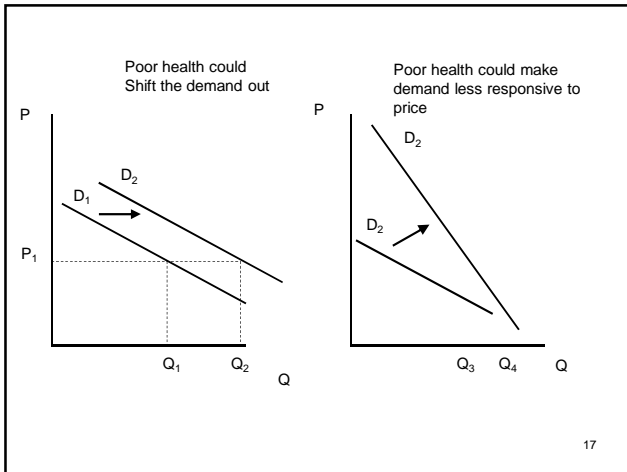
- $\eta = \% \Delta Q / \% \Delta \text{Income}$
- $\eta = 0.25$
 - 10% increase in income, 2.5% increase in quantity demanded
- $\eta = 1.5$
 - 10% increase in income, 15% increase in quantity demanded
- Normal goods $\eta > 0$
- Inferior goods $\eta < 0$

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Shifts in demand due to health state

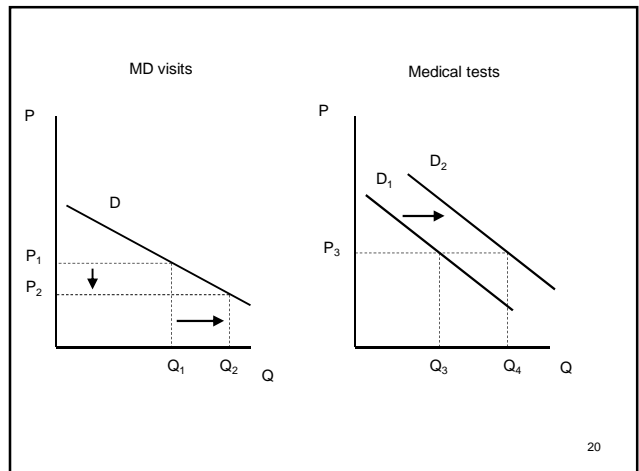
- Demand for medical services is state-dependent
- When health is poor, demand may be greater
 - At any price, you demand more
- Change in health status could have two effects
 - Shift demand
 - Make less/more price responsive

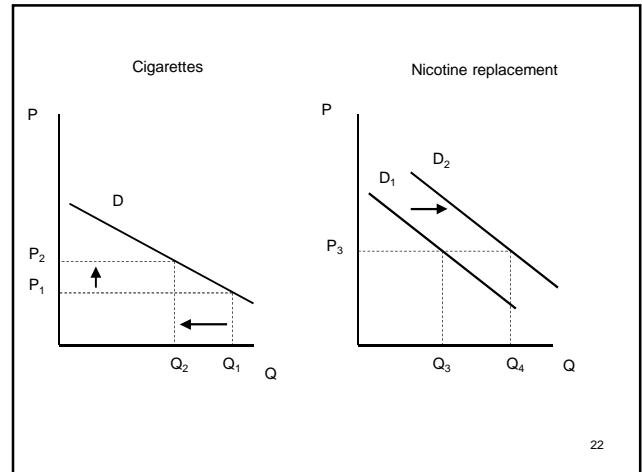
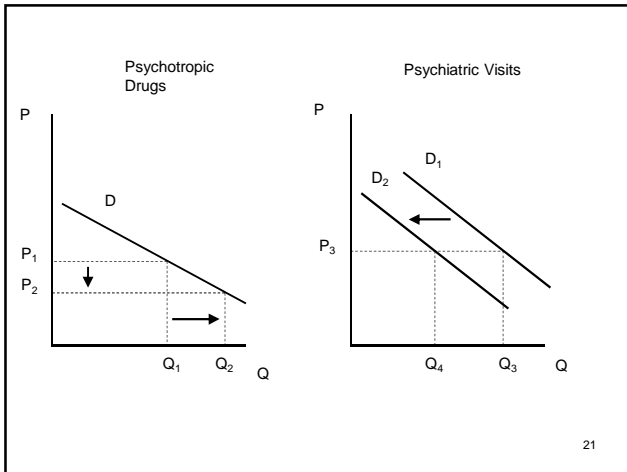
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- **Suppose you are diagnosed w/ high cholesterol**
 - **Predictor of heart disease**
 - **Increased risk of death**
 - **Standard treatment after diagnosis**
 - Change diet
 - Increase exercise
 - **As cholesterol level rises, ability to control with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

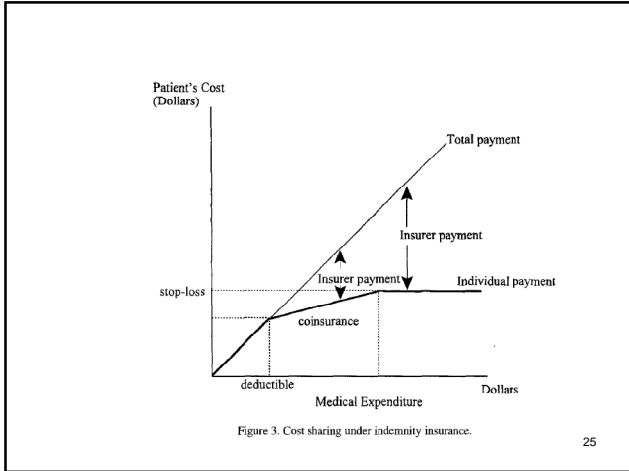
- Insurance is designed to reduce the welfare loss due to uncertainty
- Insurance can however generate 'moral hazard'
- Can reduce moral hazard by cost-sharing
- In most cost sharing plans, the costs of using medical care by policy holders is however reduced, encouraging use

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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 (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

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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 of 5%**

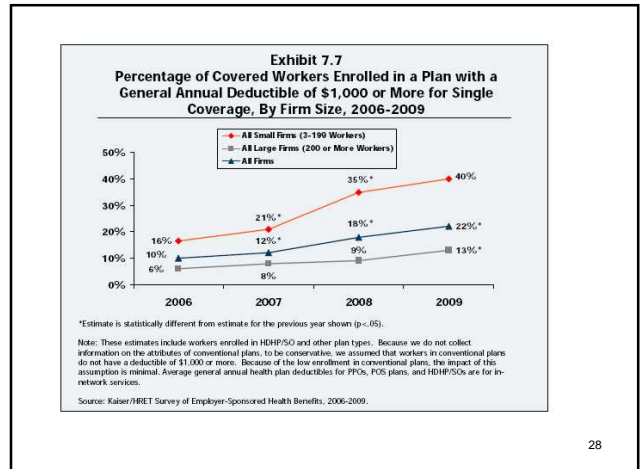
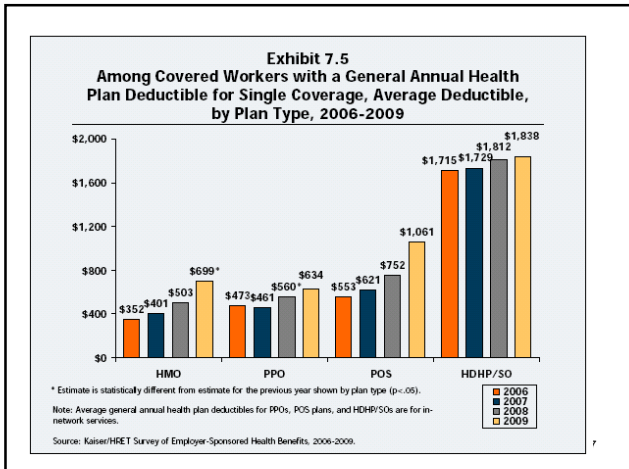
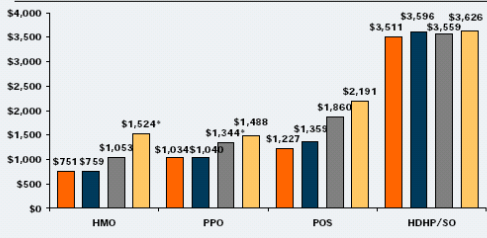


Exhibit 7.12
Among Covered Workers with a General Annual Health Plan Deductible for Family Coverage, Average Aggregate Deductible, by Plan Type, 2006-2009

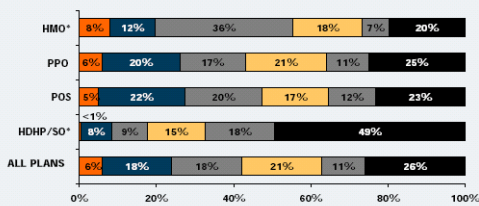


* Estimate is statistically different from estimate for the previous year shown by plan type (p < .05).

Note: Average general annual health plan deductibles for PPOs, POS plans, and HDHP/SOs are for in-network services.

Source: Kaiser/HRET Survey of Employer-Sponsored Health Benefits, 2006-2009.

Exhibit 7.28
Among Covered Workers with an Out-of-Pocket Maximum for Single Coverage, Distribution of Out-of-Pocket Maximums, by Plan Type, 2009



* Distribution is statistically different from All Plans distribution (p < .05).

Note: Distributions are among covered workers facing a specified limit for out-of-pocket maximum amounts. High-qualified facilities are required by law to have an out-of-pocket maximum of no more than \$5,500 for single coverage and \$11,000 for family coverage in 2009.

Source: Kaiser/HRET Survey of Employer-Sponsored Health Benefits, 2009.

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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%

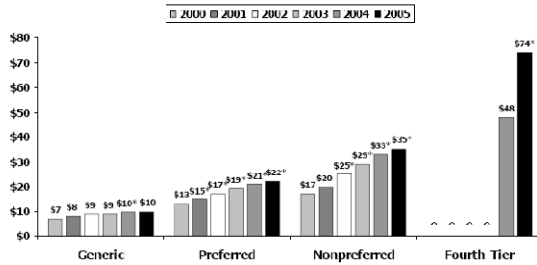
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Among Covered Workers with Separate Hospital Cost Sharing, Average Cost Sharing, 2005*

	Average Hospital Deductible/Copay	Average Hospital Coinsurance	Average Hospital Per Diem
All Small Firms (3-199 Workers)	\$264	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%	29%	27%
Top 2 percent	-	-	35	38	39	41	39	38
Top 5 percent	52%	43	50	55	55	58	55	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 1/4 of all HC spending
 Top 5% represent 1/2 of all spending
 Top 30 percent represent 90% of all spending

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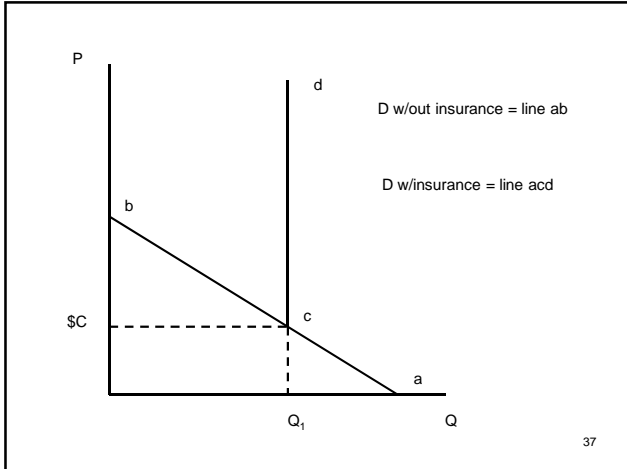
Copayments

- 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

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- 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)

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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

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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)

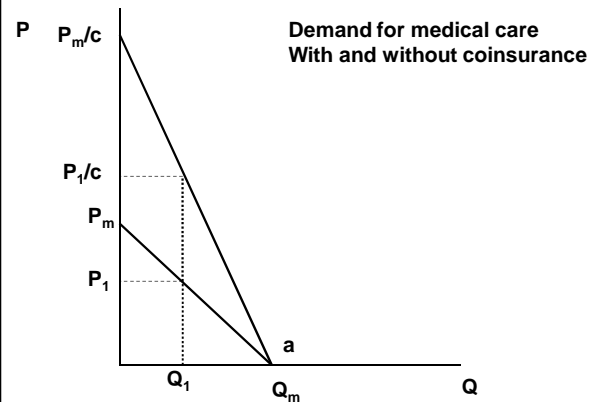
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- In our supply and demand graph world, the price axis will represent the price received by sellers (P_s)
- Without coinsurance
 - $P_d = P_s$
- With coinsurance
 - $P_d = cP_s$ so
 - $P_d / c = P_s$

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- 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
 - $P_d = Pc = 100 - 10Q$
 - $P = 100/c - 10Q/c$

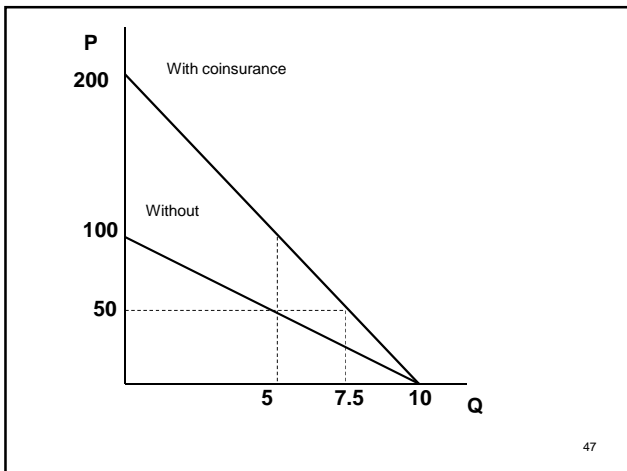
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- $P = 100 - 10Q$
 - when $P_s = 0$, $Q = 10$ and
 - when $P_s = 100$, $Q = 0$
- Let $c = 50\%$
- $P = 100/c - 10Q/c = 200 - 20Q$
 - when $P = 0$, $Q = 10$ and
 - when $P = 200$, consumers pay 100 and $Q = 0$

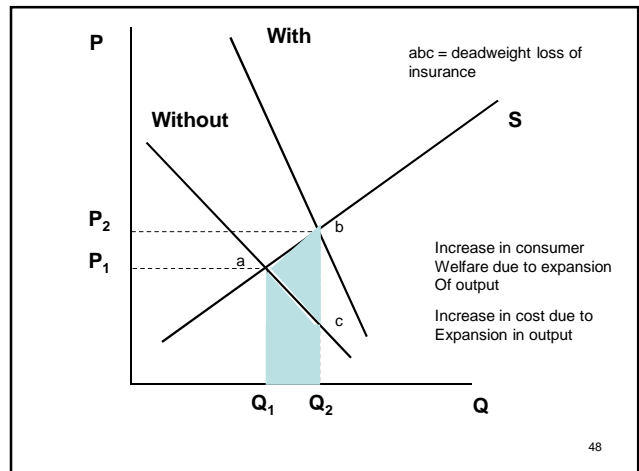
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- Note that if $c = 0$, when $P = \$50$, $Q = 5$
- With $c = 0.5$, $P = \$50$, $Q = 7.5$

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Deadweight loss of insurance

- **With coinsurance**
 - Output ↑ from Q_1 to Q_2
 - Price received by sellers ↑ 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**
 - $P_d = P_s c = 40 - 2Q$
 - $P = 40/c - 2Q/c = 40/.25 = 2Q/.25$
 - $P = 160 - 8Q$
- **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?

- $Q = 13$

- $P_d = 40 - 2Q = 40 - 2(13) = 14$

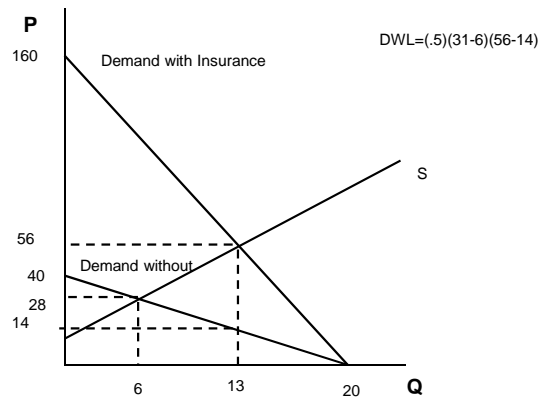
- DWL= triangle abc

- Area = $(1/2)$ height x base

- $= (1/2)(56-14)(13 - 6)$

- $= 140$

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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

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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)
 - (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

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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.
- Question is, how does one go about estimating a model with real world data?

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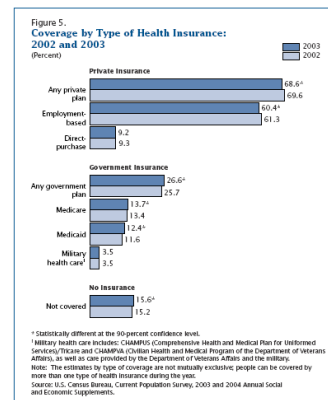
Typical study

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

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Table 7
Health Insurance Coverage of Workers, 2003

	Workers (millions)	Percent Distribution by Coverage Type				
		Employer	Individual	Medical	Other ^a	
Total - Workers^b	141.8	70.7%	5.6%	3.8%	1.1%	18.7%
Age						
18-24	52.7	62.2%	6.4%	6.1%	0.9%	24.4%
25-54	70.3	76.6%	4.8%	2.8%	1.0%	15.0%
55-64	18.8	72.5%	6.4%	1.5%	2.3%	17.3%
Worker's Annual Income^c						
<\$20,000	45.2	47.6%	7.8%	8.7%	1.9%	34.2%
\$20,000 - \$30,999	46.6	74.3%	4.6%	2.4%	0.9%	17.2%
\$30,000+	50.1	87.7%	4.6%	0.8%	0.9%	6.2%
Family Poverty Level^d						
<100%	12.0	21.6%	9.6%	17.8%	1.5%	49.6%
100-199%	22.0	42.7%	6.9%	8.2%	1.5%	40.8%
200-299%	23.0	67.6%	6.0%	3.3%	1.3%	22.0%
300-399%	22.6	79.3%	4.8%	1.4%	1.2%	13.3%
400%+	64.1	87.0%	4.6%	0.7%	0.9%	6.0%
Work Status^e						
Full-time/Full-year	97.4	77.7%	6.2%	1.9%	0.9%	16.4%
Part-time/Part-year	15.4	55.7%	6.9%	8.0%	1.5%	28.8%
Part-time/Full-year	13.1	68.2%	10.6%	6.1%	2.2%	23.0%
Part-time/Part-year	11.9	51.6%	11.1%	15.8%	2.3%	24.7%
Business Size (in Workers)						
Self-employed ^f	12.8	49.6%	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%	4.8%	4.5%	0.9%	20.0%
100-499	16.3	77.2%	2.9%	3.7%	0.7%	15.4%
500-999	6.1	78.2%	3.7%	2.3%	1.1%	13.9%
1000+	29.3	79.4%	3.2%	3.7%	0.9%	12.8%
Public Sector	20.4	86.4%	0.7%	2.3%	1.6%	7.1%

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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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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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- 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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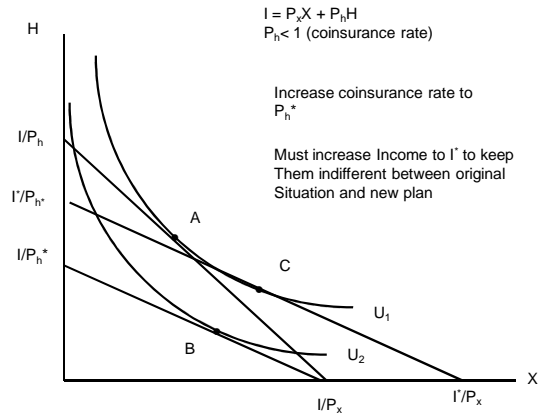
Experimental design: RAND

- 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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Annual Per Capita Medical Use

Plan	Visits	Outpat. \$	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

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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
- $\xi = [(Q_2 - Q_1) / (Q_1 + Q_2)] / [(P_2 - P_1) / (P_1 + P_2)]$

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- 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
- $\xi = [(2.73 - 3.33)/(2.73+3.33)] / [(0.95-0.25)/(0.95+0.25)] = -0.17$

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Elasticities, Going from 25-95% Coinsurance

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

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	MEPS 2005	Rand HIE 2005 \$ Free Care
Total spending, <65	\$2686	\$1410
Inpatient	\$743	\$769
% with any inpatient	0.058	0.103
Prescription drugs	\$551	\$106
Outpatient	\$273	\$630

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