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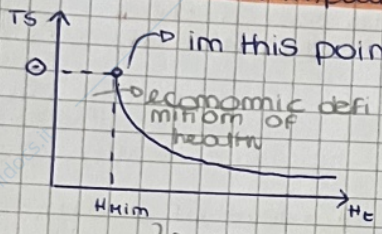
↳ productive time

$T^P = \Theta - T^S = T^W + T^Z + T^H$

The healtier you are, the less time you spend sick, increased productive time can be reinvested into health (T^H) or T^W and T^Z. The only way to reduce the risk of sick time (T^S) is to improve health

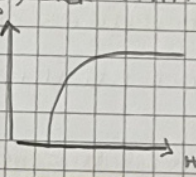
→ health is an input in the production of productive time



individual is death if $H < H_{min}$ and alive

IF $H > H_{min}$

as health increases, sick time decreases



> H

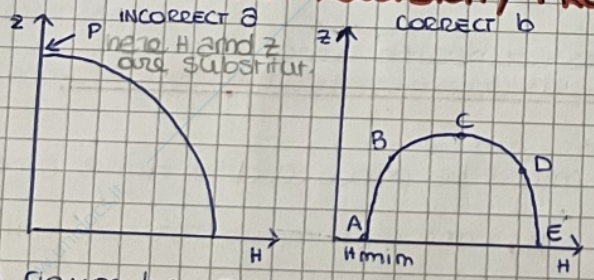
< marg ret.

↳ no productive time

3 roles of Health in the Grossman Model

1. Health is a **consumption good** = it contributes directly to individuals utility
2. Health as an **input into production** = it generates productive time (T^P) which is useful for producing H and Z
3. Health is a **form of capital** = it endures from period to period, it can accumulate (or depreciate) over time, so improvements in health today can lead to better health tomorrow. It's a stock that goes through time

THE PRODUCTION POSSIBILITY FRONTIER (PPF)



EFFICIENT COMBINATION/FRO is the possibe combination of H and Z attainable, given an individual's budget and time constraint.

Point P is not attainable, an individual w/ low H will have few resources to produce any Z

In figure b:

- Point **A**, H_{min}, so no productive time for work, play or improvement of health, cannot afford any Z
- Point **B**: "free-lunch zone", small improvements in health yield large increases in productive time, can increase Z w/out giving up H
- Point **C**: MAXIMUM Z possible, can't improve health w/out taking away Z, if try to increase Z by shifting resources, sick time will increase and outweight gain in resources for Z. Increases in health will not produce extra time to offset time spent improving health
- Point **D**: is the **tradeoff zone**, increases in H only yield small decreases in sick time. Increases in H, takes away from Z
- Point **E** = individual spend all time and money in health, ignores all home goods Z

MAX of a good, given the level of the other

- From A to C = frontier is increasing, you increase both: complementary good, then substitutes

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3. Health as a form of stock/capital investment aspect of health

On any day individuals consider not only today's utility $u(H_0, Z_0)$ but all future utility as well

$$U = u(H_0, Z_0) + \delta u(H_1, Z_1) + \delta^2 u(H_2, Z_2) + \dots + \delta^{\Omega} u(H_{\Omega}, Z_{\Omega})$$

$$= \sum_{t=0}^{\Omega} \delta^t u(H_t, Z_t)$$

high level of health in one period leads to high level of health in the future

- Health is a stock; some of it carries over each new period
- Home good Z is a FLOW (it lasts for only 1 period)
- δ = individual's discount rate $(0 < \delta < 1)$
  - a person values utility more now that in the future, when raised to its power it becomes smaller
- Ω = individual's lifespan (total number of periods)

Health depreciates over time

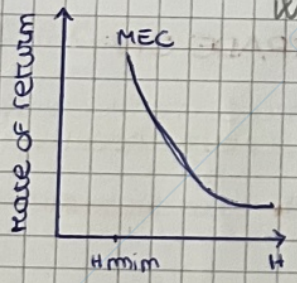
Some of yesterday's health lasts to today but not all of it

$H_t = H(1-\gamma) H_{t-1}, T_t^H, M_t) \rightarrow$ How fast health dissipates

- γ = rate of depreciation
- H_t = health at period t
- H_{t-1} = health from previous per.
- T_t^H = time spent on health in t
- M_t = market inputs for health

MEC curve and investments in health

w/ its own rate of return

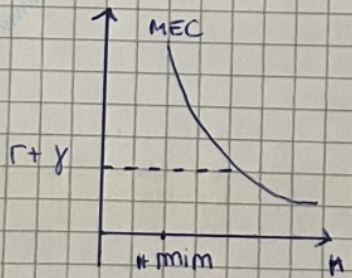


- Marginal EFFICIENCY OF CAPITAL
  MEC curve = indicates how efficient each unit of health capital is in increasing lifetime utility

When level of H is low, small investments have high return to productive time

Downward sloping, diminishing marginal returns to health

Cost to investing in health



- Opportunity cost
  Forgoes putting money into other investments
  r = interest rate of alternative market investment
- Depreciation due to aging (γ)
  Health must pay a return of at least $r + \gamma$
  if return is less than $r + \gamma$, then market return beats health investment return

H^* = optimal amount of health
Marginal cost balances with marginal benefit of health investment

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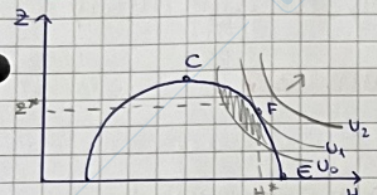
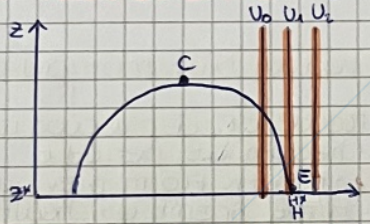
CHOOSING OPTIMAL H and Z



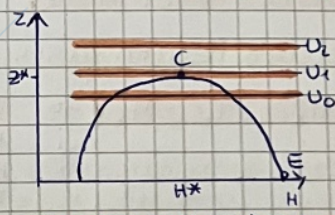
An individual who value both H and Z chooses a point btw C and E in order to maximize their utility.
Chooses point F:
- U_2 is attainable given PPF constraints
- At U_0 an individual can obtain more U
- At F U am PPF are tangent
- H* and Z* are optimal level

The individual is willing to give up some health in order to gain utility from other good. In GM model ppl makes trade off when maximizing utility

EXOTIC PREFERENCES and INDIFFERENCE CURVES



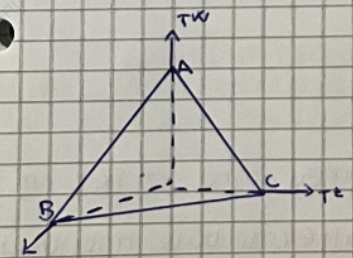
- Cares only about Health H
- vertical indifferences curve
- H* and Z* at point E



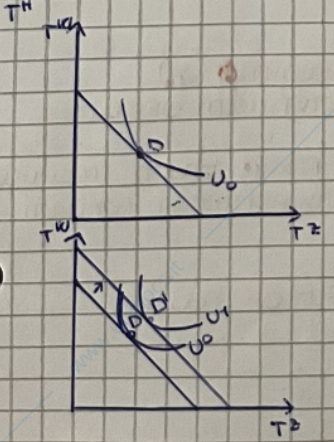
- Cares only about home good Z
- Horizontal indifference curves
- H* and Z* at point C

THE LABOR-LEISURE-HEALTH IMPROVEMENT TRADE OFF

Individual's prior health, over which he has no current control. Current decision about health will affect his future health
→ $\Theta = T^P + T^S$ → $T^P = T^W + T^H + T^Z$
Total productive time is increasing in health but diminishing marginal returns.



in A an individual is workaholic, he devote all his productive time to work
B = healthaholic
C = playaholic



Slope of time constraint is the wage
If the individual has already decided about T^H he has to make the tradeoff only among T^W and T^Z, the shape of the indifference curve only derives from utility function.
He chooses point D where U_0 is tangent to the time constraint

When health improves more productive time is available, time constraint shift outward

Capire!

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- Im **RAND HIE** = - a patient cost sharing increases, the nr° of episodes of out patient decreases, for both acute and chronic conditions (like diabetes/high blood pres

- Im **OREGON** ME DICAL STUDY = lottery winners have more outpatient visits than lottery loosers

Both studies find downward-sloping demand for outpatient care

- Inpatient care = any interaction w/ doctors that involves an overnight stay in a hospital

Both studies does not find significant difference, so the demand is still downward sloping, but less elastic than demand for outpatient care

we expect that the more severe the condition, the less price sensitive the patient. so we would expect demand for ER should be completely price insensitive, but there is evidence that the demand is downward sloping
↳ RAND HIE find differences, participants were sensitive to price

- Pediatric care = it is tipically paid by parents
  - Rand Hie shows that parents are price-sensitive even w/ respect to health care for their children (so even in this case the demand is downward sloping
    ↳ case antibiotics
  - Mental health and dental care (also downward sloping)
  - Prescription of drugs (↓ price, ↑ use of prescription drugs)

- non randomize experiment evidence: **US MEDICARE**

Citizens are eligible for health insurance through medicare when they turn 65 but not before, if demand for health care is downward sloping, we expect a jump in health care usage at 65 → this is known as DISCONTINUITY STUDY

· MEASURE PRICE SENSITIVITY

One simple measure of price sensitivity is the slope of the line plotted between 2 points of the measured demand.
↳ the problem is that units are not comparable
so we use:

ELASTICITY OF DEMAND = the ratio that represents how a fixed percentage change in the price of a good leads to a change in the quantity demanded, measured as a %

$$E = \frac{(Q_2 - Q_1)/Q_1}{(P_2 - P_1)/P_1}$$

relatively inelastic ($-1 < E < 0$)

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we need a measure to compare the relative price sensitivity of ≠ goods

→ **ARC ELASTICITY**: let (Q_1, P_1) and (Q_2, P_2) be two points on a single demand curve

$$E_{arc} = \frac{\Delta Q / (Q_1 + Q_2)}{\Delta P / (P_1 + P_2)} \qquad \Delta Q = Q_2 - Q_1 \qquad \Delta P = P_2 - P_1$$

- **INELASTIC** $(-1 < E_{arc} < 0)$: salt, coffe, dental care, impatient
- **ELASTIC** $(E < -1)$ = Fresh tomatoes, meals

The simplest way to compare the health of ≠ groups is w/ mortality rates

- **Oregon Medicaid** = no ≠ btw lottery wimmers and losers
- **RAND HIE**: Failed to find ≠ btw treatment groups, it has impact only on the most vulnerable
  The high risk ppl on the free plan were 10% less likely to die than high risk participants on the cost sharing plan

Does price for care affect health?

- **RAND HIE**: generally, no health ≠ btw ppl on free plan vs cost sharing (only ≠ in blood pressure, myopia)
- **OREGON MEDICAID**: lottery wimmer self reported better overall health, more healthy days and lower rates of depress.

Discrepancies may be because oregon only focus on low income, while RAND is more cross sectional

CONCLUSION

Demand for health care is downward sloping. Quantity of care demanded is sensitive to price.
But generally, price of health care does not seem to affect one's health

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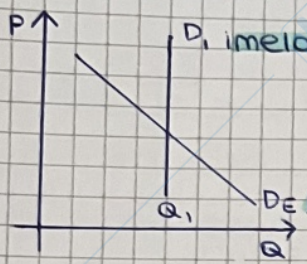
CHAPTER 2
DEMAND for HEALTH CARE



D_1 / Q_1 = to have a certain level of care ppl are going to pay any price
→ price do not significally change the demand

D_E = takes price into account when deciding how much care to seek
→ price affect the demand

consumers are price sensitive when it comes to medical care. PPl w/ ≠ budget constraints, life expectancies, quality of life evaluate ≠ the tradeoff btw medical care and other goods

→ demand for health care is downward sloping

- Randomized experiment = a study that assigns treatments randomly to ≠ groups. A randomized controlled exper. includes a control group which is randomly chosen and receives a placebo or the usual treatment they would have received if not enrolled in the trial

2 RANDOMIZED EXPERIMENTS: - RAND health insurance exp. (HIE)
- oregon Medicaid Experiment

- **RAND**: 1974 - 1982, they randomly assigned (2000) families from (six) US cities to ≠ insurance coverage plans

4 copayments groups: Free, 25%, 50%, 95%.
↳ is the fraction of the medical bill, so ppl assigned to ≠ plans had to pay ≠ prices for the same service
→ only focus on low income

- **oregon Medicaid** Experiment: compared (2) groups of low income adults = Medicaid lottery winners vs lottery loosers. The winners got to apply for public health insurance through Medicaid (so they faced lower out-of-pocket prices for care), while loosers could not get Medicaid

pag 12 pro vs cons

Result: health care demand curves are downward sloping: price changes affected demand for health care

≠ MEASURES OF CARE

- Outpatient care (→ also called ambulatory care) = any interaction w/ a doctor or other medical care professional that does not involve an overnight stay, they tend to be less complex

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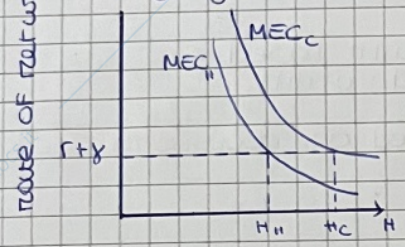
Predictions of the Grossman model

① Better health among the educated

- well educated individuals are more efficient producers of health.
College grads benefits more than a high school dropout



better educated are more efficient at each level of health investment

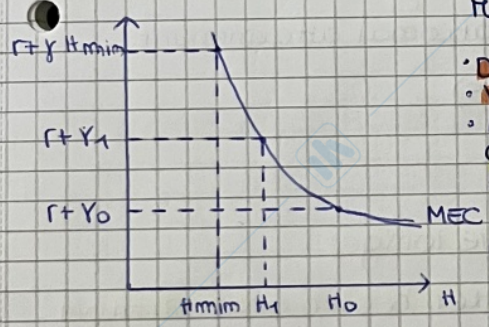
$MEC_C > MEC_H$

H_C^* is higher than H_H^*

MEC_C = colleg graduates
MEC_H = high school dropout

② declining health among the aging

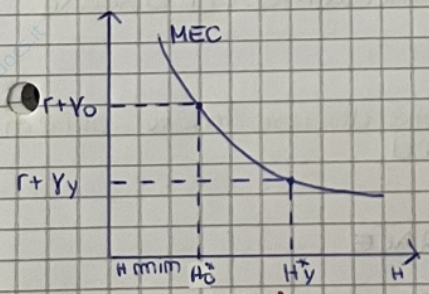
recall: $H_t = H((1-\gamma)H_{t-1}, T_t^*, M_t)$



- depreciation γ is not constant
- γ increases w/ age
- As γ increases, costs $(r+\gamma)$ increases and it takes more resources to maintain same level of health

As a result of increasing depreciation γ over time, optimal health H^* also declines over time

optimal death in the Grossman model



- Because of rising depreciation, there are better investments in the market than the individual's health
- H^* eventually reaches H_{mim}

CONCLUSION

- Is health smt that happens or is chosen?

Grossman model says it is chosen, in fact we even chooses when we die

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CHAPTER 3
DEMAND FOR HEALTH: THE GROSSMAN MODEL

3 ROLES OF HEALTH: ① A consumption good
② An input into production
③ A form of stock/capital investm

1. Health as a consumption good

Health contributes directly to utility (is not in the utility funct.)

health ≠ health care

Simple-period utility: $u_t = u(H_t, Z_t)$

H_t = level of health
Z_t = "home good"
↳ everything else

· Time constraints in the Grossman model

In a single period there are only 24 h/day to contribute to utility:

T^W = time working, T^H = time improv. health, T^Z = time playing, T^S = time sick

$$\Theta = T^W + T^Z + T^H + T^S$$

Each hour spent working (T^W) produces income, which can be used to buy medical care ($\uparrow H$) or play puzzles ($\uparrow Z$).
T^S (time sick) is ≠ because it does not increase utility, so it is time loss that you can use to ↑U

2. Health as an input into production of health and of productive time

Both health and home good Z must be produced w/ time and market inputs

$$H_t = H(H_{t-1}, T_t^H, M_t)$$

$$Z_t = Z(T_t^Z, J_t)$$

M_t = market inputs for health H (weights)
J_t = market input for home good Z (EX videogames)

Today's H (H_t), depends also on yesterday's H_{t-1}

Budget constraint

$Y_t = W \cdot T_t^W$
↳ dollars/unit of time

An individual can spend her income in two items: M and J, let P_H and P_J be the two prices so:

$$P_H \cdot H + P_J \cdot J \leq W \cdot T_t^W = Y_t \rightarrow Y_t = WT_t^W = P_H \cdot H + P_J \cdot J$$

Time and budget constraint are not indipendent!

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Health disparities w/ UNIVERSAL INSURANCE

Even in countries w/ universal health insurance, health disparities persist

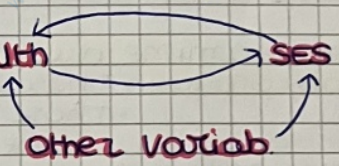
Canada = infants born to poor families are nearly twice as likely to have poor self reported health than those born in rich families

THEORIES

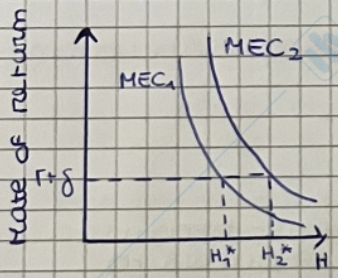
Why do health disparities exist?
- Early life events
- Income levels
- Stress of being poor
- Work capacity
- impatience
- Adherence to medical advice

policy importance of understanding causes of disparities before addressing them.

what causes what:



The Grossman Model and health disparities



Recall MEC indicates the return on each additional unit of health capital.

≠ SES groups may have ≠ MECs

Hypothesis for health disparities

1. The efficient producer hypothesis — Better educated
   Education improves H
   - Hypothesis: better-educated individuals are more efficient producers of health than less well educated ind.
     - Grossman predicts that ppl who are more efficient health producers will have higher H* (Education improves health)

Lleras-Muney (2005) find that an additional year of schooling caused 1.7 year increase in life expectancy in 1920s US

Possible reasons for this positive correlation

- lessons in school helps students to take better care of themself
- schooling helps students be more patient when it comes to payoffs of investments (like health)
- Better educated more likely to adhere to treatment regimens

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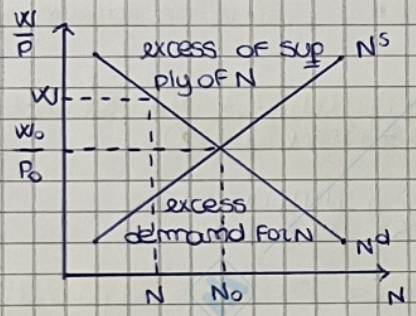
CHAPTER 5
THE PHYSICIAN LABOR MARKET

↳ not a perfectly competitive market

LABOUR MARKET FOR PHYSICIANS

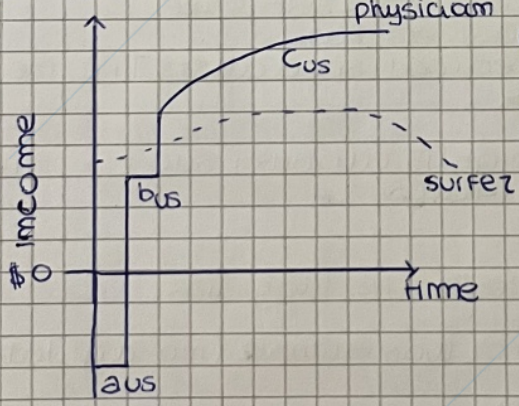
- New report reveals alarming shortage of country doctors (The Guardian 13 oct 2019)
- America's aging population is leading to a doctor shortage crisis (CNBC 6 sept 2019)
- Europe has a shortage of doctors
  ↳ this shortage has many causes: a large number of doctors reaching retirement age, to few new doctors being trained, too many specialists as opposed to general practitioners.



↳ A non-competitive labour market

Jobs are not all the same $W_1 \neq W_2$
Must consider lifetime costs and benefits

RETURNS TO MEDICAL TRAINING



Unlike most occupations, returns to medical training are very back-loaded
- Medical school and residency expensive in direct costs and opportunity costs.

So those who choose being physician are patient enough to value future returns

NET PRESENT VALUE the discounted sum of all future earnings

↳ is a way of calculating value of all future streams of income (from today's perspective)

$$NPV = \sum_{t=0}^{T} \delta^t I(t)$$

you give up smt today to have more tomorrow

The discount factor δ is a measure of how much less an individual values future income over present income
- $0 < \delta < 1$, small if impatient and large if patient
- Those with high δ have high NPV from being a physician
- Those with low δ have low NPV (maybe even negative)

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The Whitehall study (Marmot 1978-1991)

Compares health status of British civil servants
British civil servants relatively homogeneous in background and share workplace environments.
All the british citizens have the same access to health care through the National Health service

→ Disease morbidity and mortality rates highest for low-grade civil servants.
Low-grade civil servants reported more stressful work and home environments

⑤ Income inequality hypothesis

- hypothesis: health disparities are caused by an unequal distribution of income. (related to the allostatic load hypothesis). More equal societies are less stressful and therefore healthier.

If theory is true then policymakers should aim at reducing inequality within a community.
The health status of a society may decline even if average income rises if income becomes more concentrated

⑥ Access to care hypothesis

- hypothesis: those w/ high incomes can afford more generous health insurance compared to those of low income

But health disparities persist in countries w/ universal health insurance (Canadian youth and British civil servants)

⑦ Productive time hypothesis

SES differences are caused by disparities in health
Bad health leads to lower productive time and therefore less time to produce income
Bad health → less time to produce income
Oreopoulos and Black study siblings growing up in the same household
→ those with worse health during infancy have higher mortality rates, lower educational achievement and lower adult earnings

⑧ The Fuchs hypothesis

Bad health does not cause low SES, and low SES does not cause bad health. A third factor - time preference - causes both health and SES both determined by willingness to delay gratification. PPl who are willing to delay gratification are more willing to invest in things like education and health, and have high discount factors δ

$$U = U(H_0, Z_0) + \delta U(H_1, Z_1) + \delta^2 U(H_2, Z_2) + \dots + \delta^n U(H_n, Z_n)$$

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Another way of expressing discount factor is:

$$\delta = \frac{1}{(1+r)}$$ ▷ discount rate

Where r is the discount rate, analogous to the market interest rate that would make a person with discount factor δ indifferent btw saving for tomorrow and spending today, high r indicate impatience

Ex. $\delta = 0.9 \rightarrow r = 0.11$

very patient have high discount factors δ and low discount rates r

INTERNAL RATE OF RETURN (IRR)

Consider 2 possible career choices P and S with incomes path I_P and I_C

IRR = r^* is the discount rate which equalizes the NPV of both careers (or the ≠ btw NPV(P) − NPV(S) = 0)

$$\sum_{t=0}^{T} \frac{I_P(t) - I_S(t)}{(1+r^*)^t} = 0$$

$r > \delta$ impatience
$r < \delta$ patience

Someone with IRR of r^* values career P and S equally

IRR in medicine is tipically btw 11% and 14%
- significantly higher than market interest rate
- This is true for dentists and lawyers too
- IRR may be even higher for medical specialists like neuro surgeons and immunologists.

The fact that IRR has stayed high is curious: suggest that being a physician is highly lucrative

BARRIERS TO ENTRY ▷ might explain the high IRR

In 19TH century, becoming a doctor was simple (no regulation)

- American Medical Association (1847)
  - Pre-req's for medical school
  - 4 years medical school
  - Require doctors to have a license to practice
  - 1910 Flexner report helped shut down low-quality med schools
  - ▷ less med schools and less med students
- Caps on medical school class size
- Doctors need license to practice on their own
  International med graduates: long and ardous process to practice in the US

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(2) Thrifty phenotype hypothesis (Barker hypothesis)

- Genetic reasons for being inefficient at producing health
- Deprivation of resources (food) in utero and early childhood leads to activation of "thrifty" genes that are useful for scarce environmental conditions.
  These "thrifty" genes good for scarce environments but bad in conditions of abundance. More likely to develop diabetes, obesity, and other disorders later in life.
  Disparities arise because poorer individuals are more likely to have resource deprivation early in life

Natural experiments = use environmental shocks that naturally create control and treatment groups

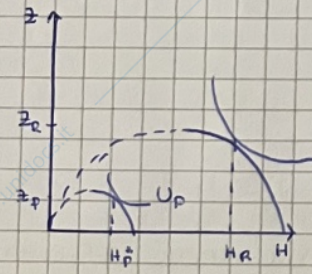
The Dutch Famine study (natural experiment in WWII)

Holland suffered a famine due to a German blockade of food.
This creates 2 baby groups: • Those in utero during famine
• Those conceived after famine

The 2 groups are similar, except for in utero deprivation (so hopefully no selection bias)

→ Babies in utero during famine had higher rates of diabetes and obesity in adulthood

(3) The direct income hypothesis

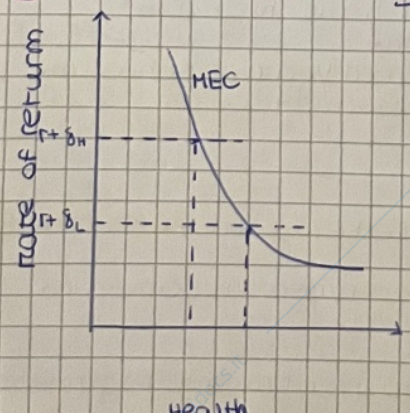


- hypothesis: disparities exist because rich people have more resources to devote to health

Rich individuals have an expanded PPF because of extra financial resources

Expanded PPF = higher H* that can be obtained

(4) Allostatic load hypothesis



- hypothesis: prolonged or repeated stress is unhealthy and can cause an increased rate of aging

In the Grossman model, aging is represented by the rate of depreciation of health capital (γ)
High stress load leads to a higher γ

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- Nurses and Physician assistants: limited in scope of practice
- Alternative medicine: chiropractors, acupuncturists need licensure too
  ↳ ensure that doctors are qualified

Because of barriers to entry, consumers have to pay above the competitive price
Physicians therefore earn monopoly rents
↳ wages above the competitive price due to artificial constraint of the market

PHYSICIANS AS AGENTS

Patients trust physicians to act as perfect agents for their health

Doctors' foremost concern should be patients' well being, not their own financial status and reputations

PHYSICIAN-INDUCED DEMAND (PID)

1. Information asymmetry btw doctors and agent
   Patients cannot assess whether an extra test or procedure ordered by doctor is necessary
2. Financial incentive for doctors to prescribe more services than needed
   - Empirical evidence than when reimbursement rates for various procedures change, doctors prescription practices also change

DEFENSIVE MEDICINE

↳ overutilization of testing and services
protects against malpractice lawsuits

Doctors fearful of lawsuit may overprescribe (and overcharge) for only marginally-useful procedures

Mello (2010) estimate that medical liability system in the US costs $55.6 billion annually

CONCLUSION

- Physician supply highly regulated: leads to a shortage of doctors, hard for other health care providers to fill the void
- Investments returns to being a doctor and specializing is very high
- Physicians are not always perfect agents of care
  - over utilization of care
  - Physician induced demand and defensive medicine
  - Racial discrimination

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INCOME W/ INSURANCE

Let I'_H and I'_S be income w/ insurance

Sick: $I'_S = I_S + q - r$
Healthy: $I'_H = I_H + 0 - r$

For risk averse optimally is $I'_H = I'_S$

FULL INSURANCE = it means no income uncertainty

Final income is stateindepemdent = regardless of healthy or sick, final income is the same
→ risk averse individuals prefer full insurance to partial insurance (given the same price)

- Full insurance → state indipemdence : $I'_S = I'_H$
  payout implies

So = $I_H + 0 - r = I_S + q - r$

$I_H = I_S + q$

$q = I_H - I_S$ payout = ≠ btw incomes w/out insurance

ACTUALLY FAIRINSURANCE = insurance is a fair bet

So the premium equals the expected payout $r = pq$

insurer makes zero profit/loss from fair insurance

ACTUABLALLY FAIR, FULL INSURANCE

- Healthy state

$I'_H = I_H - r$
$= I_H - pq$
$= I_H - p(I_H - I_S)$
$= pI_S + (1-p)I_H$

$I'_H = E(I)p$

- Sick state

$I'_S = I_S - r + q$
$= I_S - pq + q$
$= I_S - p(I_H - I_S) + (I_H - I_S)$
$= pI_S + (1-p)I_H$

$I'_S = E(I)p$

Comsumers with fair and full insurance achieve their expected income w/ certainty.

insurance and risk aversion
↳ simply by reducing uncertainty, insurance can make this risk averse individuals better off

relative to the state of no insurance, w/ insurance she loses income in the healthy state ($I_H > I'_H$) and gains income in the sick state ($I_S < I'_S$)
The risk averse individual is going to sacrifise some good times in healthy state to lose the bad times in the sick state

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- **Cost characteristics**: high Fixed costs → a natural oligopoly (economies of scale)

- **Ownership**: hospital like public = Firms" performance cannot be judged looking at profits, although budget concern

→ Healthcare is a particular good

Positive volume - outcome correlation: surgical mortality rates decrease w/ increased hospital volume

- **Learning-by-doing hypothesis** = high volume leads to good outcomes
- **selective-referral hypothesis** = good outcomes leads to high volume

DIFFERENTIATED PRODUCT OLIGOPOLY few firm im the market bc strict b to entry

Hospital industry is a differentiated product oligopoly goods are not perfect substi

- **Strict barriers to entry**: buildings, technology, staff...
- **Few Firms**: each can affect market outcome (no price taker) cost to enter
- **Strategic interaction**: game theory
- **Herfindahl-Hirschman Index**: $HHI = \sum s_i^2$ 0 → monopoly
  Measure of market concentration
- **Concentration ratio** (CR_4)

- **Strategies**: price, quantity, quality, technology

- **Services provided by each firm are not perfect substitutes**
  → (differentiated product) P > MC
  - Horizontal differentiation (price) location
  - vertical differentiation (quality)

UMITED COMPETITION → not just due to barriers to entry

- **Because of insurance**: - prices not transparent
  - Moral Hazard for insured patients
- **Government often sets prices**
- **Emergency nature** of health care means that patients are unable to search for the "best" and "cheapest" hospital

IS HOSPITAL COMPETITION GOOD FOR PATIENTS? Typically competition improves quality and lowers prices

BUT: - Presence of insurance hinders price competition
- Patients are typically referred to hospitals by physicians, so hospital compete for physicians

→

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CHAPTER 7
DEMAND FOR INSURANCE

Why buy insurance?

- Demand for the insurance is driven for the fear of the unknown
  - Hedge against risk - the possibility of health outcomes
- Purchasing insurance means forfeiting income in good times to get money in bad times
  - if bad times avoided, then money lost

EX.: individual who buy health insurance but never visits the hospital might have been better off spending money elsewhere

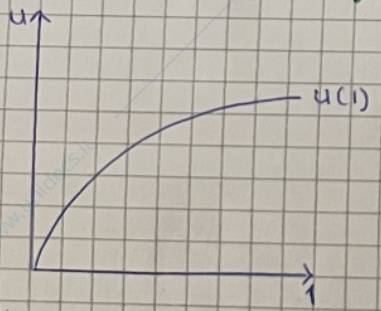
RISK AVERSION

→ risk aversion drives demand for insurance

The individual is risk averse if s/he prefers the certainty equivalent to a "lottery" w/ the same expected value

We can model risk aversion through utility from income $u(I)$
- Utility increases w/ income $U'(I) > 0$
- Marginal utility for income is declining $U''(I) < 0$
- A measure of absolute risk aversion = $\frac{U''(I)}{U'(I)}$

INCOME and UTILITY



graphically
- Utility increasing w/ income $U'(I) > 0$
- Marginal utility decreasing $U''(I) < 0$

Adding uncertainty to the model

An individual does not know whether she will become sick, but she knows the probability of sickness $0 < p < 1$ health = $1 - p$

If she get sick, medical bills and missed work will reduce her income

$I_H > I_S$

EXPECTED VALUE = $E(X)$ is the sum of all the possible outcomes of X weighted by each outcome's probability

$E(X) = p_1x_1 + p_2x_2 + \dots + p_mx_m \rightarrow E(I) = pI_S + (1-p)I_H$

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EXPECTED UTILITY

E[U(X)] is the sum of the utility from each of the possible outcomes, weighted by each outcome's probability

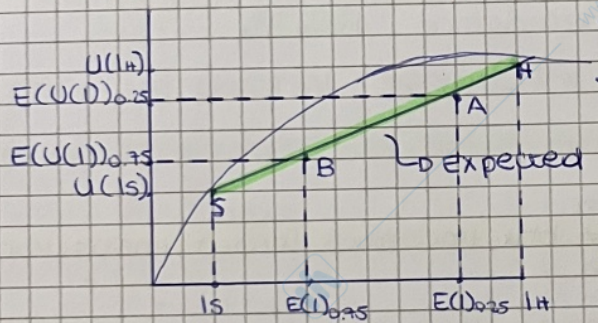
$E[U(X)] = P_1 U(X_1) + P_2 U(X_2) + \dots + P_m U(X_m)$

EXPECTED UTILITY W/OUT INSURANCE

- Lottery scenario similar to case of insurance customer
  → She gains an high income I_H if healthy and low income I_S if sick

Expected utility $E(U(I)) = pU(I_S) + (1-p)U(I_H)$

E[U(I)] and probability of sickness



- The person is sick w// certainty ($p = 1$)
- $E(U) = U(I_S)$ equals the U from certain income I_S (S)
- If no chance of bec. sick $p = 0$
- $E(U) = U(I_H)$ equal utility from certain income I_H (H)

For p ($0 \le p \le 1$) expected utility falls on a line segment btw S and H

Ex. if $p = 0.25$, person's expected income

$E(I) = 0.25 I_S + (1 - 0.25) I_H$ → utility at that expected I is point A

For risk averse people $U[E(I)] > E(U(I))$ *

RISK-AVERSE INDIVIDUALS = prefer certain outcomes to uncertain ones w// the same expected income

* → they prefer utility from expected income that expected utility from uncertain income

Concave utility function $U'(I) > 0$, $U''(I) < 0$

A BASIC HEALTH INSURANCE CONTRACT

Customer pays an upfront fee, r = insurance premium
- if ill, customer receives q = insurance payout
- if healthy customer receives nothing

income –	sick	$I_S + q - r$
	Healthy	$I_H + 0 - r$

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CHAPTER 6
THE HOSPITAL INDUSTRY

Trend in lenght of stay

- Technology advances have reduced recovery times
- Insurer increasingly design hospital payment to incentive shorter hospital stays

→ increase in outpatient visits
decreased lenght of stay

THE HOSPITAL INDUSTRY

Hospitals, like firms, organise « production » using inputs (ma chines, physicians, nurses...)

Their objective depends on ownership:
- profit for private hospitals
- other objectives (health, equity) for non profit and Government owned.

- Hospitals and physicians
- Relationship among hospitals (the hospital market)
- Hospitals and patients.

DIFFERENT MODES OF HOSPITAL - PHYSICIAN RELATIONSHIPS

Modes:
- "Physicians' workbench" (Majority in US)
  - Physicians not directly employed by hospital
- Direct employees (UK NHS; US "hospitalists")
- Physician-owned hospitals (Japan; US)

Tradeoffs btw the ≠ modes:
- Physician loyalty to hospital or the patient?
- Doctors without connection to the hospital may overuse hospital resources

HOSPITAL AS FIRMS

- Public hospitals: · Government owned and government financed
  · Objectives = equity, health as a merit good
- Private hospitals: · For profits
  · Not for profits

They all "compete" in the market: for patients, physicians and funding

Competition involves: price, quality, location, technology and innovation

Output: quality of care, clinical outcomes, access

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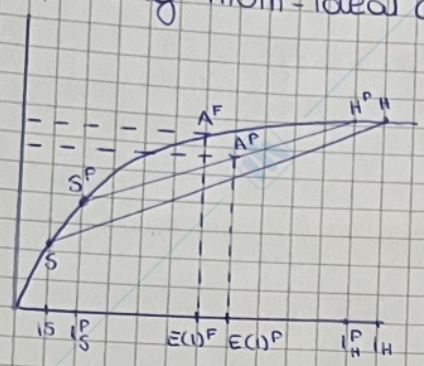
Comparing non-ideal contracts



A^F = Full but unfair contract

A^P = partial and fair

- In this case $U(A^F) > U(A^P)$

Even though A^F is unfair, its relative fullness (i.e. higher payout) makes it more desirable

But notice if contract A^F became more unfair, then expected income $E(I)$ falls → if too unfair, A^F may generate less utility than A^P.
A^P may become more full by increasing its payout → uncertainty falls, so point A^P moves. At some point, this consumer will be indifferent btw the two contracts.

CONCLUSION

- Demand for insurance is driven by risk aversion
  - Desire to reduce uncertainty
  - Diminishing marginal utility from income
  - $U(I)$ is concave, so $U''(I) < 0$
  - $U(E(I)) > E(U(I))$

- Risk aversion can explain not only demand for insurance but can also help explain:
  - large family sizes
  - Portfolio diversification
  - Farmers scattering their crops and land holdings

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- Medical arms race hypothesis = greater competition among hospitals for physicians can result in redundancy and overconsumption of medical technologies. This can actually increase costs without improving quality
- Lots of empirical research about the effect of hospital competition on patient outcomes: mixed findings and ≠ policy implications

FOR-PROFIT and NON PROFIT HOSPITALS

US hospital industry has both for profit and non profit hospitals
→ Majority are non profit: 2009 = 75% of private hospitals are organized as non profit

Benefits of non profit status: · exempt from taxes
· donors receive a tax reduction

Costs //: · can not sell stock
· can not distribute profits to owners
· Restricted to certain charitable activities

Why non profit exist: ① Altruistic-motive theory
Some entrepreneurs prefer altruism over prof

② Government-failure theory
Politics ineffectively help those in need

③ Asymmetric information
Donors trust non profits more w/ money

④ Non profits are for profits in disguise
· "profits" are distributed as higher wages or non monetary benefits
· Mixed study result

Who pays? How are set the prices?

- The Government
- Insurance
- Patients (out of pocket)

Prices vary greatly across hospitals

- According to public price lists or "chargemasters", the cost of a chest X-ray in 2004 ranged btw $120 to $1519 across 7 hospitals in California.
  - tremendous variability
  - buyers (both insurer and patients) rarely pays the chargemasters price
- Hospitals and insurers - both public and private - periodically negotiate rates
  - rates vary w/ relative bargaining power of hospitals and insurers
  - same hospital may have ≠ rate for ≠ insurers

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Who pays for uncompensated care?

Last-resort laws mandate that hospital treat all patient who enter their emergency rooms

- uncompensated care = hospital charges not covered by out-of-pocket payments, public insurance or private insurance
  → someone has to pay for uncompensated care
- unpaid hospital care is paid for through cost-shifting
  - rich patients pay for poor patients' care (cross-subsidization)
  - in the US, reimbursement rates much higher for private insurers than for Medicaid or Medicare

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INSURER PROFITS

Expected profits $= E[\Pi(p,q,r)] = (1-p)r + p(r-q)$

$= r - pq$

FAIR and UNFAIR INSURANCE

- In a perfectly competitive insurance market, profits will equal zero

  $E[\Pi(p,q,r)] = 0 \rightarrow r = pq$

- In an unfair insurance (positive profits)

  $E[\Pi(p,q,r)] > 0 \rightarrow r > pq$ → expected outcome

An insurer would never offer a contract w/ negative profit

FULL VS PARTIAL INSURANCE

Partial insurance does not achieve state independence

- Full insurance

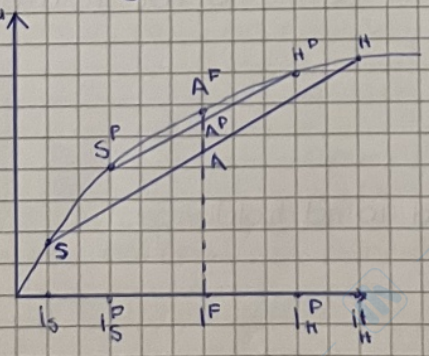
$$\begin{aligned} l'_S &= l'_H \\ l_S - r + q &= l_H - r \\ l_S + q &= l_H \\ q &= l_H - l_S \end{aligned}$$

- partial insurance

$$\begin{aligned} l'_S &< l'_H \\ l_S - r + q &< l_H - r \\ l_S + q &< l_H \\ q &< l_H - l_S \end{aligned}$$

Size of the payout q determines the fullness of the contract → closer q is to $l_H - l_S$, the fuller the contract

comparing insurance contracts



A^F = Fair and Full
A^P = Fair and partial
A = uninsurance

$u(A^F) > u(A^P) > u(A)$

- Ideal and non-ideal insurance contract

	Fair	Unfair
FULL	$r = pq$ $q = l_H - l_S$	$r > pq$ $q = l_H - l_S$
PARTIAL	$r = pq$ $q < l_H - l_S$	$r > pq$ $q < l_H - l_S$

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We found $E[X|P] = \frac{1}{2}P$

→ $\frac{3}{2} E[X|P] > P$

$\frac{3}{2} \cdot \frac{1}{2} P > P$

$\frac{3}{4} P > P$

This is impossible, hence buyers will not buy for any P

No cars sell, no pareto improving trades
The market unravels

buyers will not buy because do not like cars enough to buy a car of quality $\frac{1}{2}P$ for a price P

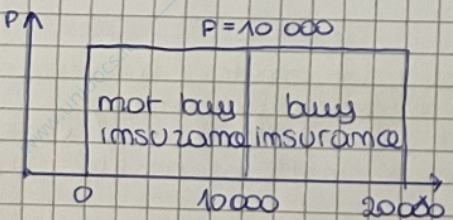
IN HEALTHCARE

- Each customer$_i$ has an expected amount of health care costs over the course of the year x_i
- An insurance company offers a single policy w/ an annual premium P. This full insurance policy covers all health care costs incurred during the year
- Customer are risk-neutral, they will purchase insurance if and only if P is less than his expected health care costs x_i
- The insurer cannot distinguish btw healthy and sick customers

Analogy btw this 2 markets:
- cars = customer bodies
- sellers = customers
- Buyers = insurance companies

- The seller try to convince the buyers that the "cars" are healthy
- Just as a hight quality car is worth a lot to buyers, a healthy customer is worth a lot to insurers.
- Just like high quality cars leave the market when a universal price is set, high quality ~~cars~~ bodies will leave the market when a universal premium is set.

HEALTH INSURANCE MARKET



Suppose an insurer offers a contract w/ premium $10 000 for the year

→ only the least healthy ppl buy insurance, their average health expenditure are 15 000

The insurer raises premiums to 15000 on the next year

ADVERSE SELECTION DEATH SPIRAL = successive rounds of adverse selection that destroy an insurance market

The hearth of the problem is adverse selection: only the worst customers stay in the market when the insurer sets the premium

No way for the insurer to turn a profit in this very simple model

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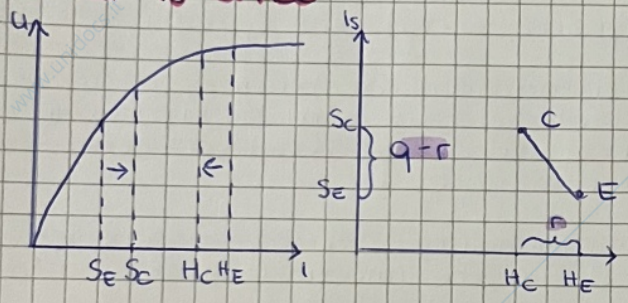
CHAPTER 9
ADVERSE SELECTION: THE ROTHSCHILD (Michael) - STIGLITZ (Joseph) MODEL 1976

INTRODUCTION together risk aversion and Asym. INFO in the supply for insurance

- Individuals - have ≠ health risk
  ↳ are risk averse (ready to trade I_H for I_S)

- Consider health insurance markets w/ asymmetric INFO
  AKERLOF: distructive potential of asym. info

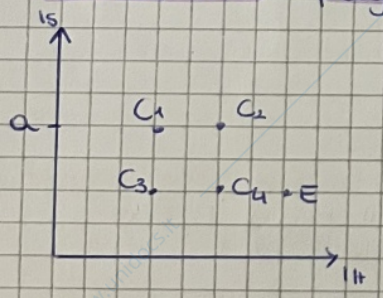
THE I_H - I_S SPACE



- Recall the income utility space
- Take H_E and S_E points and bundle them to the point E (endowement point) in I_H - I_S space

E = income of an individual both healthy and sick

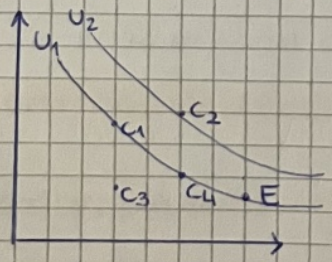
Point C represents a partial insurance contract
→ Horizontal shift = premium r
→ vertical shift = payout if sick (q-r)



Given C_1, C_2, C_3, C_4 and endowment point E we can make some assumptions

- Individuals prefer C_2 to C_1
- Prefers C_1 to C_3
- Cannot compare preferences btw C_1 to C_4
- Cannot compare preference to E
- C_2 is the best

INDIFFERENCE CURVES IN I_H - I_S Space



- Downward sloping TradeOff I_H I_S Willing to give up income in one state if compensated for more income in the other state
- Convex because risk-averse
  More downward sloping at low levels of I_H but flatter at high levels

I_S an I_S are imperfect substitutes, result of risk aversion

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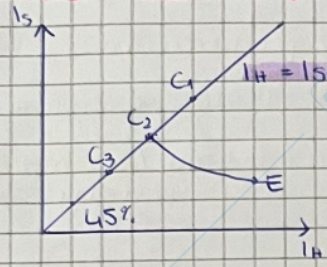
THE FULL INSURANCE LINE



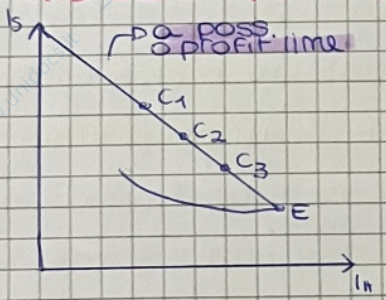
The 45° line is the full insurance line

Any point on the line represents a full insurance contract

where income H = income S

THE ZERO PROFIT LINE

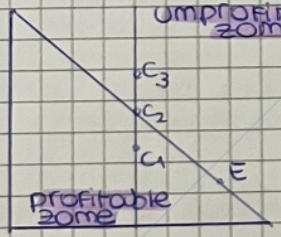
Slope $\frac{1-p}{p}$



Set of contract such that the premium is exactly the same as the expected payout (no profits for insurance company)
Fraii = flatter
It runs through the endowement point

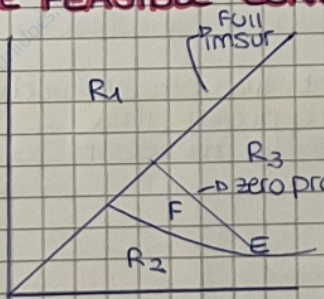
Also com be thought of as the fair line

The zero profit line divides $I_H - I_S$ space into profitable and unprofitable zones



- C_1 = below zero profit, so profit for insurance companies
- C_3 = above the zeroprofit is a loss of money for companies
- No company will offer points above the zero profit line

THE FEASIBLE CONCTRACT WEDGE (F) only point of meet



R_1 = overfull insurance, get more income if you are sick

R_2 = under the indifference curve going through E

R_3 = Northeast of zero profit line companies will loose money

FINDING an EQUILIBRIUM

IF
1. all individuals select the contract that offers the most utility
2. No contract in the set earns negative profits for the firm offering it
3. There exist no contract or set of contracts outside the set that, if offered, would attract customers and earn at least zero profit

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- The robust receive inferior insurance contracts that are not as full as they like, the robust are quantity constrained
- Does this suggest the robust and the frail could make a Pareto improving trade?

CAN MARKET SOLVE ADVERSE SELECTION?

- Full Disclosure (Free checks up → no private info → ≠ premiums

Is it Fair? → if morbidity w/ costly health care → either no insurance or too high premium

But there could be market solutions, under one crucial assumption:
↳ Health ≠s btw robust and frail only appear over time as customer age

- Lifetime insurance contract = two customers pool together at age 18 and make a life long, contractually-binding commitment. By age 50 one is robust and one is frail
  → This "solves" adverse selection but creates antagonistic relationship and may be legally unenforceable
- Guaranteed renewable contract = premiums are front-loaded so that robust and frail both want to remain in the contract voluntary.
  But still a problem = customers can't switch insurers so there is no competitive pressure
- Cochrane lifetime contract = insurers also provide premium insurance.
  1995 (Sl. 22) EX: if someone is diagnosed w/ cancer, they get a windfall payment to afford future health insurance premiums that will be very high
- Group plan (usually paid by the employer) = cheaper as they pool risk. But if a person looses its jobs or retires? (→ Government)
- Mandatory insurance (or universal coverage)
  Government forces everyone to buy the contract at the intersection of the full insurance line and the population zero profit line.
  Provides risk pooling and redistribution
- Subsidize insurance coverage
- Regulation that improves restrictions on price discrimination by characteristics

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WHEN THE MARKET FOR LEMONS WORK?

What if buyers value cars very highly?

New utility functions $U_S = \sum_{j=1}^{m} x_j + M$

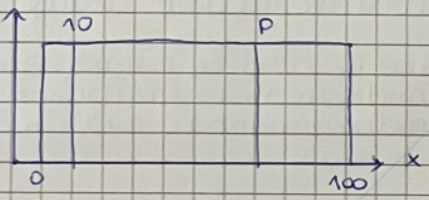
$U_B = \sum_{j=1}^{m} \frac{5}{2} x_j + M$

Will this fix the market?

New condition for buyers $\frac{5}{2} E[X_{m+1}] \geq P$

recall that $E[X|P] = \frac{1}{2} P$ This is unaffected by the buyers utility function

What if there is a minimum guaranteed car quality?



The condition for buyers is as it was before, but now $E[X|P]$ will be ≠ because a ≠ subset of cars is on the market

This is promising: the worst cars were forced off the market, so the remaining cars are better

When do buyers buy? if $\frac{3}{2} E[X|P] > P$

Based on the formula for the expectation of a uniform distribution $E[X|P] = \frac{1}{2}(P+10)$

Buyers buy if $= \frac{3}{2} E[X|P] > P$

$\frac{3}{2} \cdot \frac{1}{2} \cdot (P+10) > P$

$\frac{3}{4} P + \frac{15}{2} > P$

Buyers will buy if the price is below 30$

capire!

CONCLUSION

- Asymmetric information causes parties to misrepresent themselves
- Adverse selection removes high-quality goods from the market, leaving only low-quality
- Generally the market will unravel unless:
  - someone values a product highly enough to have a positive change in utility
  - Government regulation through a price floor promotes a minimum standard of quality

We need: • Risk-Aversion

→ The Rothschild-Stiglitz model combines asymmetric information and risk aversion.

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CHAPTER 8 ADVERSE SELECTION: AKERLOF'S MARKET FOR LEMONS

Market doesn't work and Fail and adverse selection

ASYMMETRIC INFORMATION

DEF = a situation in which agents in a potential economic transaction do not have the same information about the quality of the good being transacted

The used car market is the standard context to starting exploring **THE INTUITION BEHIND THE MARKET FOR LEMONS** this theme

FIRST: symmetric information

- Imagine a well functioning used car market
- sellers advertise cars, and buyers can accurately assess the condition of each car for sale
- some buyers will be willing to pay more for cars in good condition, others are happy to get a deal
- symmetric information: buyers and sellers have sym. info about the quality
  outcome = each car sells for a ≠ price depending on its quality

- Pareto-improving transaction = a transaction that leaves all parties at least no worse off, market will function

one goal of a market is to make sure all Pareto-improving transactions take place
→ ex.: all the cars end up w/ the people who value them the most.

EX 100 cars: 50 quality and 50 lemons

	quality	lemons	There are pareto improving exchanges
P_S	2000	1000	
P_B	2400	1200	

Willingness to pay for a car of unknown quality (average)

$$2400 \cdot 0,5 + 1200 \cdot 0,5 = 1800 < 2000$$

only lemons will be sold at a price btw 1000 and 1200
Market for good quality cars disappears

NEXT: asymmetric information

- sellers can determin car quality, but buyers cannot
- All cars look identically good to the buyers
- Any cars that sells, sell for the same price; the best cars will not be offered on the market, it is possible that the cars will not end up w/ the ppl who value them the most

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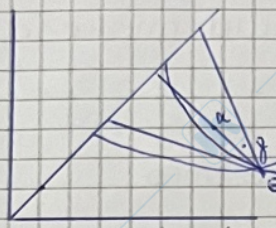
Case 3: asymmetric information, heterogeneous customers



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Any possible pooling equilibrium must be on the population zero-profit line

- If to the right of zero-profit, firm loses money
- If to the right of zero-profit, then other firms can enter the market

- Contract α: both frail and robust individuals choose α where
  - firm makes zero profits because α is on the zero profit line.
  - However, because robust and frail indifference curves are different slopes, other insurance firms can enter the market at β and appeal to the robust individuals

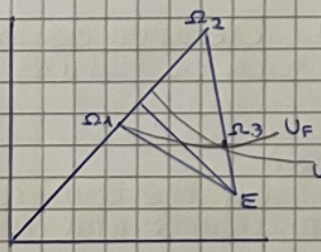
NO POOLING EQUILIBRIUM CAN EXIST

(create adverse selection!)

- Only attract the robust individuals
- Good for firm offering β because expected payout is low and firms can expect positive profits
- Bad for firm offering α because left with frail individu. and can expect to lose money do to increased payouts

FINDING A SEPARATING EQUILIBRIUM (sometimes)

- separating equilibrium = a set of contracts where one attracts frail individuals and the other attracts robust individuals while satisfying equilibrium conditions



Recall: Ω_1 and Ω_2 cannot co-exist because frail individuals will move to Ω_2 from Ω_1

Need a contract Ω_3 that will not tempt frail individuals to leave Ω_1

Ω_3 lies on the same indifference curve as Ω_1 for frail individuals but most likely ch. Ω_1

- Robust individuals prefer Ω_3 to Ω_1

Both frail and robust are maximizing their utility

WHO IS HARMED?

- When firms cannot tell frail or robust individuals apart, frail customers still receive full insurance at an actuarially fair price

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CONDITIONAL EXPECTATION = expected value of the random variable, given that a certain condition occurs

X = quality
P = price
E(X/P) = expected quality knowing that the quality is P

→ only cars w/ quality less that p will be offered → the expected quality given the price p is p/2

A FORMAL STATEMENT OF THE AKERLOF MODEL

SELLER and BUYER UTILITY FUNCTION

- sellers and buyers derive utility from the cars they own and other goods
- Buyers value cars 50% more than sellers

x_j = quality of the j-th car owned
M = utility from other goods

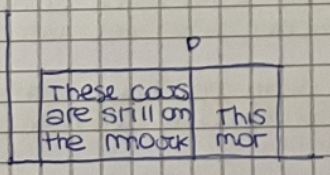
$$U_S = \sum_{J=1}^{n} x_j + M$$

$$U_B = \sum_{J=1}^{n} \frac{3}{2} x_j + M$$

Distribution of car quality = is uniformly distributed btw 0 and 100

Information assumptions =
- Buyers do not know the true quality of a particular car, but they do know a lot
- Buyers know the utility function of the sellers and know the distribution of cars available for sale
- They also understand that sellers will withdraw highest quality cars if the price does not justify selling

Which cars will sellers offer



- A seller will put a car on the market if selling it will increase his utility
- If a seller sells his car of quality x of P dollars, he loses x units of utility but gains P dollars
- Hence he will only put car j on the market if $P > x_j$

↳ remove cars with $x > P$

Like sellers, buyers are trying to maximize utility, but they have to think in terms of expected utility

When will buyers buy? She pays P dollar and loses p units of utility. She gains a car w/ expected value E[X|P] so she gains $\frac{3}{2}$ E[X|P] units of utility

So buyers will buy if $\frac{3}{2} E[x_i] \geq P$

The formula for expectation for a uniform distribution is simply the average of the endpoints
So → $E[X|P] = \frac{1}{2} P$

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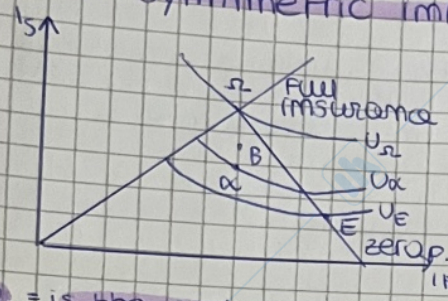
Case 1: symmetric information, homogeneous customers

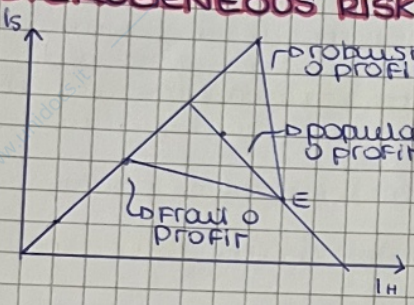


Is the set $\{E, \alpha\}$ an equilibrium?

- α lies on a higher indifference curve (condition 1)
- α is below the zero profit line (cond 2)
- But β attract customers away from α and still make positive profits

Ω = is the only possible equilibrium

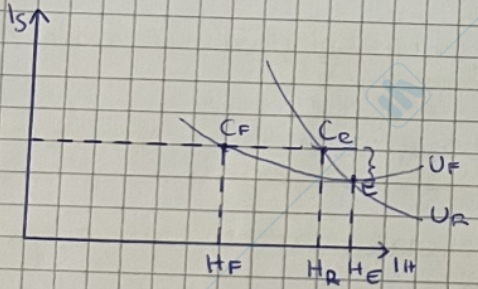
HETEROGENEOUS RISK TYPES



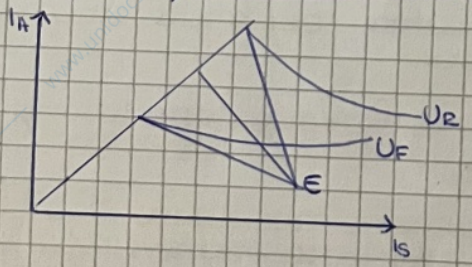
- Robust = low probability p of getting sick
- Frail = higher probability of getting sick

Slope of the zero profit line depends on the probability of sickness

Indifference curves



Case 2: symmetric information, heterogeneous customers



- Ideal contract point lies on an individuals respective zero profit line
- Indifference curves lie tangent to the zero profit line

INFORMATION ASYMMETRI and THE POOLING EQUILIBRIUM

- **POOLING EQUILIBRIUM** = a contract that attracts both Robust and Frail individuals while also satisfying equilibrium conditions

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Why is there only one price?

- Imagine that 2 cars are offered for ≠ prices in this market
  P and P' > P
- No buyer will want to buy the expensive car, bc both cars will seem the same for asym. info
- All sellers will have to lower their prices to match the lowest price on the market

Why are some cars not offered?

We know the market has one price P
Consider the seller who owns the nicest car on the market - it is probably worth way more than P
- The seller has no reason to remain in the market
- Why doesn't he advertise the high quality of his vehicle and charge a higher price

Outcome = only the lower-quality cars stay on the market.
This is our first example of adverse selection

ADVERSE SELECTION = the oversupply of low-quality goods, products, or contracts that results when there is asymmetric information
highest quality product will not be offered

What happens to our market?

Recap: - Cars only sell at one price
- As a result, the best cars leave the market

Buyers know the average car remaining on the market is of low quality
Unless buyers value cars very highly, they will not want to buy these cars

The market unravels, and potential pareto improving transactions do not occurr. This is a market failure

*The market fails because of a lack of incentives for honesty

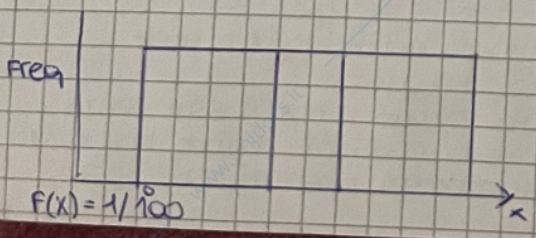
RANDOM VARIABLES

x is a random variable in [a, b]

- Discrete $(x_1, x_2, \dots, x_m)$
  $(p_1, p_2, \dots, p_m)$
  $\Sigma x_i p_i$

- Continuous
  F(x) density function: F(x) = prob(x = x)
  F(x) cumulative distribution function:
  F(x) = prob(x ≤ x) F(a) = 0 F(b) = 1, why?
  $E(x) = \int_a^b f(x)\,dx$

The uniform distribution in [0, 100]



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CHAPTER 11
MORAL HAZARD

- Agent takes an action that affects his payoff as well as the principal's
  - Effort
- Principal only observes outcome, an imperfect indicator of the agent
- Agent may choose an inefficient action
- Principal's problem is to find a contract that induces high effort
- In insurance markets
  - Insurance company → Principal
  - Insured individual → Agent
  - Action effort in avoiding accidents or thefts
  - MH = Ability of insured individuals to affect the probabilities of events.

The term moral hazard was used for the first time in the context of health insurance by Arrow (1963) to characterize the fact that the insured use more health care to treat a given illness than the uninsured
→ widespread medical insurance increases the demand for medical care

MORAL HAZARD W/ HEALTH INSURANCE

- Insured ppl take risks w/ their health that similar uninsured would not take, and demand more expensive treatment from their doctors when they get sick
- MH is the downside of health insurance because it raises society's level of health care expenditures
- Insurance coverage, by lowering the out of pocket price of care paid by the individual, may increase health care use

EX ANTE MH or hidden action = individuals exert less (unobserved) effort in maintaining their health (less exercise, more cheeseburger, smoke)
EX POST MH or hidden information = healthcare utilization increases w/ coverage
→ If so society healthcare spending increases w/ coverage

EX ANTE VS EX POST

- Ex ante MH = behaviour changes that occur before an insured event happens and make that event more likely
  - leaving the stove on
  - skipping the flu vaccine
- Ex post MH = behaviour changes that occur after an insured event happens and make recovering from that event more expensive
  - use expensive drug instead of generic

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Whose opinion matters in QALY surveys?

- Healthy survey respondents may be unequipped to imagine the quality of life in health states they have not experienced
- Expert panels are unlikely to ably represent patients' preferences
- People who have lived in a condition for decade tend to understate the suffering that healthy people would feel if they suddenly developed a condition (Blind mass)

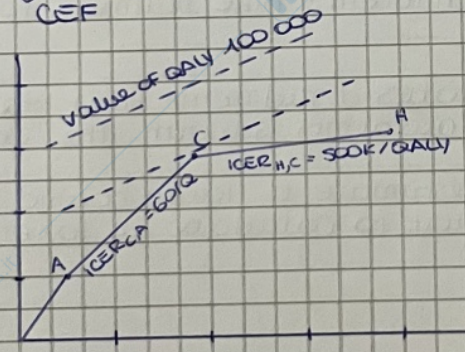
COST-BENEFIT ANALYSIS (CBA)

↳ is the process of choosing an optimal treatment among all potentially cost-effective ones, given a certain monetary value for each unit of health effect
- This optimal treatment is then termed cost-effective for a person or agency w/ that valuation

Example: let us assume that we values each QALY at $100 000

Treatment	Cost	value of QALY	B-C
A	40	100	60
C	160	3·100 = 300	140 → best treatment
H	360	3.4·100	-20

When we place a monetary value on each qualy, we can implicitly create a set of indifference curves that can be plotted w/ the CEF



① Plot the indifference curves
② Find the tangency point
③ W/ these indifference curves, the cost-effective treatment is drug C

- IF costs and benefits last for T years, we have to discount them and compute the Net present value of the treatment

$$NPV = \sum_{t=0}^{T} \frac{B_t - C_t}{(1+r)^t} \qquad r = \text{discount rate}$$

$\sum_{t=0}^{T} \frac{B_t}{(1+r)^t}$ is the value of QALE

Estimating the value of life

- QALE is the sum of QALY

- Value of life estimates rely primarily on 3 sources: Human capital, labor market choices, product purchase decisions and Government policies

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PRICE DISCRIMINATION group pricing

- Comsumer differ by some observable characteristics that affect their willingness to pay (age, income, status, nationality)

→ Market segmentation ↳ linear price
- A uniform price is charged to all consumers in a particular group
- ≠ uniform prices are charged to ≠ groups

- Firm sets higher prices in inelastic markets since demand is less responsive to prices: $\varepsilon_1 > \varepsilon_2 \rightarrow P_1 < P_2$

WELFARE EFFECTS

- PROFIT increases
- Comsumer in the market with high demand (lower demand elasticity) are worse OFF, since the price in this market has increased.
- Comsumers in the market w/ low demand (higher elasticity) are better OFF, since price in this market has decreased

- There seems to be little evidence of price discrimination:
  - No country wants to pay high price (Free riding)
  - Arbitrage
  - Price controls

WHERE TO ADDRESS RD?

- Pharma companies: choice of where to direct RD effort is affected by potential profits
  - Market shares
  - Price
  - Probability of success

- innovator/scientist responds to other incentives
  - Fame
  - helping people
  - Research funds

INDUCED INNOVATION = discoveries that result when innovators change their research agenda in response to profit opportunities

EX: changing demographics: AS the US population aged btw 1970 - 2000, drug companies turned their attention to drugs for the elderly (glaucoma medication)

Who is harmed by induced innovation?

- Diseases that are rare (orphan disease) or that mostly occur in developing countries (tropical diseases) receive less attention from researchers, because there is less profit to be made

- Governments have tried to harness the power of induced innovation to fight these diseases
  - Orphan drug act in the US
  - Advanced purchase of yet undiscovered vaccines for HIV, malaria, TB

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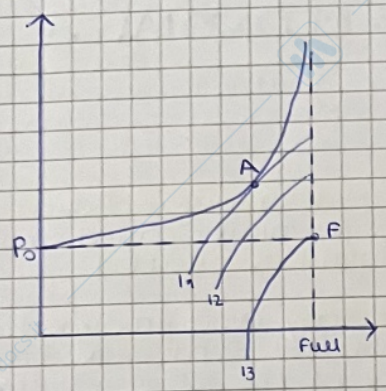
But in the world of moral hazard, a person's probability of sickness P increases w/ the FULLness of his insurance



As discussed, insurance coverage may induce recklessness, as ppl take less care or adopt new dangerous hobbies

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Insurance providers react by raising premiums for full coverage

Since, in a competitive market, premiums are a function of the probability of sickness, we can re-label the y-axis in the previous graph the "premium per unit of coverage"
The upward sloping curve represents the set of contracts that an insurer may offer to a person, who, w/out insurance, would have probability P_0 of sickness

Instead the new optimal contract in a world w/ moral hazard is at A
However compared to contract F, contract A charges higher per unit premiums and offers a lower quantity of insurance.

Contract A falls on a lower indifference curve than F and the drop of utility is $I_3 - I_1$ is the social loss when comparing a world w/out moral hazard to one w/ moral hazard

THE UPSIDE OF MORAL HAZARD?

- Extra preventive care
  - Evidence from Rand hie, oregon medicaid
  - This is a beneficial effect if and only if ppl consume less preventive care than they should
- The income effect
  - Insurance makes ppl richer by making expensive surgeries unaffordable w/out insurance

CONCLUSION

- Understanding moral hazard is critical to understanding how health insurance works
- Insurance plans in real markets are always necessarily incomplete because of moral hazard
- New technologies increases MH and increase health exp

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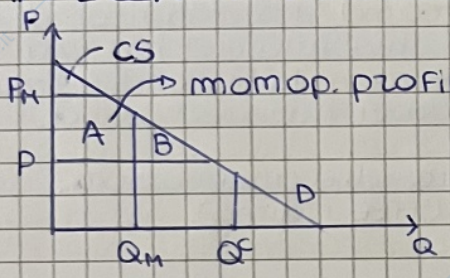
- To obtain a patent, the inventor must file an application to the PTO
- Patentability requirements:
  - subject matter eligibility, novelty, non-obviousness and usefulness
- Patent protection grants a monopoly position for 20y but at the same time induces firms to invest in RD
- The traditional view is that absent patent protection firms would not invest in RD, in fact, imitation by competitors would reduce the profits the inventor is able to appropriate.
- "optimal" patent protection must trade-off static vs dynamic efficiency
- optimal design of patent along 2 dim - patent lenght
  - patent breadth

OPTIMAL LENGHT (Nordhaus 1969)



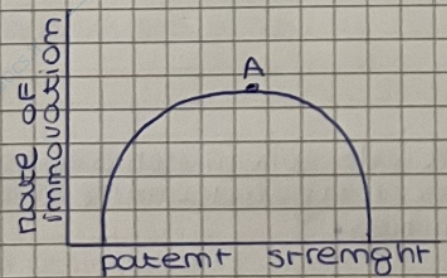
CS without patent = A + B + CS

social value of innovation (A+B)
Life cycle of the product = N years
Firm's profits : A - K
K = cost of innovation
↳ social welfare
SW = TA - K + (N-T)(A+B)

optimal value T* TA - K = 0
T* = K/A
↳ prices / profits

Optimal lenght is positive but finite
- IF T = 0 Firms do not invest in RD
- AS T increases - Firms invest more in RD
  - ↳ But society must wait longer to get B
- IF T is too long may deter subsequent innovation
  - RD are cumulatives, they stay on the shoulder of giants

HOW STRONG SHOULD PATENTS BE?



- Downside of stronger patents
  - Customers have to pay monopoly prices for a longer period
  - Less incentive for further innovation by the same company
  - Legal barriers to subsequent innovation by another company

BUT! if patents are too weak, no incentive do develop new drugs

PATENTS IN DEVELOPING COUNTRIES

- Low-income countries think about this tradeoff differently
  - Monopoly prices weigh more heavily on low-income population
  - Free rider effect: if the US has patent protections, companies will develop new drugs even if there are weak patent protections in India
- Price discrimination
  - ≠ prices in ≠ prices (in theory)
  - Black market importation makes this impossible (practice)

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EX: There is a suitcase across a busy street w/ a million dollars im it. If you cross the busy street to get the suitcase, there is a 1% chance you will be struck by a bus and killed. If your answer is yes, your life cannot be worth more than $100 million to you (1mlm / 0.01)

HUMAN CAPITAL

Quantify the loss of a person's marginal productivity as result of ill health, the marginal loss in economic output that results from a person not being able to work.
The monetary value of lost productivity due to ill health is computed at the "market price of labour (wage).

Using the labor market to reveal VSL

Im order to attract workers to more hazardous jobs, high risk employers offer additional wages ("risk premiums", which supplement the wages workers would earn im comparable, but lower risk jobs.
If researchers know both the risk premium for a job and the ≠ im risks, then they can estimate how much a worker values his life

EX: a worker who would take a job w/ a 1% higher fatal injury risk for $50000 more im wages has a VSL of 50 000 : 0,01 = 5mlm

Using purchase decisions to reveal VSL

EX: Jenkins (2001) used price data for children's bike helmets to estimate their VSLs

- The decision to wear an helmet indicates a judgment that the risk reduction of head trauma from bike accidents is worth the cost of buying helmets
- Researchers used the prices of helmets to estimate a lower bound for the value of risk reduction and use that to calculate a lower bound for the VSL of helmet-wearers.

Using Government policies to reveal VSL

EX. im 1972, a US law guaranteed kidney dialysis to all patients under 65 w/ end-stage renal disease for free
- Kidney dialysis costs approximately 50 000/QALY
- The passage of this amendment suggests that a QALY is worth at least 50 000 to american taxpayers

CONCLUSION

- Health systems/insurers can neither cover every single new technology, nor refuse to cover all new procedures
- selective about which procedures to cover
  - HTA is a tool that many insurers and national health systems use to make these coverage decisions

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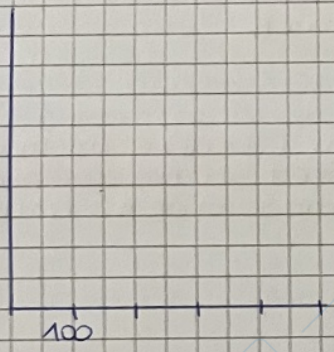
THE AVERAGE COST-EFFECTIVENESS RATIO (ACER)

$ACER = \frac{C_T}{E_T}$ → typically will not reveal all the potentially cost-effective drugs

COST-EFFECTIVENESS FRONTIER (CEF)

A subset of treatment strategies for a condition that are not determined by any other treatment. Any treatment on the CEF is said to be potentially cost-effective
The CEF simplifies comparison btw treatments by allowing analysts to rule out dominant drugs (which should never be used), and focus only on options that potentially cost-effective



- connected non dominated options to form CEF
- The slope of the CEF btw 2 points is equal to the inversive of the ICER btw the 2.

MEASURING COSTS

In order to calculate the ICER, we need to measure the costs of each treatment → not the money costs of resources but the opportunity costs

Whose perspective?
- Society: all costs counts
- Health care sector: disregards costs imposed on patients or their families
- The patient = only costs directly borne by patients count

Which costs count?

- Direct costs: - health care
  - non-health care (ex. transportation)
- Indirect costs: - patient and family (work and leisure) time
- Intangible costs: - side effects (difficult to measure)
- Discounting

How is "effectiveness" measured?

One common measure of effectiveness is increased life expectancy

or the Quality-Adjusted Life Years (QALY) approach combines quality of life and life expectancy into a single index

→

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There is price distortion in insurance markets because insurance companies cannot monitor everything patient do and price their action accordingly → information asymmetry

3 CONDITIONS FOR MH

1. Price distortion = the cost of a risky action to an individual is reduced, consequence of insurance
2. Asymmetric info = prevents an insurer from adequately pricing the action
3. Behaviour response = individual responds to price distortion by changing behaviour

HOW TO LIMIT MORAL HAZARD

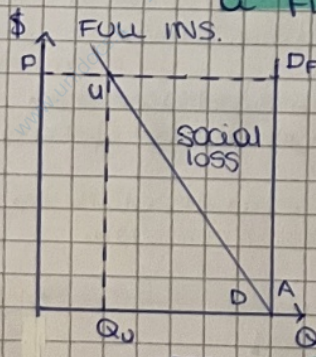
The extent of MH depends on both how sensitive demand is to price and the amount of price distortion caused by insurance. Insurers cannot alter customer's price sensitivity (bc is a property of their demand functions), they have to reduce the price distortion due to insurance

COINSURANCE COPAYMENTS DEDUCTIBLES MONITORING

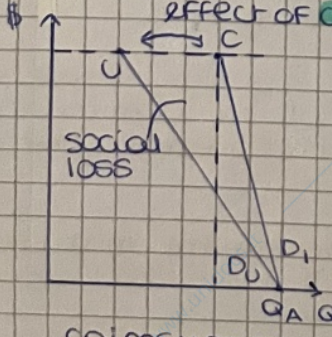
COST SHARING: COINSURANCE and COPAYMENT

are 2 insurance contract provisions that maintain positive marginal costs for the insured. These plans effectively limit insurance coverage so they are no longer full

- **COINSURANCE** = insurance provision in which enrollees pay a % of each medical bill, and the insurer covers the remaining portion.
- **COPAYMENT** = insurance provision in which enrollees pay only a fixed amount, called a copay



W/out insurance, the individual would consume Q_U → every unit of medical care he consume would provide at least as much marginal benefit as marginal cost
But w/ Full insurance his marginal cost of medical care falls to 0



Imagine the consumer start at 0% coinsurance (Full. Ins.)
As coinsurance rises, out-of-pocket prices move closer to actual prices and the demand curves rotates back toward the uninsured demand curve

coins 100% equivalent to no insurance

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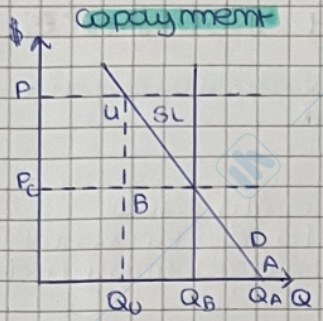
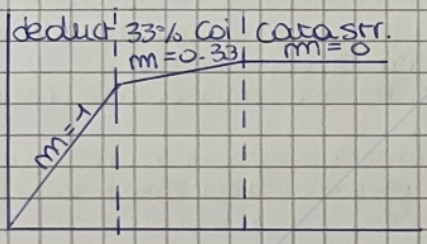
Copayment



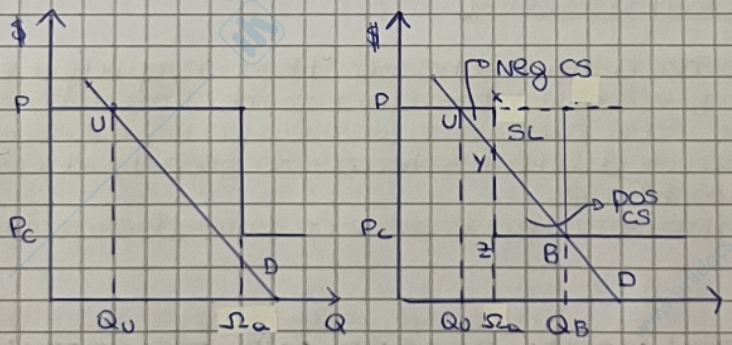
Imagine his insurer institutes a copay of P_C which becomes the effective price for each episode of care
This reduces demand from Q_A to Q_B

DEDUCTIBLES

- Set minimal levels of expenses below which the insurer does not help reimburse medical expenses



This figure shows the relationship btw out-of-pocket expenses and total medical expenses for a 33% coinsurance policy w/ a deductible of 2 and full insurance for catastrophic care above 4



Requiring insurance enrollees to pay a deductible can limit or eliminate MH from insurance if the deductible is low enough, MH may still persist

MONITORING

Some insurance companies try to observe and guide the preventative measures their customers take, while others choose to supervise the medical care that customers receive
- Motivation
- Employee incentive programs w/ payouts if you:
  - see a nutritionist
  - do yoga once a week
  - get a fitness test
- Gatekeeping
  - primary care physicians

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QALYs

In a QALY calculation, each year of life receives a quality weight q btw 0 and 1 that reflects the quality of that life-year.
A year lived in perfect health has quality of weight $q = 1$
May be a year with cromic cough and insommia is only worth $q = 0.5$

QALEs

Calculating QALYs requires estimating 3 INFO:

1. The probability P_t of surviving to each year t
2. The quality of life q_t for each year
3. A time discount rate

A person's quality-adjusted life expectancy (QALE) is the number of additional years he expects to live, weighted by the discounted quality of his life in each of those years (the sum of his QALYs)

$$QALE = \sum_{t=t_0}^{z} \delta^{t-t_0} q_t P_t$$

SURVEY METHODS: quality weights

- Visual analogue scale (VAS) asks respondents to rate health outcomes btw 0 and 100
  - Pro: simple to administer and easy to understands
  - Coms: does not require respondents to think about trade offs btw ≠ health states, results may not reflect the intensity of respondent's preferences

- Standard Gamble (SG): For wealth condition H respondents choose btw having H with certainty or a gamble w/ probability p of full health and probability $(1-p)$ of death. The point of indifference btw these two option is used as the quality weight q of health condition H
  - Pros: reflects intensity of preferences better than VAS
  - Coms: may be affected by risk aversion

- Time trade-off (TTO): respondents choose btw ① living for t years w/ a health state H before dying and ② living for a shorter amount of time T in full health before dying. The quality weight q of health state H is the ratio T^*/t
  - Pros: reflects intensity of preferences better than VAS
  - Coms: may be biased if T^* is a function of age

EQ-5D: based on a questionnaire w/ 5 questions w/ pre-scored value set, derived by one or several of the direct methods. Each combination of the responses can be assigned a weight using specific value sets. The british value set, has been developed by using TTO and VAS in a sample of the British general public

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EVIDENCE OF MORAL HAZARD IN HEALTH INSURANCE

Health insurance, by design, lower the price individuals pay for medical care. So yes, there is MH

BUT health care is not like other goods: ineast dem
- Demand is determined by needs, not only price
- Demand for health care may actually be upward sloping: preventive care improves health and may reduce health care utilization
- By reducing, visits to ER, coverage of the uninsured, may reduce healthcare expenditures

- MH is difficult to study empirically because of Asym. info

Evidence of ex ante moral hazard:

- RAND HIE = ppl on the free plan more likely to show up at the hospital w/ broken bones or drug abuse
- GHANA = insured households less likely to use mosquito nets, key for preventing malaria
- SEGURO POPULAR = low-income Mexicans assigned to receive free insurance were less likely to get a flu shot and cancer screenings.

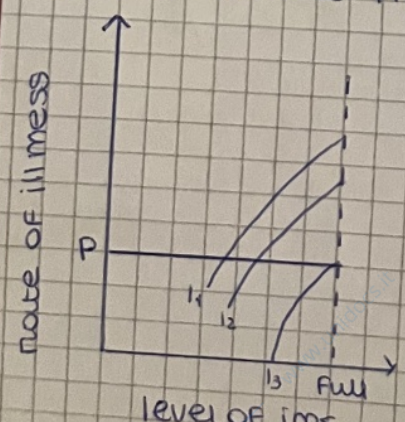
Evidence of ex post moral hazard:

- STANFORD EMPLOYEES = after a 1967 change that required a new 25% copay, visits to the doctor declined by 24%
- RAND HIE = those on the free plan more likely to visit hospitals
- GERMANY = introducing deductibles leads to greatly decreased health expenditures
- CANADA = ppl w/ prescription drug coverage visit doctor more often

THE TRADEOFF BETWEEN MORAL HAZARD AND RISK REDUCT.

Asymmetric information creates a tradeoff btw more insurance coverage, which generates more moral hazard, and less insurance coverage, which increases risk exposure.

The relationship btw insurance coverage and probability of sickness w/out moral hazard



- In this case, a person's prob. of sickness p does not depend on the fullness of ins. coverag.
- Risk-averse individuals prefer lower probabilit. of sickness and fuller insurance, so utility is increasing toward the graph lower right corner
- Fuller insurance increases consumer utility - and full insurance F maximizes it

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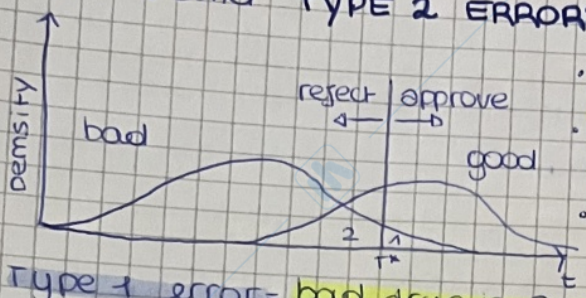
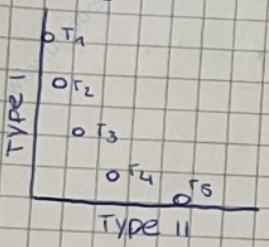
TYPE 1 and TYPE 2 ERRORS



- The FDA has to decide how restrictive im approving new drugs
- Phase III trials do not have complete information about a drug
  - Probability of distribution T
- Restrictive (high T*) VS permissive regulations (low T*)

- Type 1 error = bad drug is approved $T_B > T^*$
- Type 2 error = good drug is rejected or delayed $T_G < T^*$

There is a tradeoff btw rejecting good drugs and approving bad drugs



ROC shows the tradeoff btw type 1 and 2 errors
Regulators balance social welfare and potential harm
- More incline to avoid type 1 errors because of media attention
- Type 2 hard to catch

OTHER REGULATIONS

- Doctors have prescription power
  - true in most countries
  - benefit = less intentional and unintentional abuse of drugs
  - cost = time, inconvenience, expense
- Bans on direct-to-consumer (DTC) advertising
  - Bans in place in most developed countries except US
  - Benefit: prevent moral hazard, reduce strain on doctor patient relationship
  - cost: customers may not find out about new drugs that will benefit them

CONCLUSION

- Tradeoffs
  - patents → incentive for innovation vs affordable perceptions
  - Government price controls → innovation vs affordability
  - regulation → more new drugs vs fewer dangerous drugs
  - Type 1, Type 2 errors = approve bad drugs vs decline good
  - Doctors prescription → increase safety of drug use vs expensive drug

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CHAPTER 12
PHARMACEUTICALS and THE ECONOMICS OF INNOVATION oligopoly

INTRO

The pharmaceutical industry got his start 1899, when Bayer, a German chemical company introduced a painkiller called Compamy Today the pharm. industry is huge and tightly regulated

The pharmaceutical sector is a high technology and knowledge-intensive industry. The industry has a two tier structure. The largest firms account for the majority of the RD investemn in the industry of patents. A large number of smaller firms manufacture off-patemt products or under license to a patemt holder. The industry is highly regulated

THE LIFE CYCLE OF A DRUG

- Find chemical compound that might treat a disease
- Then test it on animals to show it is not toxic
- Then test on humans in 3 phases:
  1. Low dose to healthy individuals (2y)
  2. Dose to unhealthy individuals (2y)
  3. Test effectiveness in preventing disease or medical conditions (3-4y)

→ Get approved for sale by FDA or similar body

Once the drug is approved for sale, the drug company has a temporary legal monopoly protected by a patemt (20 years). This is the company's chance to recoup the millions of dollars spemt on testing. After that time is up, other companies can produce the same drug cheaply and profits decrease sharply

DRUG DEVELOPMENT IS COSTLY

Hard to find a promising chemical in the first place.
→ Only 2-5% of drugs that enter Phase I pass to Phase III
The whole process can cost 500 million or more to bring a drug to the point of approval

HOW do we induce companies to make these costly investments?

- Patemts create a legal monopoly and hence the opportunity for monopoly profits
- In practice, only the top 30% of drugs pay for themselves.
- High share of RD is financed by own resources → entry barrier

PATENTS

- A patemt grants its holder a temporary monopoly on the exploitation of an invention. The patemt-holders acquires the exclusive right to prevent other parties from using, commercialising or importing the patemted product or process.

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CHAPTER 14
HEALTH TECHNOLOGY ASSESMENT

HTA

- Systematic evaluation of properties, effects and/or impacts of health technologies (medicines, medical devices, vaccines) and interventions

- Approach used to inform policy and decision-making in health care, especially on how best allocate limited resources to health interventions and technologies

It may be applied to:
- broad public health programmes (immunization or screening for cancer)
- priority setting in health care
- identifing health interventions that produces the greatest health gain and offer value for money

- priority setting
process of determining how health care resources should be allocated among competing programmes or people

Decision about:
- General budget allocated to health (% GDP)
- Which disease to target
- who are the beneficiaries
- Where to direct research

Who sets priorities:
- Governments
- Foundations
- ONG
- Private donors

Which objectives:
- Max general population health
- Reduce health inequalities
- Universal health coverage

Criteria for priority setting:
- Cost-effectiveness
- Poverty reduction
- Target severe diseases
- Target the young

Which interventions are worthwhile

- Measure the impact of the health problem:
n° of cases, n° of deaths, amount of disability, pain or suffering, n° of people at risk, amount of lost income due to health prob.

- Resources needed for intervention (costs)
Personel, buildings, equipment, pharmaceuticals, training, info

- Outcomes or consequences (benefits)
- Measure impact before and after intervention or
- Measure impact w/ or w/out intervention

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PATTERN

- Am individual faces some risk of a bad event x and his actions can increase or decrease its likehood
- He holds an insurance contract that will help pay some or all of the costs of x. Thus his price of x is now lower
- In response to price distortion, he way his behaviour to increase the chance of x, or increase the costs for recovering from x
- The insurance cannot observe this behaviour change. There is an information asymmetry
- The riskier behaviour creates a social loss, because the costly event x occurs more than it would have been w/out insurance

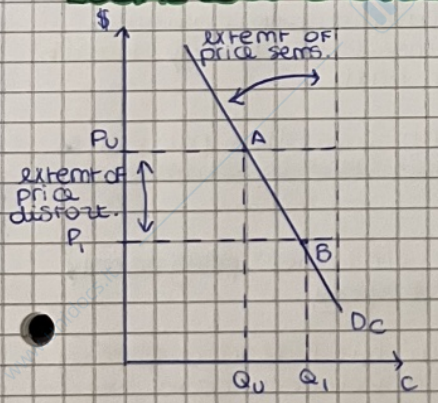
How does moral hazard lead to social loss?
There is an individual that loves hamburg. but risk harth att.

- w/ insurance = his cost of burger declines, since the insures picks up the cost of heart attack care
- w/out insurance = his cost for each burger includ P burger and P of hearth attack

In this case social loss occurs the form of extra money, labor, time and effort that other expend on caring for hearth attacks caused by burger over consumption

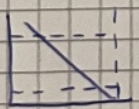
SOCIAL LOSS CAUSED BY MORAL HAZARD

SL = PU - CS

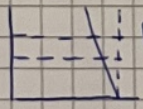


- w/ insurance, the effective p of burgers falls from Pu to P1, and his consumption from Qu to Q1
- Point A is the socially equilibrium point // B is the outcome w/ insurance
- Extra burger consumed btw Qu and Q1 result in more costs than they are worth
- The vertical distance btw Pu and P1 shows the extent of price distortion (helps to determine social loss from MH)
- The angle btw the demand and the vertical represents the extent of price sensitivity

The larger this angle is, the more responsive behaviour is to price distortions and the larger the social loss from MH



price distortion and price sesitivity are high, big social loss



price distortion and sens are minimal small social loss

- The extent of price distortion is a function of the completness of the insurance → the fuller the insurance, the greater the price distortion
- The extent of price sensitivity depends mostly on the nature of the risk being insured and how controllable it is (genetic disease vs heourth attack)

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Patent vs Pandemic (Stiglitz)
↳ In the absence of public intervention, we will realm reliant for life-saving drugs and vaccines on a monopoly driven system that favors profits over ppl.

AN OUNCE OF PREVENTION (Bloom)

The current system for developing and manufacturing vaccines relies sustainability on the profit motive of major multinational pharmaceutical companies
Despite the high societal value of vaccination against diseases of epidemic potential, aspects of vaccine economics create challenges for achieving socially optimal levels of vaccine RD, production and uptake
- Global public good
- Externalities

- The Coalition for epidemic Preparedness Innovations (CEPI) is a global partnership launched in 2017 to develop vaccines to stop future epidemics
- Cepi, Gavi and the WHO have launched COVAX to ensure equitable access to covid-19 vaccines and end the acute phase of the pandemic by the end of 2021

REGULATION OF THE PHARMACEUTICAL INDUSTRY

competition and regulation issues in the Pharmaceutical industry

- Regulation: - Price controls
  - Safety and EFFicacy
  - Prescription controls
  - Bans Advertising

- competition: - Abuse of dominant position
  - Collusion
  - Merger regulation

PRICE CONTROLS - Benefit consumers (CS)
↳ Reduce spending

- In Public health systems: price ceilings set or negotiated by the Government are the result of Bargaining btw the Gov. and Pharma companies (monopsony or buying power vs market power)

Ex in Italy list of max price for each drug
in UK NHS sets the price at which they are willing to purch. drugs
in US bergaining btw insurance and Pharma companies

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- Cost effectiveness analysis (compares the costs and benefits of ≠ medical treatments
- Cost - benefit analysis (the process of choosing an optimal treatment by creating a tradeoff btw money and health)
  - it generates enormous controversy because it involves placing an explicit value on human life

Objective → maximizing health (not consider equity)

COST-EFFECTIVENESS ANALYSIS

↳ the process of measuring the costs and health benefits of various medical treatments, procedures and therapies.

CEA is the less controversial part of HTA, because it is concerned w/ measuring cost and benefits, not balancing them against each other.
Often multiple treatments, w/ varying costs, can be used to treat a given disease

- If one treatment is both cheaper and more effective than a second treatment is said to be DOMINATED by the first
  → it is never optimal to use a dominated treatment, bc there is always a more effective and cheaper alternative

If neither treatment is dominant, one treatment must be both more expensive and more effective (in this cases CEA is used to help decide whether the extra expenditure is worth it.

INCREMENTAL COST-EFFECTIVENESS RATIO (ICER)

Consider 2 treatments for the same disease: A and B
A is more expensive and efficient, so neither treatment dominates the other

$$\text{ICER of A over B} = ICER_{A,B} = \frac{C_A - C_A}{E_A - E_B} > 0$$

		cost/pat	life exp
Ex HIV screening	Targeted screening	$ 51,517	21.063
	Universal screen.	$ 51,850	21.073

$$ICER = \frac{51850 - 51517}{21073 - 21063} = 85\ \$/\text{day}$$

Lead poisoning example

	Cost of tr.	Prob of reading dis
Conservative tr.	786 $	35.3%
Aggressive tr.	$ 1778	21.6%

$$ICER_{agg,cons} = \frac{1778 - 786}{0.353 - 0.216} = \$7241/\text{reading dis}$$

This ICER provide a price for avoiding a reading disability
Note that the ICER does not make a determination about wether this is worth or not, it is just an empirical fact about costs

$$ACER_T = \frac{C_T}{E_T}$$

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