Demand for Medical Care

7MHPH010 – Health Economics and Health Policy

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Demand for Medical Care

Outline

- Derived demand for medical care
- Factors that effect demand
- Empirical evidence

Utility of Health

Health as an input

- People do not necessarily care about consuming medical care (m) perse
- They derive utility from being healthy and from consuming other goods

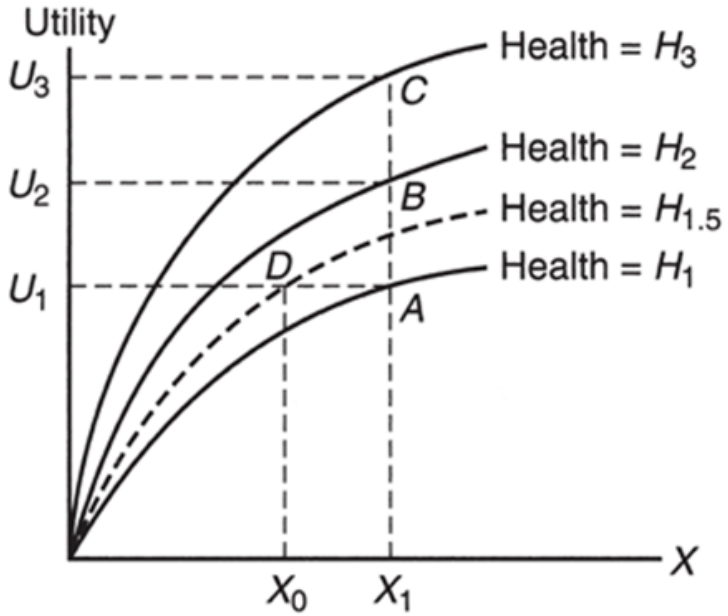
$$u = U(h, x)$$

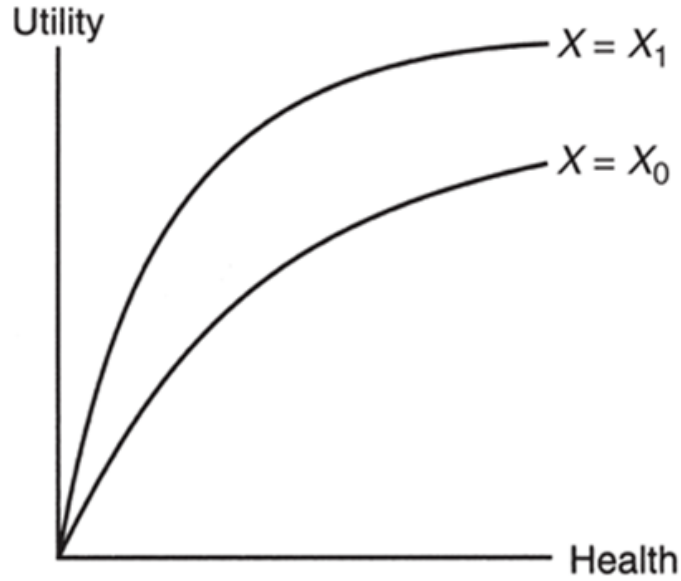
  - where H is the stock of health an individual possess
  - X is the consumption of all other goods
  - $U(\cdot)$ is the utility function
- The stock of health generates a *flow* of services that yield satisfaction (i.e. utility)
- Stock of health (H) is a produced good
- Health is demanded for two reasons
  - Consumption
  - Investment

Utility of Health

Marginal Utility of Health

- Utility increases with H and X
- Marginal utility is positive ($MU_H = \Delta U/\Delta H > 0$ and $MU_X = \Delta U/\Delta X > 0$)
- Marginal utility is diminishing ($\Delta MU_H/\Delta H < 0$ and $\Delta MU_X/\Delta X < 0$)

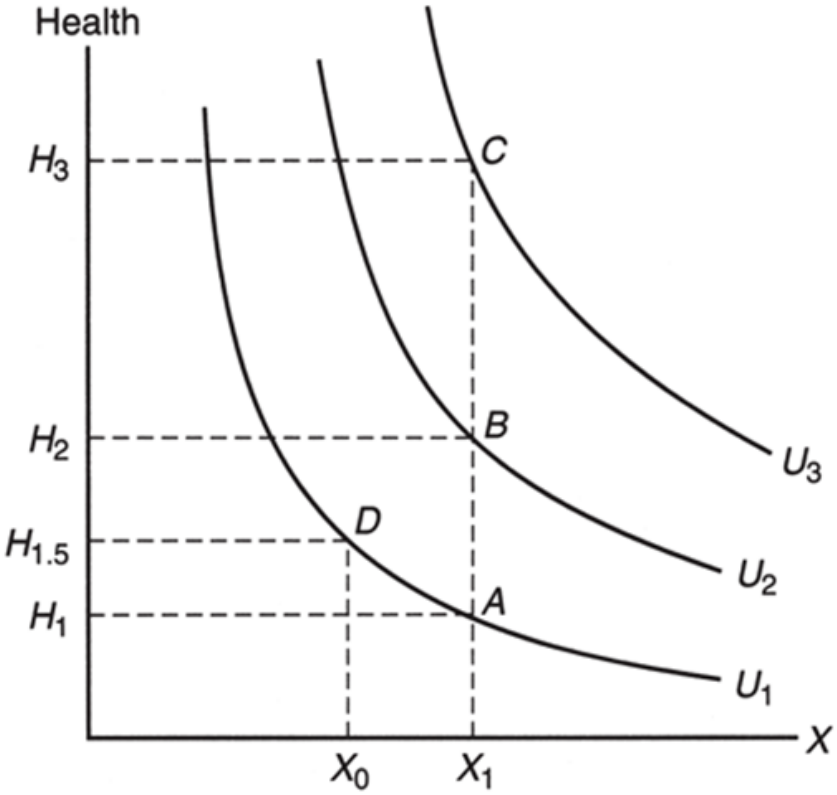




Utility of Health

Indifference Curves

- We can combine the previous two graphs to generate the indifference curves between H and X



- Combinations of X and H at $A(X_1, H_1)$ and $D(X_0, H_{1.5})$ are at U_1 level
- Combinations of X and H at $B(X_1, H_2)$ are at U_2
- Combinations of X and H at $C(X_1, H_3)$ are at U_3

Utility of Health

Health Production Function

- Earlier, in $u = U(H, X)$, we noted that H, the stock of health, is a produced good
- People produce health in the same way that firms produce goods
- Medical care is one input into the production of health
- We can think of a health production function as

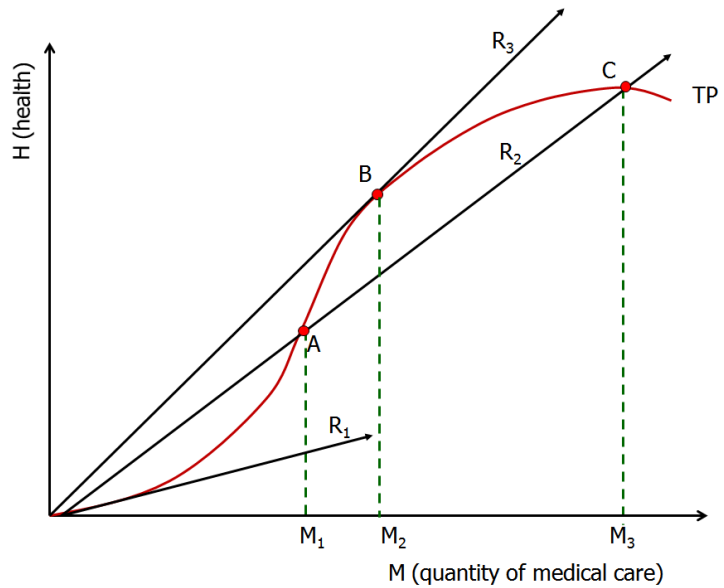
$$H = g(m, o)$$

  - where m is the medical care an individual gets
  - and o is other factors in the production of personal health, for example,
    - genetics
    - age
    - lifestyle (smoking, exercise, driving fast red cars, etc.)
    - education
    - income
  - As with any production function, we can talk about total product, marginal product and average product of health with respect to medical care m, or any of the other inputs for that matter (see lecture notes on production functions)

Health Production Function

Total Product, Marginal Product and Average Product

- **Total product** curve for medical care
- $H = g(m, o)$ describes the relationship between composite medical input and other goods and health
- Central idea is that the curve
  - initially dishes up ("U shaped")
  - then tips over to be hill shaped
  - the point at which it tips over is the inflection point (A in the graph)



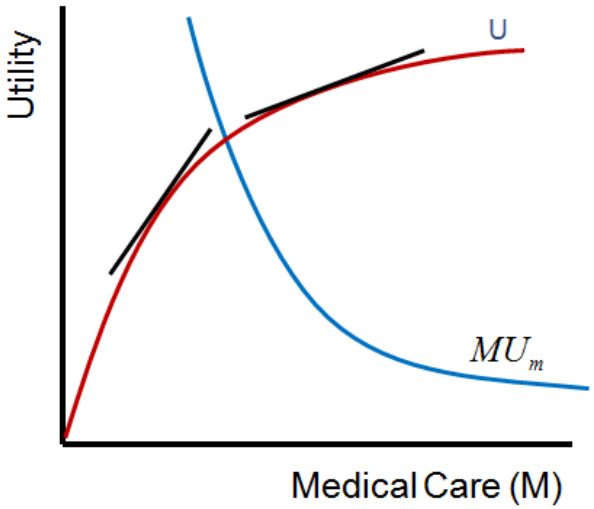
- **Average product** (of an input) is defined as the total product divided by the quantity of that input – thus, average product of health care (m) is $AP_m = \frac{H}{m}$
- **Marginal product** is defined as the change in the total product that occurs due to a unit change in an input (when all other inputs are held constant) – thus, the marginal product of medical care (m) is $MP_m = \frac{\Delta H}{\Delta m}$
  - R_1, R_2 & R_3 are rays from the origin – the slope of the ray gives AP_m
  - Slope of the TP curve (wrt to m) gives MP_m
  - At A (the inflection point) MP_m is max
  - At B AP_m is max (and is equal to MP_m)
  - At C MP_m is zero
  - **Law of diminishing returns:** If equal amounts of a variable are added and all other inputs are held fixed, the resulting increments to output will eventually diminish (i.e. $\Delta MP_m / \Delta m < 0$)

Utility of Medical Care

Derived Utility

- Utility of Medical Care
  - As mentioned earlier, we derive utility from health, not medical care $U(H,X)$
  - Health is produced using medical care as one of the inputs $H = g(m,o)$
  - There is no direct utility from medical care but we can combine the previous two equations

$$u = U(g(m,o),X)$$



- Utility increases with medical care
- Marginal utility of medical care is the slope of utility function $MU_m = \frac{\Delta U}{\Delta m}$
- Slope of the utility function wrt medical care is decreasing
- Marginal utility of medical care is equal to the product of marginal utility of health multiplied with the marginal product of health $MU_m = MU_H MP_m$

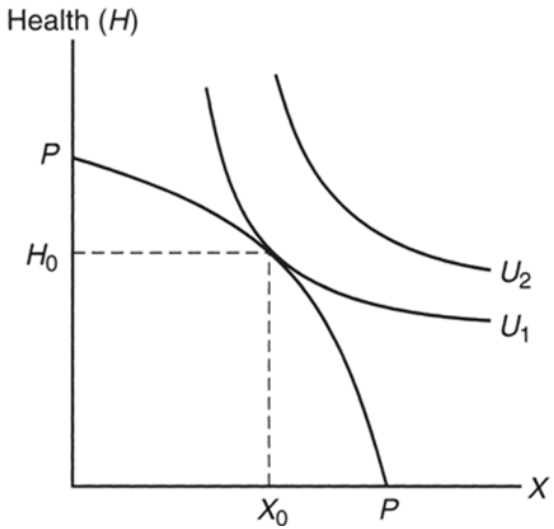
$$MU_m = \frac{\Delta U}{\Delta m} = \frac{\Delta U}{\Delta H}\frac{\Delta H}{\Delta m} = MU_H MP_m$$

Demand for Medical Care

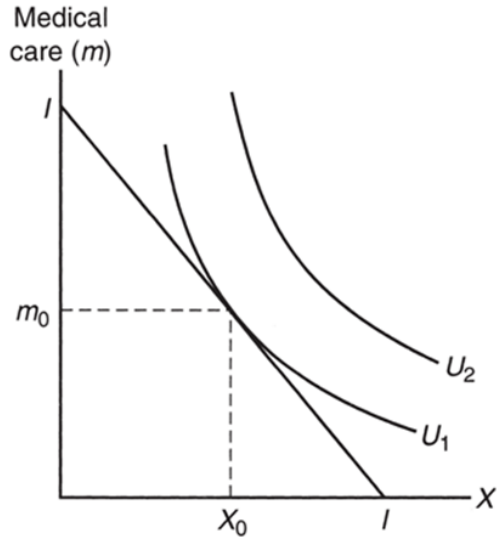
Optimal Bundle

- Consumer wants to maximize utility $U(H,X)$ subject to the constraints $H = g(M,O)$ and $p_x X + p_m m \leq I$

- Curve labeled PP is the *production possibility curve* – represents the feasible combinations of X and H the consumer can attain given budget and production function $H = g(M,O)$
- PP is downward sloping and concave because of diminishing marginal productivity of m in producing H
- Optimal combination of other goods and health – tangency point at (X_0, H_0)



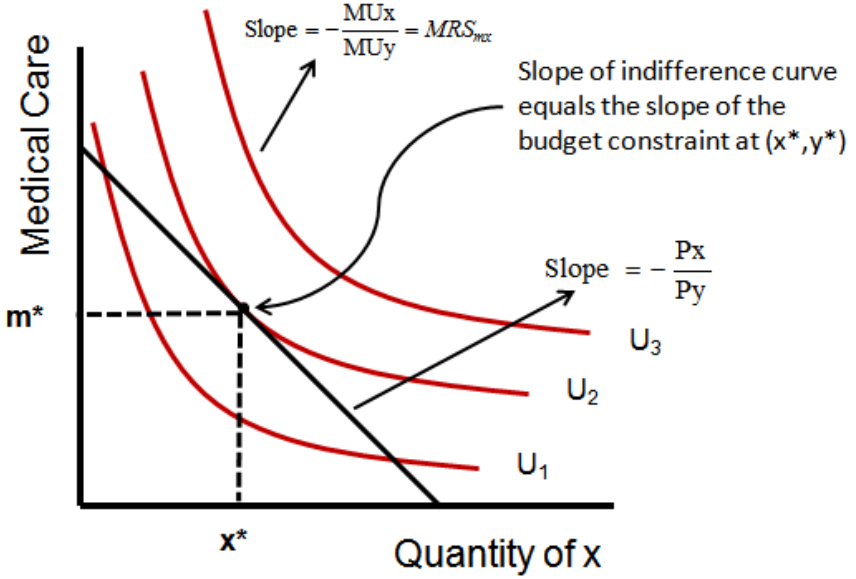
- Straight line II is the budget line given by $p_x X + p_m m = I$
- I is consumers income, p_x and p_m are the prices of other goods and medical care
- Optimal combination of other goods and medical care – tangency point at (X_0, m_0)



Demand for Medical Care

Optimal Bundle

- Consumer wants to maximize utility $U(H,X)$ subject to the constraints $H = g(M,O)$ and $p_x X + p_m m \leq I$



- I is consumers income, p_x and p_m are the prices of other goods and medical care
- Budget line given by by $p_x X + p_m m = I$

$$m = I/p_m - (p_x/p_m)x$$

- Optimal bundle given at the point of tangency, i.e. where

$$MRS = \frac{p_m}{p_x}$$

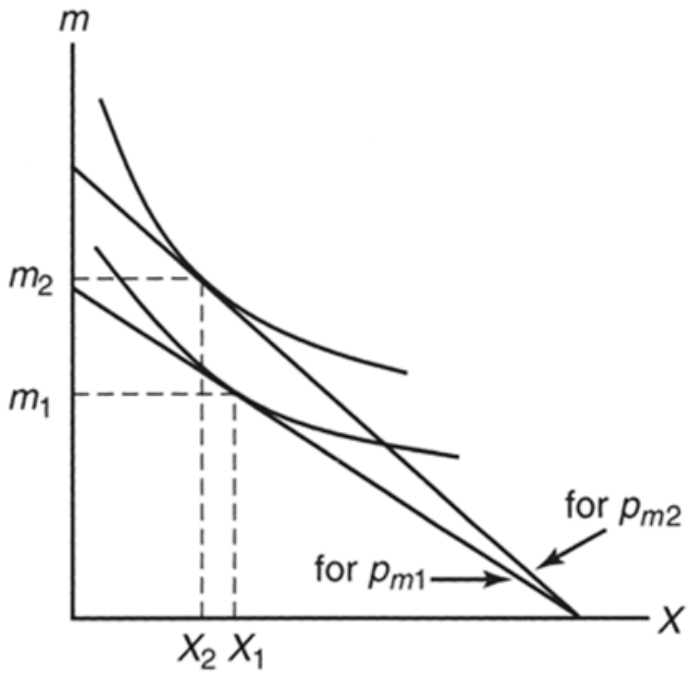
or equivalently

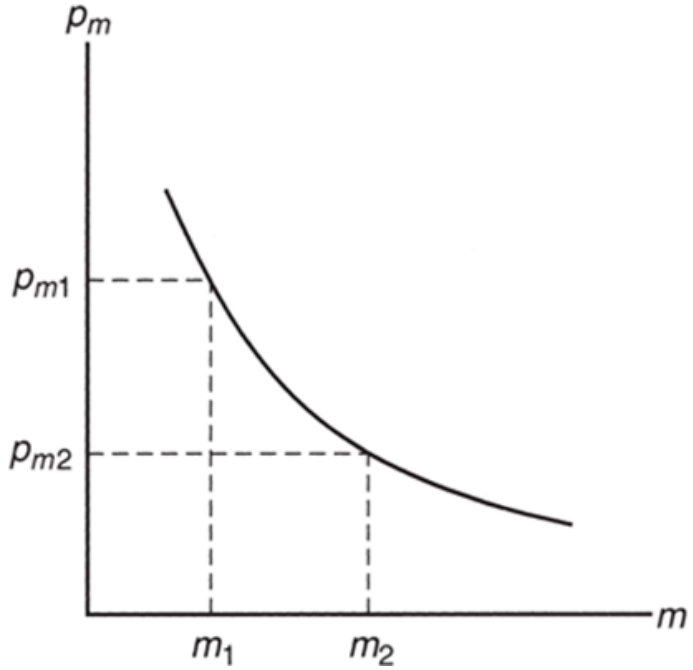
$$\frac{MU_m}{p_m} = \frac{MU_x}{p_x}$$

Demand for Medical Care

Derived Demand for Medical Care

- Plot changes in price against optimal level of medical care at different prices to derive the demand curve for medical care
  - Say price for medical care changes from p_{m1} to p_{m2}
  - When price is p_{m1} consumer chooses m_1 level of medical care
  - When price falls to p_{m2} consumer chooses m_2 level of medical care
  - Left to right downward sloping demand curve for medical care



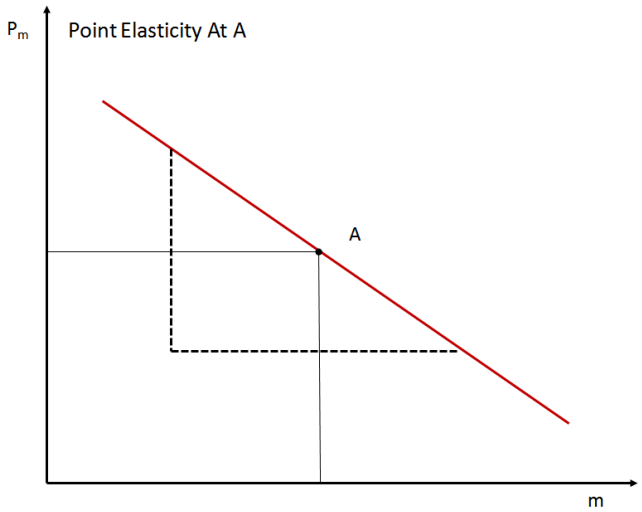


Demand for Medical Care

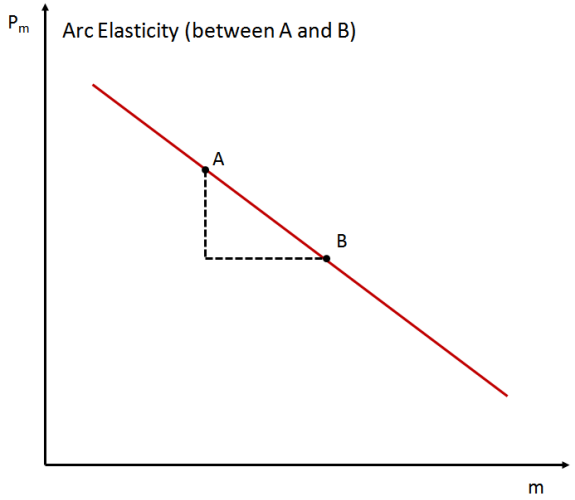
Price Elasticity of Demand

- Price elasticity of demand is defined as percentage change in quantity divided by percentage change in price (see lecture notes on economic tools)
- Price elasticity $\eta_{QP} = \frac{\%\triangle m}{\%\triangle p} = \frac{\triangle m/m}{\triangle p/p} = \frac{\triangle m}{\triangle p}\frac{p}{m}$
- We often use two concepts of elasticity – point elasticity and arc elasticity

- Point Elasticity – measured at a point on the demand curve and is the usual measure or elasticity (percentage change in quantity wrt percentage change in price)
- $\eta_A = \frac{\triangle m/m}{\triangle p/p} = \frac{\triangle m}{\triangle p} \cdot \frac{p_A}{m_A} = \frac{1}{Slope} \cdot \frac{p_A}{m_A}$

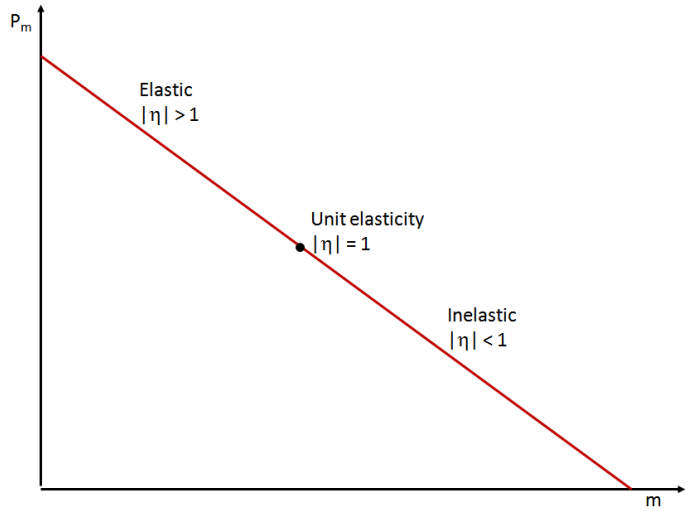


- Arc Elasticity – measured between two points and measures the change in quantity and price relative to the average of two observed values
- $\bar{\eta} = \frac{\triangle m/\bar{m}}{\triangle p/\bar{p}} = \frac{1}{Slope} \cdot \frac{(p_1+p_2)}{(m_1+m_2)}$

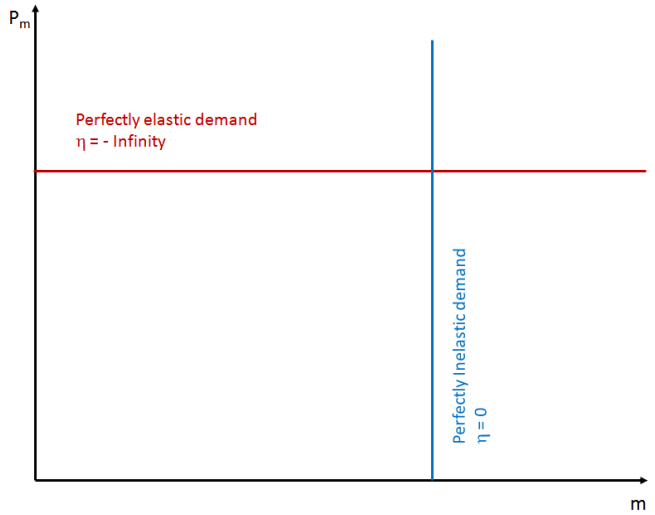


Elastic and inelastic demand

- Demand is elastic if $|\eta| > 1$, inelastic if $|\eta| < 1$ and has unit elasticity if $|\eta| = 1$
- At higher price, demand is more elastic



- On a graph of p against m, a horizontal demand curve is perfectly elastic $\eta = -\infty$
- On a graph of p against m, a vertical demand curve is perfectly inelastic $\eta = 0$



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Multiple inputs

- Many inputs (types of medical care) may go in to produce health

$$H = g(m^1, m^2, \ldots, m^n)$$

  - Doctors
  - Nurses
  - Medicines
  - etc.
- Each type of medical care would be demanded according to its respective marginal productivity given the amount of all other medical inputs
- For each input, we can derive the demand curve as in the forgoing analysis

Demand for Medical Care

Cross price effects

- For each input, we can derive the demand curve as in the forgoing analysis
- From the consumer demand point, are these complements or substitutes
  - Complements – milk and sugar (doctors and nurses?)
  - Substitutes – tea and coffee (brand name versus generic drugs)
- Equivalently, is the cross price elasticity positive or negative[1]
  - Let m^x, m^y be two different medical products with prices p^x and p^y respectively
  - Cross-price elasticity

$$\eta_{m^x m^y} = \frac{\%\triangle m^x}{\%\triangle p^y} = \frac{\triangle m^x / m^x}{\triangle p^y / p^y} = \frac{\triangle m^x}{\triangle p^y}\frac{p^y}{m^x}$$

  - Complements (milk/sugar): $\eta_{m^x m^y} < 0$
  - Substitutes (tea/coffee): $\eta_{m^x m^y} > 0$

[1] Note: We are not talking about the elasticity of substitution for inputs of a production function — for that see lecture note on production function

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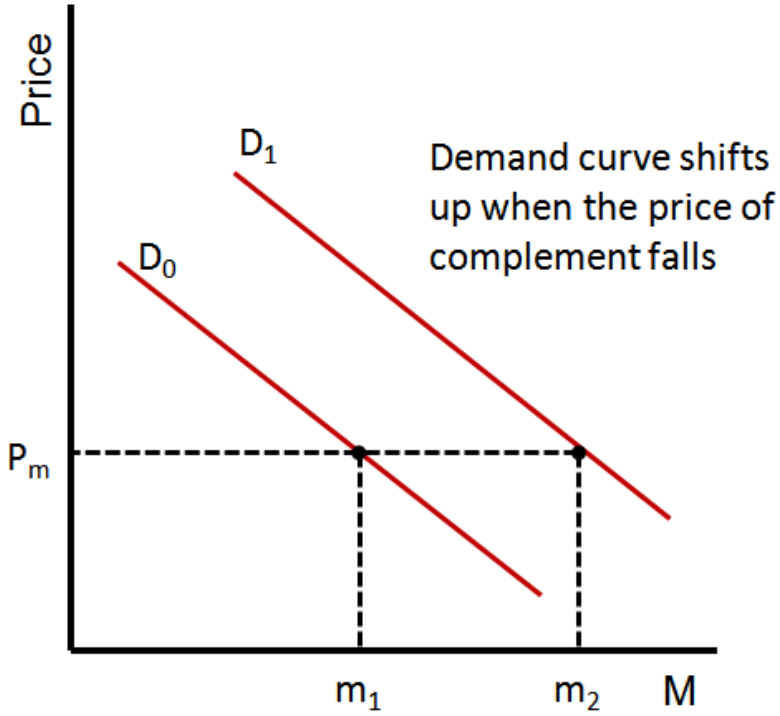
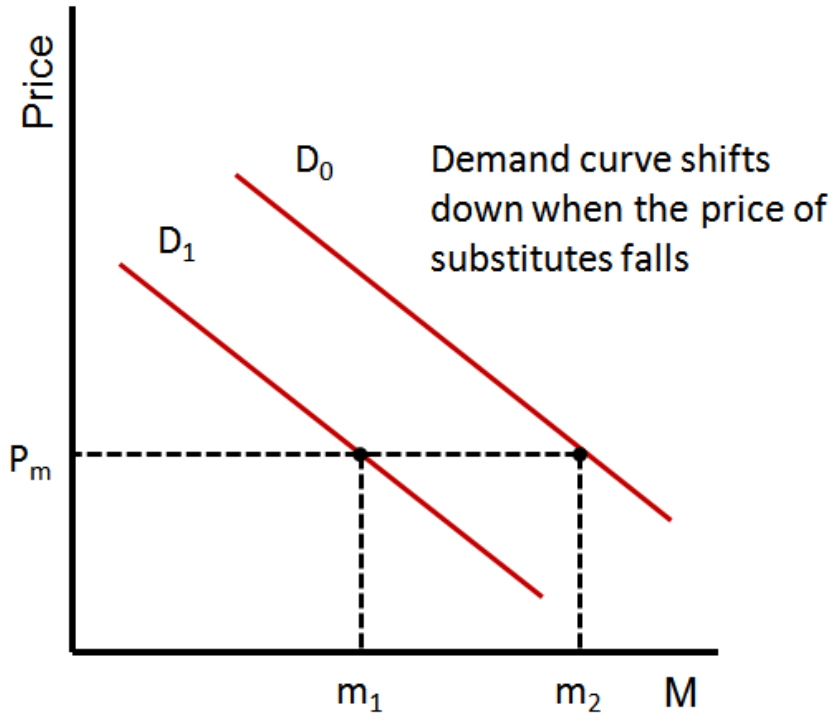
Cross price effects

Effect on demand of medical care of the change in price of related medical goods/services



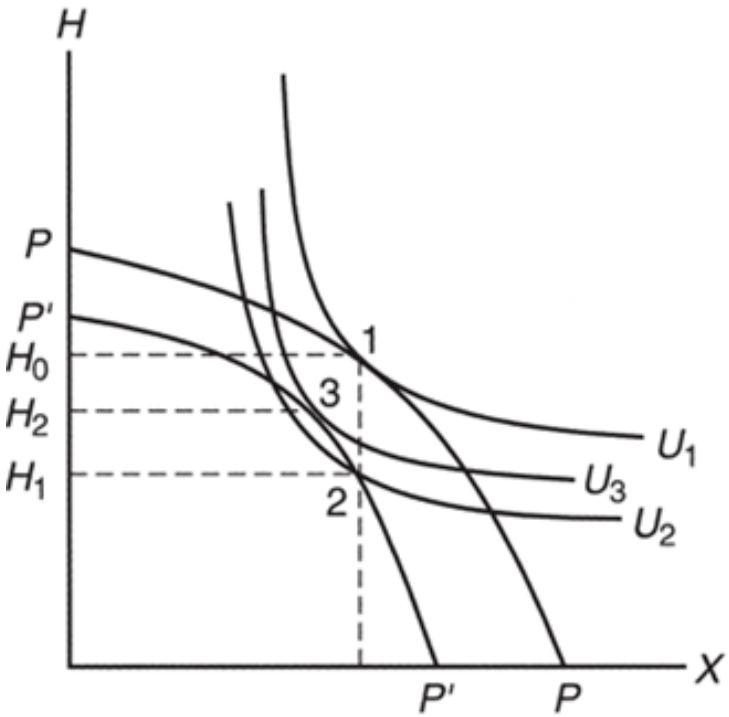


Demand for Medical Care

In sickness and in health

- Impact of health shock on medical care

- Initially patient at point 1 with utility U_1
- An illness drops health from H_0 to H_1



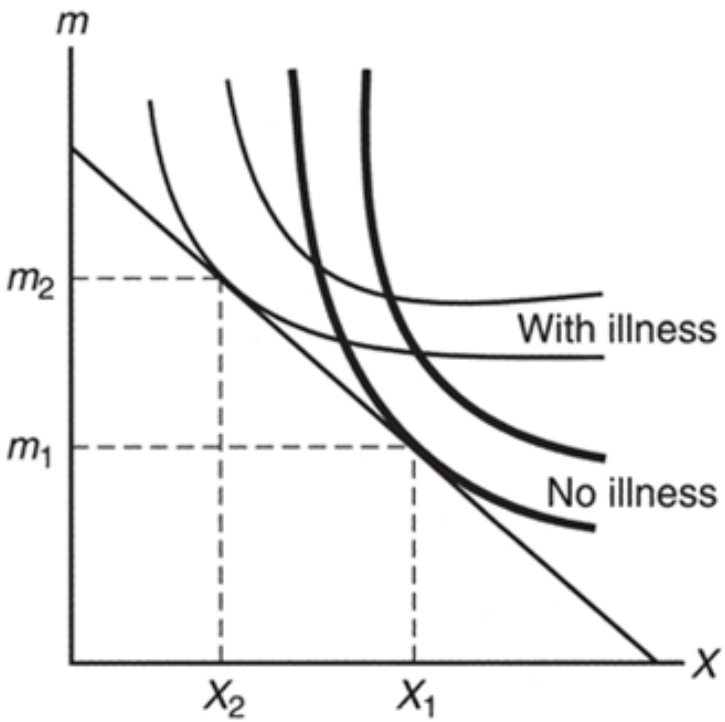
- The PPC shifts inwards for every level of X (the shape of PPC depends on the relationship between H and m)
- Can do better than point 2 – slide along $P'P'$ (by giving up some X) to point 3 with utility U_3
- Important thing to note: utility function is stable, PPC shifts inwards
- The bigger the illness event, the larger the shift in the PPC between health and other goods

Demand for Medical Care

In sickness and in health

- Impact of health shock on medical care

- Initially (no illness) patient at point X_1, m_1
- Illness changes the slope of the indifference curve between medical care and X

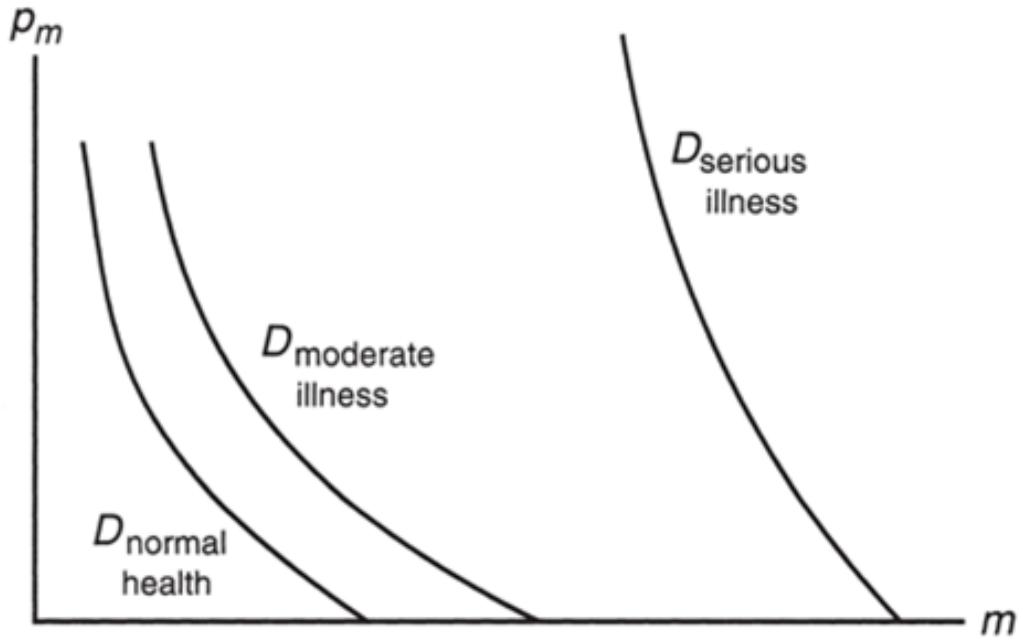


- The larger the health shock, the flatter the indifference curves (between m and x)
- Utility function $U(H,X)$ is stable but the indifference map between X, m shifts with illness (recall $MU_m = MU_H MP_m$)
- Consumption of other goods drops to X_2 and medical care increases to m_2

Demand for Medical Care

In sickness and in health

- Impact of health shock on medical care

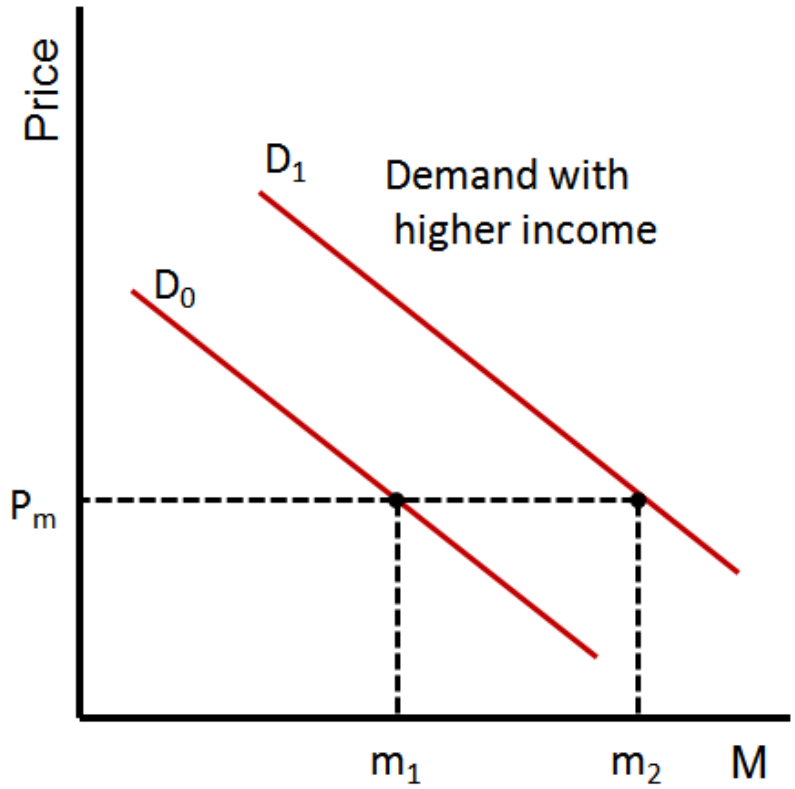


- The bigger the illness event, the larger the shift in the PPC between health and other goods
- The flatter the indifference curves (between m and x)
- The tangency must occur at larger values of m given the slope of the budget constraint
- Rightward shifts in demand curve for different levels of health shocks

Demand for Medical Care

Income Effect

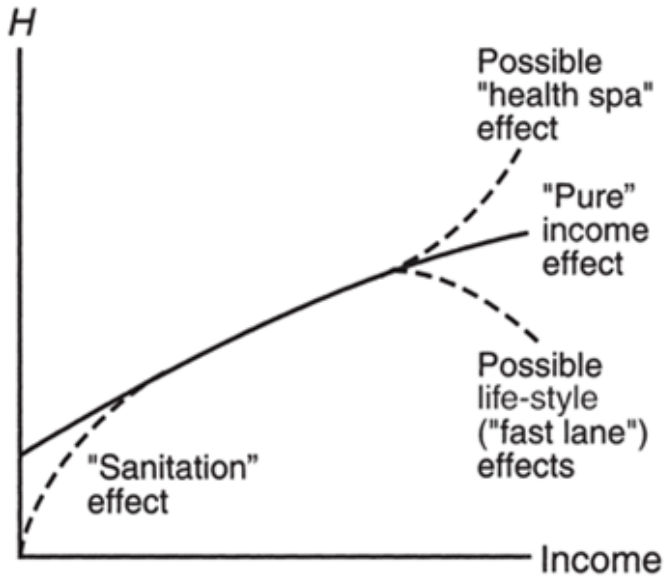
- Impact of income on demand for medical care
  - An increase in income shifts out the budget constraint
  - In turn, the derived demand curve for medical care shifts
  - If all else stays the same, then at any given price consumer is willing and able to purchase more medical care

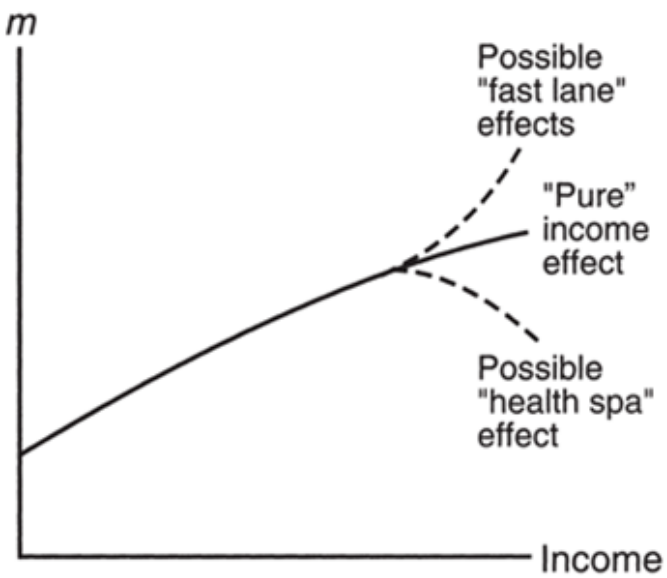


Demand for Medical Care

Income Effect

- Generally, as income increases, consumption of both m and x increases BUT ...
  - People with higher income often have better insurance than those with lower income $\Rightarrow$more medical care use
  - People with higher income may get sick less often $\Rightarrow$leading to less medical care by them
  - Higher income may give systematically different life style choices (a) life is a fast lane or (b) health spa club effect
  - On balance, you may observe something like what is given in the figure below





How much does demand for medical care change with income?

- Income elasticity – measures changes in demand with respect to changes in income
- Percentage change in quantity demanded wrt percentage change in income
- Income elasticity:

$$\eta_I = \frac{\%\triangle m}{\%\triangle I} = \frac{\triangle m/m}{\triangle I/I} = \frac{\triangle m}{\triangle I}\frac{I}{m}$$

- Often want to measure income elasticity of medical care, as well as of specific medical goods/services

Demand for Medical Care

Insurance Effect

How does insurance change behavior and demand for medical care

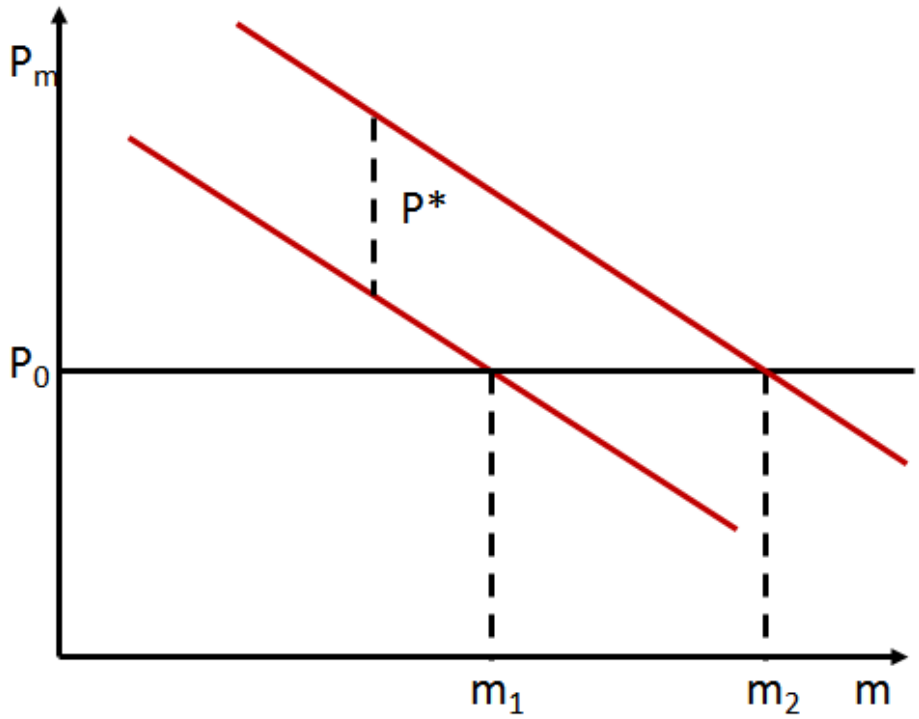
- Copayments – consumer pays part of the bill (comes in two flavors)
  - Coinsurance – the consumer pays some fixed fraction of the medical bill (20%, 25% etc.) and insurance company pays the remainder
    - Consumer pays c percent of the medical bill
    - Insurance pays $(1-c)$ percent of the bill
  - Indemnity – insurance pays consumer a flat pre-established indemnity amount for each medical service consumed
    - Example: \$125 per day in hospital
- Deductible – consumer pays some fixed amount (say \$500) per year towards medical care before insurance kicks in
- Upper limits – cap on the amount the insurance will pay per year or lifetime

Demand for Medical Care

Insurance Effect – Indemnity

- Indemnity
- The plan specifies that p^* will be paid to the consumer each time they use a particular medical service

  - The consumers demand curve just shifts up by p^*
  - If price is p_0, demand increases from m_1 to m_2
  - Indemnity plans are not very common (but they use to be)

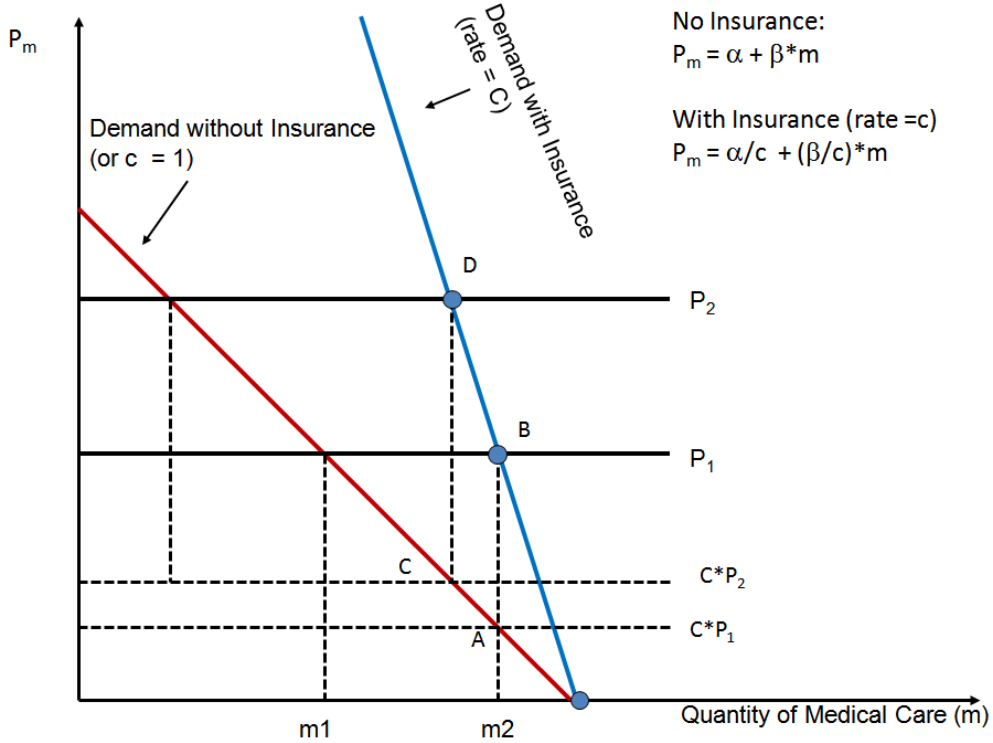


Demand for Medical Care

Insurance Effect – Coinsurance

- Coninsurance
  - Coinsurance rate of c (say 20%)
  - If price per unit is P, consumer pays cP and insurance pays $(1-c)P$

- Coinsurance rate c, rotates the demand curve clockwise
  - If price is P_1 quantity demanded (with no insurance) is m_1
  - With a coinsurance rate of c, the price to the consumer is cP_1 – hence the consumer will demand m_2
  - On an insured persons demand curve, the quantity m_2 would be demanded at price P_1 – see the point B
  - Repeat with a different initial price P_m such as P_2 – to get point D
  - Points such as B,D, trace out the insured persons demand curve
- If $C = 0$, the demand curve becomes vertical



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Insurance Effect – Deductible

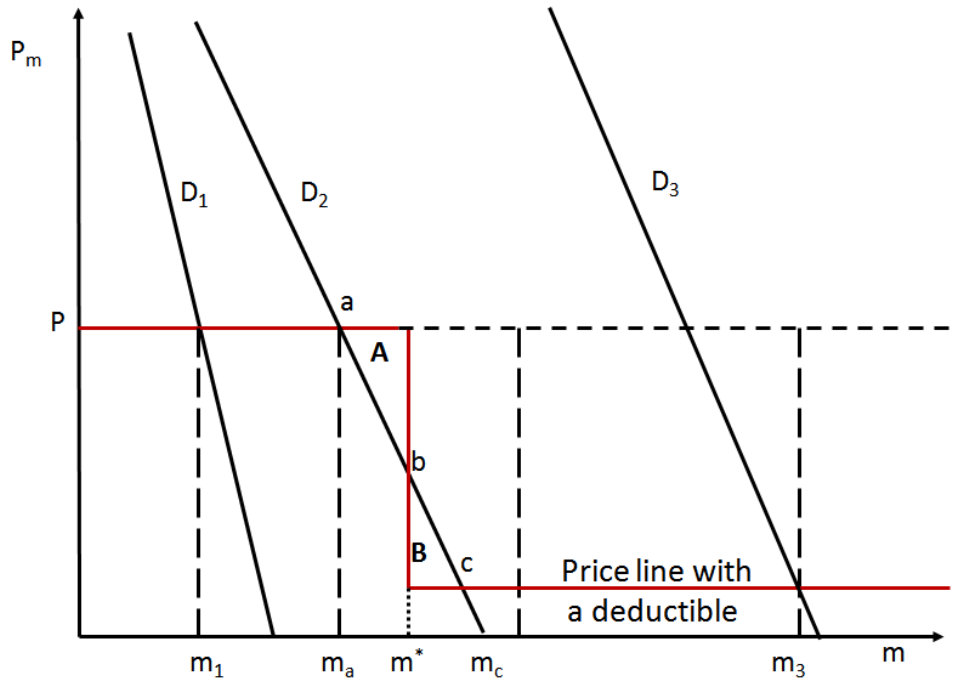
- Deductible
  - Plan specifiers deductible D (say \$200) (where $D = pm^*$) which consumer pays and after that consumer pays cp
  - Analysis complicated – depends on degree of illness severity (i.e., how much demand curve is shifted out due to illness)
    - Lowers administrative costs, because fewer small claims are filed each year
    - Lowers demand for relatively inexpensive medical services near start of the year
    - Has much less impact on demand if relatively expensive medical services are required

Demand for Medical Care

Insurance Effect – Deductible

- Deductible
  - Plan specifiers deductible D (say \$200) (where $D = pm^*$) which consumer pays and after that consumer pays cp
  - Analysis complicated – depends on degree of illness severity (i.e., how much demand curve is shifted out due to illness)

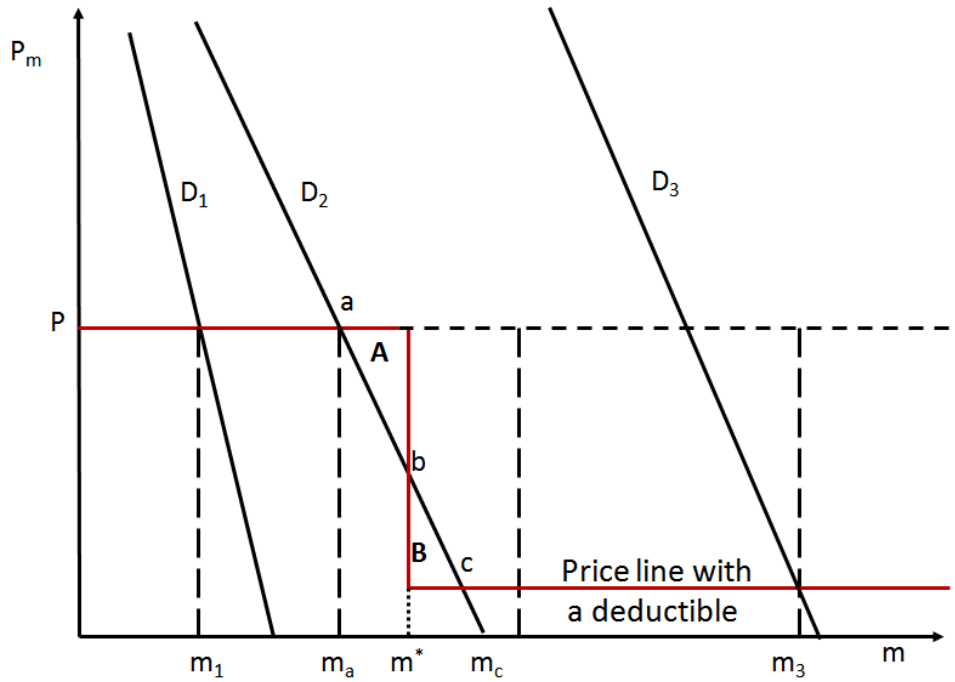
- With minor illness (D_1), consumer will act if insurance was not present and consume up to m_1
- With a serious illness (D_3), consumer will act as if the deductible was not present and will only about coinsurance – consume up to m_3
- General idea is that for minor illnesses, consumer will act as if insurance was not present (cost saving)
- With illness corresponding to D_2, will consume at m_a or m_c
  - m_a if area A $>$ area B
  - m_c if area B $>$ area A
  - never at m_b unless demand curve just touches the kink



Demand for Medical Care

Insurance Effect – Deductible

- Deductible
  - Say illness given by level D_2
  - Say consumer moves beyond m_a to m_b – then loses value in consumer surplus equal to the area A
  - Hence does not make sense to move beyond m_a and stop somewhere between m_a and m_b
  - Say consumer moves beyond m_b to m_c – then gains back some consumer surplus equal to area B
  - Thus, with illness corresponding to D_2, will consume at
    - m_a if area A $>$ area B
    - m_c if area B $>$ area A
    - never at m_b unless demand curve just touches the kink



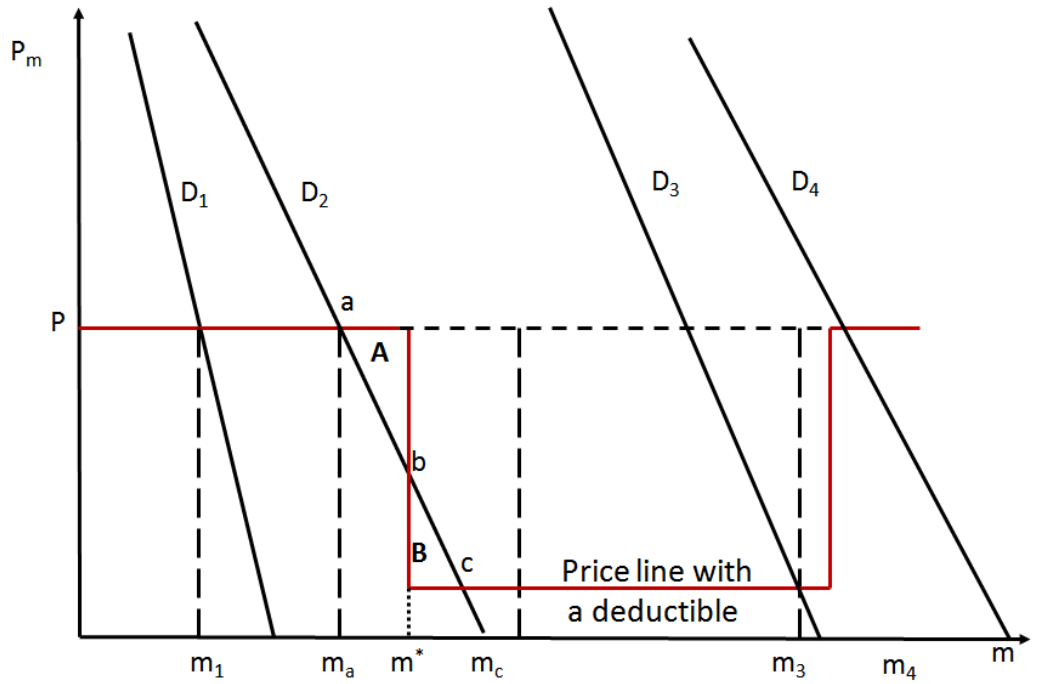
  - Another complication – say deductible is \$200 and office visit is \$75: as such it seems insurance will not change behavior but the office visit also gives the added benefit of improving insurance plan from a a \$200 deductible to \$125 deductible – may depend on the time of the year

Demand for Medical Care

Insurance Effect – Upper Limit

- Upper limit
  - Plan specifiers that after a certain amount of total payment has been made, insurance will no longer apply
  - The effect of a cap on insurance are the reverse of a deductible – they make the really serious events uninsured

- A plan with a deductible, a coinsurance and an upper limit
- Consumer pays full price after the upper limit – and for serious events such as D_4 is uninsured
- Upper limits were quite common in the past
- Most insurance plans now have a "stop loss" feature that places an upper limit on out-of-pocket spending by consumer (i.e., out of pocket price becomes zero after a certain amount of expenditures)



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Other factors

- Other factors that effect demand for medical care
  - Time and travel costs
  - Quality
  - Beliefs

Demand for Medical Care

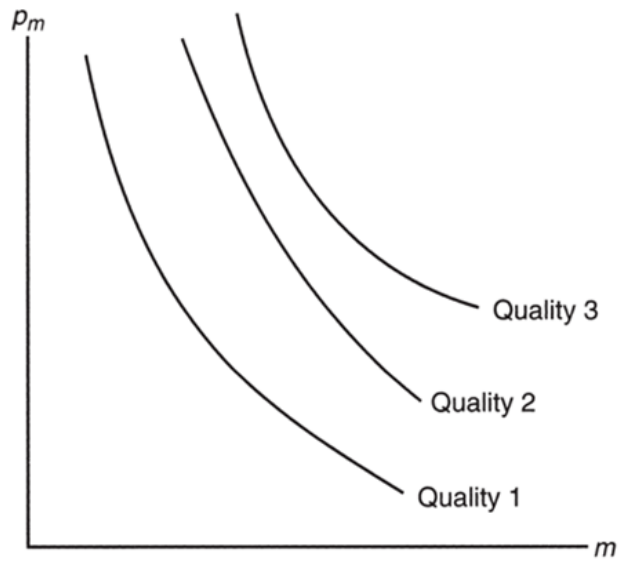
Other factors – Time and Travel Costs

- Time costs act just as money costs do in affecting demand for medical care
  - If time costs rise (either because actual time increases or the value of time rises), demand for medical care falls
  - For person working on hourly rate with no sick leave, the wage rate multiplied with time off work is the value of time
  - For person working at home, their time is worth *at least* as much as their market opportunity wage

Demand for Medical Care

Other factors – Quality

- Quality of care has to do with if the medical intervention was appropriately selected and properly carried out
  - How good is the doctor (good medical school? board certified? relevant sub-spaciality? time spent with the patient?)
  - Does the hospital have a CT scanner and did they use it on me?
- Consumers also place value on amenities associated with medical care
  - Docs office orderly and clean, good magazine supply?
  - Hoteling aspect of the hospital – flat screen TVs with good reception? quality and diversity of food? clean? parking available?)

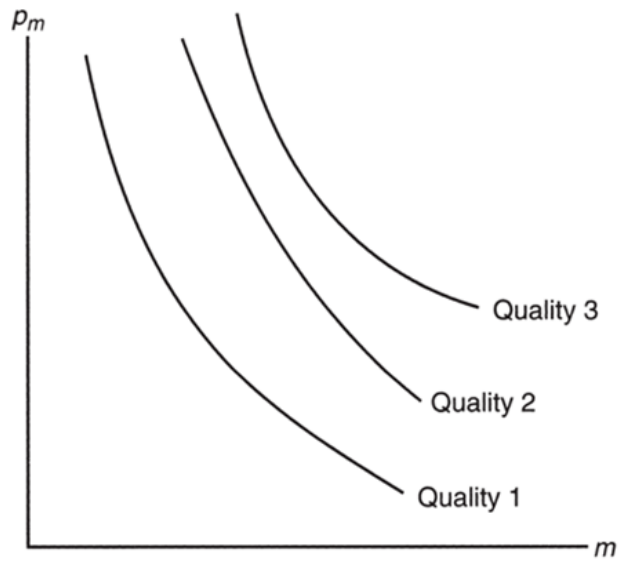


- A demand curve for a medical service is the patients willingness to pay for different quantities given a specific quality
- The higher the quality, the higher the demand curve shifts up

Demand for Medical Care

Other factors – Beliefs

- Can also think of various demand curves corresponding to the patients perceptions of quality, productivity or general desirability of medical care
- Those with stronger beliefs in efficacy of medical care will have greater willingness to pay for medical care
  - Marked by curves labeled ‘quality 2’ or ‘quality 3’
- Those with weaker beliefs in efficacy of medical care will have smaller willingness to pay for medical care care
  - Marked by curves labeled ‘quality 1’



- A demand curve for a medical service is the patients willingness to pay for different quantities given a specific belief about efficacy
- The stronger the belief in efficacy (or quality) , the higher the demand curve

Demand for Medical Care

Summary of Predictions from Theory

- Quantity demanded of medical care increases with
  - A decrease in price
  - An increase in illness severity (or a positive negative shock to health)
  - An increase in generosity of insurance plan
  - A decrease in the cost of time
  - A decrease in the time used to obtain care
  - With age (for adults)
  - An increase in income (generally true $\sim$ but not known about specific goods and services) – higher income may increase the demand for care
  - An increase in the price of substitute services and a decrease in the price of complement services
    - Price of related or other medical services move separately, or if the services are insured differently, how the demand for one changes with the price or insurance coverage of the other (complements or substitutes)

Empirical Studies

Impact of Age and Gender

TABLE 5.8 AGE AND GENDER EFFECTS ON DEMAND

	Hospital Discharges per 1,000 persons/year		Ambulatory Visits per Person/Year		Prescription Drug Use in Past Month (percent)	
Age	Male	Female	Male	Female	Male	Female
Under 18	201	183	2.65	2.40	26.2	22.0
19–44	228	434	1.58	2.90	27.1	44.6
45–64	577	566	2.78	4.08	55.6	72.0
65–74	1,450	1,355	6.19	6.71	80.1	88.1
75+	2,745	2,501	7.41	7.85		

Sources: Health, *United States*, 2007, Hospital Discharges from Table 100, Ambulatory Visits from Table 92, Prescription Drug Use in Past Month from Table 96.

Empirical Studies

Impact of Age and Gender

- Increasing age leads to more health care use
- Ratio of the oldest (75+) to that of children is 3:1 for ambulatory care and 10:1 for hospitalization
- The effects of gender on utilization are more complex
  - Of the 434 hospital discharges in the child bearing age bracket for females (19-44), 180 are for delivering children – the remaining 254 are similar to males
  - In all other age groups, females have slightly lower hospitalization rates
  - Patterns of ambulatory care show a reverse effect – in every age bracket females use more ambulatory care than males

Does time price effect demand?

Dependent Variable	Outpatient Visits	Physician Visits
Elasticity with respect to T_{out}	-0.958	0.640
Elasticity with respect to T_{phys}	0.332	-0.252

- Acton (1975,1976) examined the effect of travel time, waiting time and other variables on the demand for outpatient visits and physician care
- Table provides own and cross time price elasticities
- Own time elasticities show the importance of time
- Positive cross elasticities indicate outpatient and physician visits are substitues

Empirical Studies

Price Elasticities from selected studies

Study	Dependent Variable	Price Elasticity
All Expenditures:		
Rosett and Huang (1973)	Expenditures for hospital and physician services	−0.35 to −1.5[a]
Manning et al. (1987)	All expenditures	−0.17 to −0.22
Physician Services:		
Fuchs and Kramer (1972)	Physician visits per capita	−0.15 to −0.20
Newhouse and Phelps (1976)	Physician office visits	−0.08
Cromwell and Mitchell (1986)	Surgical services	−0.14 to −0.18
Wedig (1988)[b]		
Health perceived excellent/good	Physician visits	−0.35
Health perceived fair/poor	Physician visits	−0.16
Hospital Services:		
Feldstein (1971)	Hospital admissions per capita	−0.63
Newhouse and Phelps (1976)	Hospital length of stay	−0.06
Manning et al. (1987)	Hospital admissions	−0.14 to −0.17
Nursing Homes:		
Chiswick (1976)	Nursing home residents per elderly population	−0.69 to −2.40
Lamberton et al. (1986)	Nursing home patient days per capita elderly	−0.69 to −0.76

Empirical Studies

Firm Specific Price Elasticities

Study	Dependent Variable	Price Elasticity
Physician Services:		
Lee and Hadley (1981)	Physician price	−2.8 to −5.1
McCarthy (1985)	Physician visits	−3.1 to −3.3
Hospital Services:		
Feldman and Dowd (1986)	Hospital patient days	−0.7 to −0.8
	Hospital admissions	−1.1
Gaynor and Voght (2003)	Hospital discharges	−4.9
Nursing Homes:		
Mukamel and Spector (2002)	Case-mix adjusted days	−3.5 to −3.9

Empirical Studies

Individual Income Elasticities

Study	Dependent Variable	Income Elasticity
All Expenditures:		
Silver (1970)	Expenditures	1.2
Rosett and Huang (1973)	Expenditures	0.25 to 0.45
Hospital Services:		
Newhouse and Phelps (1976)	Admissions	0.02 to 0.04
Dental Services:		
Silver (1970)	Expenditures	2.40 to 3.20
Anderson and Benham (1970)	Expenditures	0.61 to 0.83
Physician Services:		
Silver (1970)	Expenditures	0.85
Anderson and Benham (1970)	Expenditures	0.22 to 0.41
Fuchs and Kramer (1972)	Visits per capita	0.20 to 0.57
Newhouse and Phelps (1976)	Visits	0.01 to 0.04
Nursing Homes:		
Chiswick (1976)	Residents per elderly population	0.60 to 0.90

- Note that income elasticities computed using macro data in cross country comparisons often come out to be greater than 1

Empirical Studies

Rand Health Insurance Study (HIS)

- Experiment held in 1970s
- Participation was for 3 years or 5 years
- Total person years were 20,190
- Population was $<$ age 65
- 5,809 enrollees from 4 cities and 2 rural areas were assigned randomly to different insurance plans
  - Full coverage (c=0) for all services
  - c = .25 for all services
  - c = .5 for all services
  - c = .5 for dental and mental services and c = .25 for other services
  - Deductible of \$150 individual (\$450 total per family) for ambulatory care only – full coverage on hospital care (c = 0)
  - Almost no coverage (c = .95), until a catastrophic cap had been reached (5, 10 or 15 percent of family income with an overall maximum of \$1,000)
  - Some folks enrolled in an HMO in Seattle

RAND HEALTH INSURANCE STUDY (HIS)

SAMPLE

- Under every plan there was a cap on the financial risk so that no family has to spend more than 5, 10 or 15% of their income
- Also, incentives were given to participate in the experiment
- For example, if a family income is $15,000 with 5% income catastrophic cap, they were given 5% of $15,000 ($750) upfront for participating in the experiment

TABLE 1—NUMBER OF PERSONS AT ENROLLMENT AND NUMBER OF PERSON-YEARS IN ESTIMATION SAMPLE

	Site							
Plan	Dayton	Seattle	Fitch-burg	Frank-lin County	Charles-ton	George-town	Enroll-ment Total[a]	Esti-mation Sample Total[b]
Free	301	431	241	297	264	359	1893	6822
25 Percent[c]	260	253	125	152	146	201	1137	4065
50 Percent	191	0	56	58	26	52	383	1401
95 Percent	280	253	113	162	146	166	1120	3727
Individual Deductible	105	285	188	220	196	282	1276	4175
Total	1137	1222	723	889	778	1060	5809	20190

[a] Persons.
[b] Person-years.
[c] Includes those with 50 percent coinsurance for dental and mental health and 25 precent coinsurance for all other services.

RAND HEALTH INSURANCE STUDY (HIS)

DIFFERENCE IN MEANS

TABLE 5.1 SAMPLE MEANS FOR ANNUAL USE OF MEDICAL SERVICES PER CAPITA

Plan	Face-to-Face Visits	Outpatient Expenses (1984 Dollars)	Admissions	Inpatient Dollars (1984 Dollars)	Probability Any Medical (%)	Probability Any Inpatient (%)	Total Expenses (1984 Dollars)	Adjusted Total Expenses (1984 Dollars)
Free	4.55	340	0.128	409	86.8	10.3	749	750
	(0.168)	(10.9)	(0.0070)	(32.0)	(0.817)	(0.45)	(39)	(39)
25%	3.33	260	0.105	373	78.8	8.4	634	617
	(0.190)	(14.70)	(0.0090)	(43.1)	(1.38)	(0.61)	(53)	(49)
50%	3.03	224	0.092	450	77.2	7.2	674	573
	(0.221)	(16.8)	(0.0116)	(139)	(2.26)	(0.77)	(144)	(100)
95%	2.73	203	0.099	315	67.7	7.9	518	540
	(0.177)	(12.0)	(0.0078)	(36.7)	(1.76)	(0.55)	(44.8)	(47)
Individual deductible	3.02	235	0.115	373	72.3	9.6	608	630
	(0.171)	(11.9)	(0.0076)	(41.5)	(1.54)	(0.55)	(46)	(56)
Chi-squared (4)	68.8	85.3	11.7	4.1	144.7	19.5	15.9	17.0
P value for chi-squared (4)	<0.0001	<0.0001	0.02	n.s.	<0.0001	0.0006	0.003	0.002

Note: All standard errors (shown in parentheses) are corrected for intertemporal and intrafamily correlations. Dollars are expressed in June 1984 dollars. Visits are face-to-face contacts with M.D., DO, or other health providers; excludes visits for only radiology, anesthesiology, or pathology services. Visits and expenses exclude dental care and outpatient psychotherapy. n.s. = not significant.
Source: Manning, Newhouse, Duan, et al. (1987).

- Controls for differences among enrollees (age,sex,income etc.)
- Use decreases if plan becomes less generous except inpatient dollars (but results for that are not significant)

RAND HEALTH INSURANCE STUDY (HIS)

ARC ELASTICITIES FOR VARIOUS TYPES OF CARE

TABLE 5.2 ARC-ELASTICITIES FOR DEMAND

Range of Nominal Coinsurance Variation (%)	Range of Average Coinsurance Variation (%)	All Care	Outpatient Care
0–25	0–16	0.10	0.13
25–95	16–31	0.14	0.21

Source: Manning, Newhouse, Duan, et al. (1987).

- Arc elasticities (wrt coinsureance) – note they are negative numbers
- $|\eta|$ of all care $<$ $|\eta|$ of outpatient care
- All care is more inelastic than outpatient care or outpatient care is more elastic (more responsive to changes in coinsurance rates)

RAND HEALTH INSURANCE STUDY (HIS)

ARC ELASTICITIES FOR VARIOUS TYPES OF CARE

TABLE 5.3 ARC-ELASTICITIES BY TYPE OF CARE

Coinsurance Range %	Outpatient			Total Outpatient	Hospital	Total Medical	Dental
	Acute	Chronic	Well				
0–25	0.16	0.20	0.14	0.17	0.17	0.17	0.12
	(0.02)	(0.04)	(0.02)	(0.02)	(0.04)	(0.02)	(0.03)
25–95	0.32	0.23	0.43	0.31	0.14	0.22	0.39
	(0.05)	(0.07)	(0.05)	(0.04)	(0.10)	(0.06)	(0.06)

Note: Standard errors are given in parentheses. For their method of computations, see Keeler, Buchanan, Rolph, et al. (1988).
Source: Keeler, Buchanan, Rolph, et al. (1988).

- More refined analysis accounting for catastrophic expenditures caps
- In general, the price responsiveness of medical services is still fairly small
- Elasticities correspond to intuition about 'medical necessity' in the sense that demand for hospital care is least price responsive ($|\eta|$ is small), well care is most price responsive and acute and chronic outpatient fall in between
- Generally, the elasticities fall in the range of -.1 to -.3 for most medical services

RAND HEALTH INSURANCE STUDY (HIS)

HOSPITAL AND OUTPATIENT CARE

TABLE 5.4 HOSPITAL USE IN THE HIS

Plan	Admissions per Year	Inpatient Cost (1984 Dollars)
$C = 0$	0.128	409
$C = 0.25$	0.105	373
$C = 0.5$	0.092	450
$C = 0.95$	0.099	315
Individual deductible $150	0.115	373

Source: Manning, et al. (1987).

- Are hospital services and outpatient care complements or substitutes?
- Compare two plans: (a) c = 0 for all care (inpatient and outpatient care) and (b) $150 deductible for outpatient use but c = 0 for all hospital use
- Thus, the 'price' of good X (hospital care) is the same for both the groups but the price of outpatient care is higher for the second group
- Hence, we can compare the quantity consumed of good X (inpatient care) versus the change in price of good Y (outpatient care)
- Enrollees in plan with outpatient deductible had 10% fewer hospital admissions and 9% less hospital costs that the full coverage group – these numbers indicate that hospital services and outpatient care are complements

RAND HEALTH INSURANCE STUDY (HIS)

DENTAL CARE

TABLE 5.5 ANNUAL SPENDING RELATIVE TO $C = 0.95$ PLAN ($C = 0.95$ Plan $= \$100$)

	Year 1		Year 2	
Insurance Plan (Nondental/Dental)	Nondental ($)	Dental ($)	Nondental ($)	Dental ($)
Free/free	200	252	177	152
25%/25%	145	158	128	109
25%/50%	144	181	122	98
50%	111	118	105	112
95%	100	100	100	100
$150 per person deductible	143	163	124	94

Source: Manning et al. (1985).

- Data suggests that demand for dental care would be more responsive than for other medical services

RAND HEALTH INSURANCE STUDY (HIS)

DENTAL CARE

- For higher coinsurance ($c > .25$), arc elasticity of demand is -.39 (more elastic, more price responsive)
- However, for $c < .25$, dental elasticity is about -.12 (less elastic, less responsive to price)
- Explanation:
  - People were storing up dental visits
  - People going from poor dental insurance to a generous HIS plan (c between 0 and .25) took advantage of the plan by correcting any back log of dental problems in early years
  - To see this, observe that
    - In year 1, people spend more on dental care than on other services and the difference becomes more pronounced with better plans.
    - However, in year 2, the difference was less.

RAND HEALTH INSURANCE STUDY (HIS)

PRESCRIPTION DRUGS

- Demand is more price responsive than other services
- c = 0 group used 76% more drugs (in expenditures) than the group with c = .95
- However, majority of the action was in lower c range, i.e., about 50% of increase came from going from c = 0 to c = .25.
- Leibowitz A (1989, Medical Care): Study 3,860 non-elderly individuals in 4 sites participating in RAND Health Insurance Experiment
  - Found that elasticity -0.10 for coinsurance rates of 0-25%; -0.17 for coinsurance rates of 25-95% of prescriptions dispensed
- Foxman B., et al (Journal of Chronic Disorders 1987): Study 5,765 non-elderly individuals in 6 sites in U.S. participating in RAND health insurance experiment
  - Examined effect of different levels of cost-sharing (0%, 25%, 50%, 95%)
  - Results: People with free medical care used 85% more antibiotics than those required to pay some portion of their bills
  - Cost sharing reduced the appropriate and inappropriate use of antibiotics to a similar degree

RAND HEALTH INSURANCE STUDY (HIS)

MENTAL HEALTH CARE

- Earlier analysis found the demand for mental health care services to be as responsive as other ambulatory care.
- In re-analysis (using episodes of illness, rather than spending) found it to be very price responsive
- Those in the c = 0 group used about 4 times more services than those in the c = .95 group
- However, this time the action was in the right tail
- While the affect of shifting from full coverage to c = .25 was about the same as for other services, shifting from c = .5 to c = .95 showed the effect was twice as large as for other service

RAND HEALTH INSURANCE STUDY (HIS)

EFFECTS OF DEDUCTIBLE

TABLE 5.6 PREDICTED TOTAL MEDICAL CARE COSTS FOR INSURANCE PLANS WITH DEDUCTIBLES

	Annual Spending by Type of Medical Treatment ($)				
Deductible ($)	Hospital	Acute	Well	Chronic	Total
0 (free care)	400	226	68	148	842
50	387	166	47	112	713
100	384	152	43	104	682
200	379	136	37	92	644
500	376	121	33	83	613
1,000	291	114	32	78	515
2,000	283	111	31	76	501
No insurance	280	109	30	73	492

Note: All data are 1984 dollars.
Source: Keeler et al. (1988).

- No experimental data on changing levels of deductibles – can use current results and do simulations to see what the effect of deductibles would be on demand
- Note that the largest effect comes from going from D = 0 to a small deductible of D = \$50 – but not much difference beyond that until reach a deductible of \$500
- Can also compute elasticities (by regressing ln Y on ln Deductibles where Y is total or hospital expenses) – found η of total expenses = -.07 and η of hospital expenses = -0.04 (very inelastic ... not very responsive to deductible changes)

RAND HEALTH INSURANCE STUDY (HIS)

INCOME ELASTICITIES

TABLE 5.7 INCOME ELASTICITIES FOR EPISODES

Type of Care	Income Elasticity for Number of Episodes of Illness
Acute	0.22
Chronic	0.23
Well care	0.12
Dental	0.15
Hospital	n.s.[a]

[a] Not significant.

Source: Calculated from Keeler et al. (1988), Table 3.6 (for average numbers of episodes) and Table E. 1 (for coefficients of income in regression equation). Estimated equation used SQRT (visits + 0.375) as the dependent variable and log (Income) as the explanatory variable. Elasticity is calculated as β SQRT (visits + 0.375)/visits, where β is the coefficient in the estimated regression.

- We expect that with full coverage (c = 0), the pure income effect would be either zero or very small
- However, we observe a slight U shaped curve for most services with respect to income, with low and high income families using the most care and middle income families using the least
- Income elasticity about .2 or less
- Note, however, that income elasticities computed using macro data in cross country comparisons often come out to be greater than 1