#1

Supply-demand model

positive vs. normative

are / should be

rev Kidney

① market failure - fraud, imperfect info

② fairness (equity)

③ Behavioral economics ← stng incentives, so why not?

(bias, lack of self control, etc)

Command vs. capitalist / invisible hand { firms & individual best self interest ⇒ best for society : maximum surplus }

#2 Utility maximization

{ max. profs
budget constraint

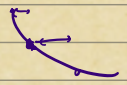
preference assumptions 1) completeness (not indifferent)

2) transitivity

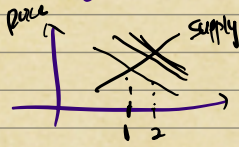
3) non satiation (more is better)

A 1C 2P
B 2C 1P] indiff

C 2C 2P ≻ prefer (by non satiation)



④ diminishing marginal utility



At price K, consumer is willing to buy more in more

3.5~4 properties

1) Consumers prefer higher indiff curves

2) I.C. never cross (~~A~~ B C B>C but B≻A)

3) I.C. downward sloping (upward → non satiation ✗)

4) only one indifference curve through for every possible consumption bundle

marginal rate of substitution ← MRS = $\frac{\Delta P}{\Delta C} = -\frac{MU_C}{MU_P}$ → can always decrease (but most of the time, ~) always decreasing (prefer balance...)

(ex) Satisfaction
Coffee 10
Parfait 20

$\therefore -\frac{1}{2} = -\frac{10}{20}$

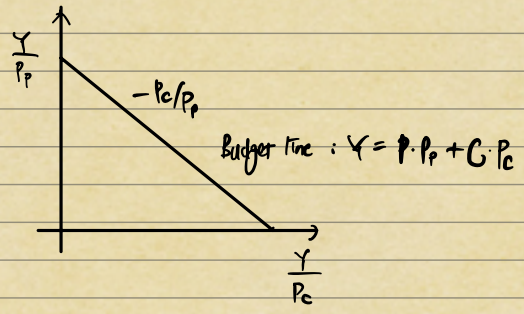
#3 Budget Constraint, Constrained Choice, Food Stamps

I. Budget constraints

Budget = Income (no saving, borrowing)

$$Y = P_p \cdot P + P_c \cdot C$$

P_p: price for pizza; P_c: price for cookie



ceo

$Y = \$12$

$P_p = \$12$ Slope $-\frac{1}{2}$

$P_c = \$6$

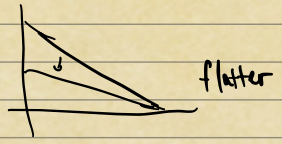
$$\text{Slope MRT} = -\frac{P_c}{P_p}$$

MRT ↗ transform

Weight Vectors

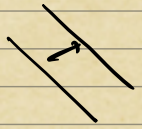
let Choice drive things (Adam Smith)

P_p: \$12 → \$18



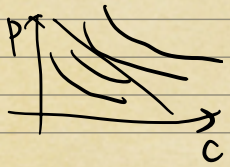
opportunity set : all possible options

budget ↑



(II) Constrained Choice

$U = \sqrt{PC}$



$$MRS = -\frac{MU_c}{MU_p} = \frac{-P_c}{P_p} = MRT$$

MU_c: you; MU_p: benefit; P_p: cost; P_c: market

Fundamental equation of consumer choice

$$\frac{MU_c}{P_c} = \frac{MU_p}{P_p}$$

(happiness per dollar)

$\frac{MU_c}{MU_p} > \frac{P_c}{P_p}$ ⇓

A: P=5 C=2

$MU_p = \frac{dU}{dP} = \frac{0.5 \times C}{\sqrt{PC}} = \frac{0.5 \times C}{\sqrt{P \times C}} = \frac{1}{\sqrt{10}}$

A: P=5 C=2

$MU_c = \frac{2.5}{\sqrt{10}}$

⇒ MRS = 2.5 willing to give up 2.5 steel of pizza for a cookie

Market says 0.5 ⇒ trade!

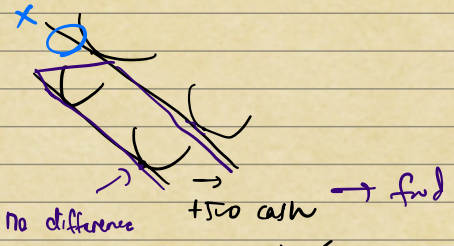
(Essentially, want MB=MC)

(III)

Food stamps ⇒ provide money to buy food if low income

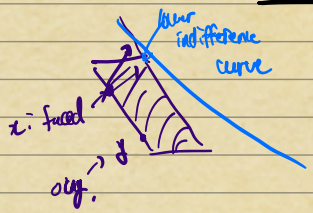
→ today name is "SNAP" = food stamp

Choices



SNAP ~~$$~~

debit card only used for food (SNAP)



Paternalistic "make not spend on sth"

Imposing preferences

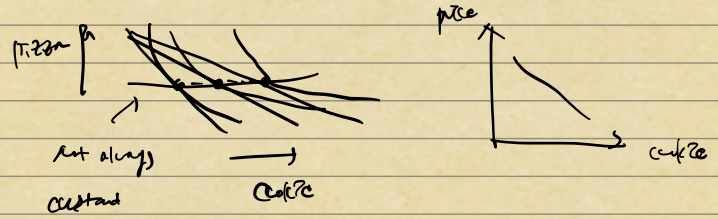
Q. Do food stamps actually increase food consumption in practice?

15% less with cash than food stamps

price for paternalism is 15%

But Yemen case, just giving cash may be better.

#4. (I) Demand curve

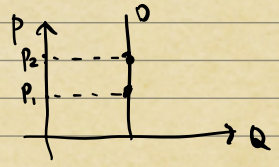


(II). Elasticity of demand

$$\varepsilon = \frac{\Delta Q/Q_0}{\Delta P/P_0} \leq 0$$

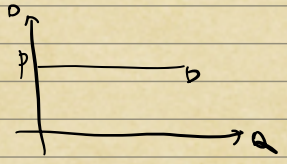
$\varepsilon = 0$; perfectly inelastic demand (not realistic)

(Ex) insulin, water, ... essentials in life w. no plausible substitute



perfectly elastic $\varepsilon = -\infty$

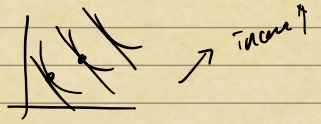
(Ex) fast-food burger, gum, ... ∃ perfect substitute



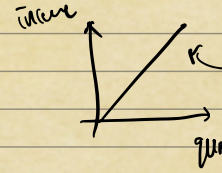
(if I charge 1 cent more, I lose all customers, etc.)

* Elasticity = Substitutability

(III) Income Shifts



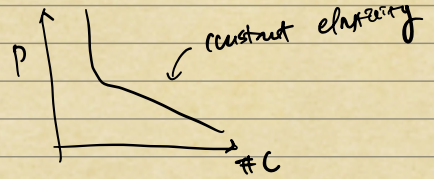
"Engel curve"



"Slope of Engel curve" income elasticity of demand (γ)

$$= \frac{\frac{\Delta Q}{Q_0}}{\frac{\Delta Y}{Y_0}}$$

So in real class we see this big



$r > 0$ Normal goods (more money you have, the more you want) < Luxuries $r > 1$ / Necessities $r < 1$

$r \leq 0$ Inferior goods (fast food, potatoes ...)

(IV) Effect of price change

("how does demand change?") price of coffee ↑ — by holding utility constant → Compensated demand, always negative

- Substitution effect: $\left.\frac{dQ}{dP}\right|_{\bar{U}}$
- income effect: $\left.\frac{dQ}{dy} \cdot y\right|_{\bar{P}}$

Inferior goods possible (why we can)

$$Q(+P_i, +y) = Q(P_i, y)$$

$$\Rightarrow \sum P_i Q_{P_i}(+P_i, +y) + y Q_y(+P_i, +y) = 0$$

$$y \left.\frac{dQ}{dy}\right|_{\bar{P}} = -\sum P_i \left.\frac{dQ}{dP_i}\right|_{\bar{P}}$$

relative desirability of two goods
effective income (opportunity set)

① New tangency

② $\frac{MU_c}{MU_p} = \frac{P_c}{P_p}$

③ $\frac{P_c}{P_p} \uparrow$

④ $\frac{MU_c}{MU_p} \uparrow$ ← rev c (marginal utility ...)

⑤ C↓ P↑

$\frac{dP}{dc} \uparrow$

	price Δ	Subs	Inc	Total
Normal	price ↑	≤ 0	≤ 0	< 0
	price ↓	≥ 0	≥ 0	> 0
Inferior	price ↑	≤ 0	≥ 0	?
	price ↓	≥ 0	≤ 0	?

Giffen good upward slope demand curve (hard to find in reality an example)

- Super poor → compare to lower the price of rice → less rice
- Moderately poor → demand

#5 Production Theory (harder) : extra step needed

Consumer theory : income & price & utility → optimize

(I) production function : maximize profits = revenue − cost
(R) (C)

"produce goods as efficiently as possible"

Q "market" $q = f(\underline{L}, \underline{K})$
↑ "firm" labor (water) capital (machine, land...)

~yrs, decades
- long run input : labor and capital are all variables (definition)
- short run input : capital fixed
  ↑ ~months

(II) SR production

$q = f(L, \bar{K})$

$MP_L = \frac{\Delta q}{\Delta L}$ ↷ output, ↷ labor

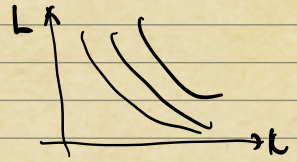
"marginal product of labor"

it's like marginal utility of good — Diminishing marginal product.
ex) digging a hole w. shovel

(III) LR production

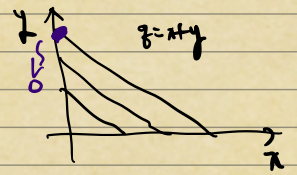
$q = \sqrt{LK}$

Isoquants = "firm indifference curve"

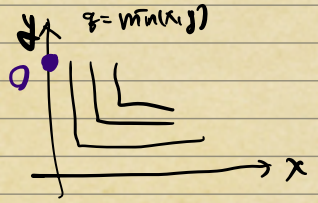


same axioms as before

Perfectly substitutable inputs $q = L + k$

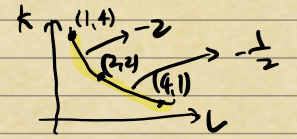


Perfectly non-substitutable inputs (Leontief production function)



(ex) left/right shoes, cereal/box, computer/programmer

MRTS (marginal rate of technical substitution) = $\frac{\Delta k}{\Delta L}$



1 worker replaces for 2 machines
$\frac{1}{2}$ machines

(due to diminishing MP)

$$\Delta L \cdot MP_L + \Delta K \cdot MP_K = 0 \quad \text{along isoquant}$$

$$\Rightarrow \frac{\Delta K}{\Delta L} = -\frac{MP_L}{MP_K} \quad \text{MRTS}$$

(IV) Returns to scale

double inputs → production will go up

$f(\ell L, \ell K) = \ell f(L, K)$

(constant return to scale)

IRS: $f(\ell L, \ell K) > \ell f(L, K)$ $(\ell > 1)$ (ex) Firms learn to specialize

DRS: $<$ (ex) More slack

Decreasing (ex) Tobacco production

Increasing (ex) primary metal → specialization

leads to Monopoly...

* We can't have forever increasing return to scale (maybe? Bigger companies)

By the effect of network?

(V) productivity

Malthus 1798 : labor

land → fixed

productivity / innovation

$Q = \underbrace{A_t}_{\text{innovation}} \cdot f(L, K)$ (A affects both L & K ; In Solow growth model, had $F(L, \underbrace{AH}_{\text{effective workers}})$ where innovation $e^{gt}N$)

mass production cost price more than a half & wiped out rivals

Total factor productivity (TFP): $\frac{\text{Total Output}}{L+K}$ (productivity determines Standard of living)

Labor productivity (K changes) $\frac{\text{Total Output}}{L}$

47-73	2.5%
73-95	1%
95-05	2.3%
05-	1.5%

Q. Why didn't IT revolution last?

Q. How did we spend all these increased productivity? Why not working less with the increased productivity?

Q. Who gains from productivity increases? (average income ↑ 0.4% only)

#6 Cost

Goal: # production – cost curve

(I) SR cost curve

$q = \sqrt{Lk}$

↑ variable

Fixed cost : $\bar{k}$

Variable cost : L

$TC = FC + VC$

$C = \bar{k} \cdot r + L \cdot w$

r: rental rate, w: wage

"rent" a water machine, ...

$\begin{cases} r = \$10 \\ w = \$5 \end{cases}$

$q = \sqrt{L\bar{k}}$

$L = \frac{q^2}{\bar{k}}$

"1 production" / # Capital = Labor

$C = r \# \bar{k} + w \# L = 10\bar{k} + \frac{5q^2}{\bar{k}}$

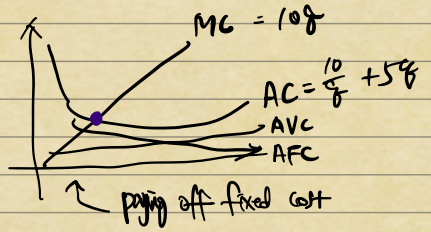
fixed cost, variable cost

$\bar{k} = 1$ $\quad 10 + 5q^2$

capital, labor

$MC = \frac{dC}{dq} = 10q$

$AC = \frac{C}{q} = \frac{10}{q} + 5q$



q that makes AC = MC ⇒ minimizing AC.

$MC = \frac{dC}{dq} = w \cdot \frac{dL}{dq} = \frac{w}{MP_L}$ ← wage, ← how productive

$$\frac{\partial q}{\partial L} = MP_L$$

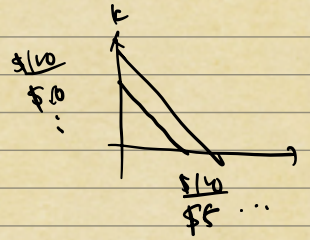
(II) Long run

k is no longer fixed

Q. Given quantity, what's (K, L)?

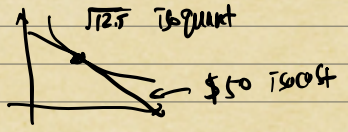
Isocost curve ($\Leftrightarrow$ Isoquants)

"w. budget constraint"



fix cost

$$\frac{\Delta k}{\Delta L} = -\frac{w}{r} = -0.5$$



$\sqrt{12.5}$ production $50 cost

$$\frac{-MP_L}{MP_K} = MRTS = -\frac{w}{r}$$

$\frac{dk}{dL}$ = marginal rate of technical substitution

(fixing q)

$$\frac{MP_L}{\$w} = \frac{MP_K}{\$r} \quad \left(\frac{MU_p}{P_p} = \frac{MU_c}{C_c}\right)$$

$1 $\Rightarrow$ how much production?

$$MP_L = \frac{\partial q}{\partial L} = \frac{0.5k}{\sqrt{KL}}$$

$$MP_K = \frac{\partial q}{\partial k} = \frac{0.5L}{\sqrt{kL}}$$

$$MRTS = \frac{-k}{L}$$

$$\frac{k}{L} = \frac{w}{r} = \frac{5}{10} = \frac{1}{2}$$

$$k = \frac{L}{2}$$

Intuition: $\sqrt{KL}$ $\Rightarrow$ indistinguishable. but $L \frac{1}{2}$ cheaper. $\Rightarrow$ want twice as many units

($w, r, f(k,L)$ given)

① $q = \sqrt{kL}$

② $\frac{k}{L} = \frac{w}{r} \Rightarrow k = \frac{1}{2}L$

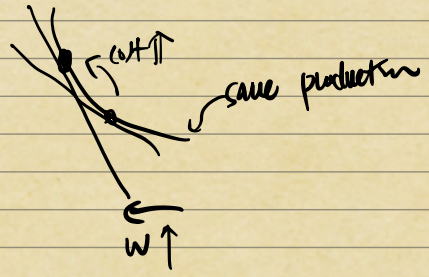
③ $q = \sqrt{\frac{1}{2}L^2} = \frac{L}{\sqrt{2}}$

④ $L = \sqrt{2}q$

$k = \frac{\sqrt{2}}{2}q$

⑤ $C = \frac{\sqrt{2}}{2}q(10) + \sqrt{2}q(5)$

$= 10\sqrt{2}q$

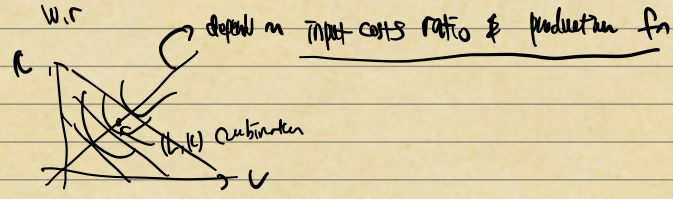


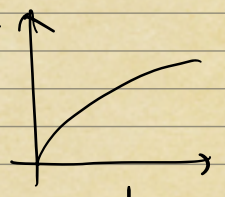
$\downarrow \frac{dL}{dk} = \frac{-MP_K}{MP_L} = \frac{-w}{r} \uparrow \downarrow$

(steeper)

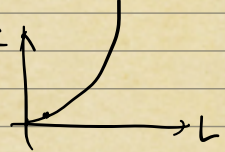
wage ↑ ⇒ replaced by machines

LR expansion path





capital heavy less productive (fast food restaurant)



heavy machinery (just run the machine)

⇒ LR cost curve

trading curve ⇝ cost ↑, producer ⇑

Tesla 200000 car ⇝ small plant

⇓

200000 ⇝ built large plant

7 Competition

(I) Sunk cost : Fixed long term cost (Like going to med school)

(ex) how much I'm willing to pay for a concert ; > $150 ⇒ sell

< $150 ⇒ go

⇒ the amount you're willing to pay vs. price is the most imp. regardless how much you paid

sell

(II) perfect Competition

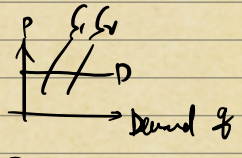
q can vary ⇝ determined by a market

(↔ consumer theory, ∃ budget constraint)

① perfect Competition

producer = price takers (can't affect)

(ex) when demand is perfectly elastic (firm)



What conditions make perfectly competitive market?

① Identical products (in consumer's perspective)

② Full information about prices

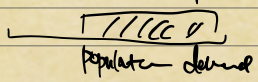
③ Low transactions cost (search cost)

Firm vs. Market demand curve

Q(P) : market demand

$q(P) = Q(P) - S^o(P)$ ← residual demand ⇝ what everyone else is selling

other firms produced!



population demand

$\sum_i q_i(p)$ ← demand of individual i

* Q industry ⇝ q can still be elastic

$$\frac{dq}{dp} = \frac{dQ}{dp} - \frac{dS^o}{dp}$$ ← supply of competitors

$\frac{dQ}{dp} < 0$ $\quad -\frac{dS^o}{dp} > 0$ price ⇒ more participants

$$\frac{dq}{dp} = \frac{P}{Q}\frac{dQ}{dp} \times N - \frac{P}{S^o}\frac{dS^o}{dp} \times (N-1)$$

$\frac{P}{Q}\frac{dQ}{dp} = \varepsilon$ $\quad \frac{P}{S^o}\frac{dS^o}{dp} = \mu$

$q = \frac{Q}{N}$ $\quad$ N identical firms

$S^o = (N-1)q$

market demand elasticity, market supply elasticity

$$\Rightarrow \varepsilon_T = N\varepsilon - (N-1)\mu$$

ε_T: firm demand elasticity < 0; $\varepsilon < 0$; $\mu > 0$

firm elasticity > market elasticity

→ quantity → quantity

$N = 100$

$\varepsilon = -1$ $\quad \mu = 1$

$\varepsilon_T = -199$

III) SR Π max.

No firm entry or exit

A) what is profit

$\Pi = R - C$

accounting profits ↪ economic profit

account for opportunity cost (time = money)

$60000 - 40000$ $\quad -(80000 + 1000 + 40000) + 60000$

B) Maximize profit

$$\frac{d\Pi}{dq} = \frac{dR}{dq} - \frac{dC}{dq}$$

$MR - ML$

$\boxed{\begin{matrix}\Pi \\ P\end{matrix}}$

(price taker)

MR = MC

what you get what you spend to make

$\Pi = R - C$

$\frac{\pi}{q} = \frac{R}{q} - \frac{C}{q}$

$\sim P \quad \sim AC$

Tax $10 per unit.

vs. fixed tax

- Shut down or not?

#8

I) perfect competition

1) $\frac{d\Pi}{dq} = \frac{dR}{dq} - \frac{dC}{dq}$

$= P - MC$

P = MC; maximized

2) $\frac{\Pi}{q} = P - AC$

Shutdown decision produce 0

P = 10

$C = 10 + 5q^2$

$MC = 10q$

$q^* = 1$

profit = R − C

$= 10 \times 1 - 15$

$= -5$

$q^s = 0 \Rightarrow$ profit = 0 − 10 = −10

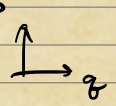
$Pq < VC \Rightarrow$ Shutdown

$P < \frac{VC}{q}$

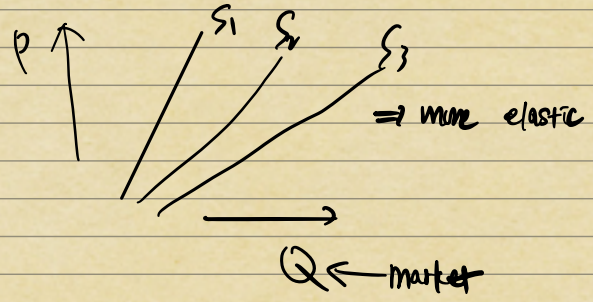
~ average variable cost

$\log q = MC = P$

so $AVC = \frac{1}{2}q = 0.5P$ ⇒ never shut-down

MC = supply curve IN perfect competition ; 

For market supply curve, ...



(II) SR-equilibrium

① $q = f(\bar{K}, L)$, w, r

→ $C = 10 + 5q^2$

② $MC = P$

$10q = P \Rightarrow q = \frac{P}{10}$

③ $Q = 6q = \frac{6}{10}P$: 6 firms

④ $Q = 48 - P$

$48 - P = \frac{6}{10}P$

$P = 30$

$Q = 18$

⑤ $P = 30$ $q^* = 3$

(III) Long-run

- can enter/exit
- No shut-down decision since all cost are variable

$\pi > 0$ enter
$\pi < 0$ exit
} $\pi = 0$

Competition forced → avg cost minimization

Firms long run profit 0 → not realistic

① limited entry

sunk cost

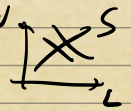
"barriers to entry"

profit > sunk cost : entry (in the long run)

② Firms may differ ⇒ diff. cost for (8-4)

③ Input price may not be fixed

may have an upward sloping supply (8-5) ← need wage to go up



① ② ⇒ firms make profits

③ ⇒ firms don't make profits

#9

(I) Shocking supply and demand curve

A) Review

SUV↑ ("complement to gasoline")

⇒ oil demand↑

price↑ ⇒ demand↑ or supply↓ ?

Why demand curve shift?

① Change in taste

② Income change

③ Change in the price of complementary / substitutable good

④ Change in the market size

⑤ Expectations of the future

Why does supply curve shift?

① Change in input cost

② Shift in the technology (production fn)

(III) Shapes of S + D

↕ ✗ inelastic ; price change from price

↔ elastic ; price change from quantity

(II) Welfare economics : tools of normative economics

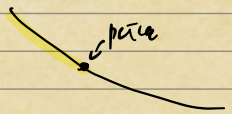
measure of well-being (not cash payments to poor people)

Consumer surplus "compensating variation" ⇒ explain consumer's behavior.

⇒ abstract than producer surplus

= benefit - price

willingness to pay = demand



surplus ∞

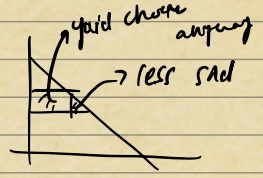
can substitute ⇒ surplus ↓

(∞ - C > ∞)

Article "Deadweight loss of Christmas"

⇒ gift < cash since cash has higher surplus

but the giver might get utility



(IV) producer surplus = profits (long run)

willingness to supply - price

= supply

① heterogeneous firms (firms w. diff level of efficiency production)

② Barriers to entry (can't enter & profit = 0)

⇒ profit since the market cost for firms profit = 0

③ upward sloping input supply

profit ; extra money goes to workers

#10. Remember. Welfare given by supply-demand curve

I) Competition maximizes welfare (+ minimize AC (before))

Social welfare = consumer surplus + producer surplus

↑ by transaction

maximized at equilibrium ⇒ "first fundamental thm"

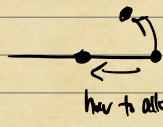
II) Gvnment Intervention

Cost: ① Deadweight loss

Efficiency loss

② Allocated Inefficiency

(Deliver to the people who want the most)



(1) wait in line for gas : not good

- opportunity cost
- technical ineff. (gas waiting in line)

: ∃ equity efficiency tradeoff

Benefit: Equity

(Vertical)

rich versus poor

(III) Examples

A) Scalping

price ceiling: Adele → scalpers

$150 $1500

Answer: Adele gets the surplus

But answers don't like answer.

usually market does it automatically

B) Find banks (eg. that gives free food to the poor)

where to?

based on what people want in their area

Give "fake" money. Tell them "You bid which food you want".

⇒ successfully allocate efficiently very market mechanism

c) Taxi Medallions

City had a system to limit # cabs

barrier to entry ⇒ makes profits

#11 Monopoly

(I) Monopoly profit maximization

Monopoly: The other extreme of perfect competition

⇒ only one firm

price maker

+ one price assumption

Max $\Pi = R - C$ when $\underbrace{MR}_{\frac{\Delta}{P}} = MC$ same as before

* Market power ⇒ ability to charge P s.t. $P > MC$

$$MR = P\left(1 + \frac{1}{\varepsilon}\right) = MC$$

$$\Rightarrow \frac{MC}{P} = 1 + \frac{1}{\varepsilon}$$

$$\text{"Markup"} = \frac{P - MC}{P} = -\frac{1}{\varepsilon}$$

Monopolist in game ⇝ Constrained by candy

Consumers are limiting factor.

Gatsby vs. Huckleberry

$11 ↑ still Count charge $ for

$4 ↑ competitive market (no copyright)

(II) welfare effect of monopoly

A) Standard

Market Failure (Deadweight loss)

Market equilibrium → social welfare maximization

3) price discrimination (privacy effect X)

⇒ just charge what customer is willing to pay.

(ex) amazon: IP address rich area
student) ⇒ charge more (later, illegal)

(ex) airplane ; last minute flight ⇒ elasticity is lower (charge more)

Signals correlated w. willingness to pay ⇝ by guessing elasticity of demand

- rich guys less elastic
- last minute deal less elastic
- supermarket in rural area more expensive (less elastic : less substitution)
- Movie during the day cheaper
- early free special (people who have more shopping time → more elastic)
- Disneyland charges you less if you live nearby

Tesla [expensive / cheaper] cars (save software)

⇝ so that you can have more expensive cars

- laser print $ home ↔ elastic consumers
$ office (closer)

#12 Monopoly II

I. How do monopoly arise?

A) Cost advantages

- Natural monopoly (ex) Rock quarry in town

(ex) water pipe installed. & water production

enormous fixed cost create a barrier to entry.

always (over AC (under where AC decreases)

↖ since fixed cost so big

B) Government action (ex) postal service

(ex) Steel, airlines, banking etc in developing city

ex patents ; protect research & development cost

(= reduce Spillover from R+D)

static vs. Dynamic tradeoff

Today: underproduce (monopolists are...) ⇒ deadweight loss

Future: produce cool things ⇒ pay off

(A) & B) ⇒ legitimate reasons for monopoly

II) Addressing monopoly

A) Government regulation

① Demand curve → hard to know for goods that doesn't exist in the existing market

Contingent valuation : asking people → inconsistent answers

② Supply curve ⇒ govnmt can't tell unless they know $TC(k, L), r, w, \cdots$

⇒ So government intervention doesn't always work

(what firms will produce)

100 (5, 10) ⇒ DWL even bigger

(hard to find competitive price)

B) Introduce competition

Infrastructure by government & let firms compete

(water pipelines) (courier delivery)

- Education : gave local schools monopoly

① enable public school choice ⇒ competition ↑
(enable any student in the district)

② Charter school (publicly funded but not regulated by local government control)
↖ by government

③ Vouchers (checks) → lots of controversy though
↓
lots of tradeoff
(market failure vs. competition → efficiency)

1) have to make sure private school's quality is on par
2) give rich guys checks too?
equity issue (smart kids all leave public schools)
3) shrink the # of students in public school
⇒ raising the average cost (potential problem)
↖ w. high fixed cost

(III) Contestable markets: market power not that big

$$MVP = \frac{P - MC}{P} = -\frac{1}{\varepsilon}$$

two ways:
① $\varepsilon \uparrow \Rightarrow$ Markup ↓
② Barriers to entry not that large ← given elasticity
(the larger it is, the more market power you have)

(ex) Airline deregulation

government thought... airline ← natural monopoly in the past
⇒ more regulation from government (on routes & prices)
⇒ price close to marginal cost

1978 ⇒ deregulation ("entry to lower cost that high!")

① price ↓
② Many more routes
③ flying sucks (quality competition → price competition)
④ hub and spoke system
→ airline dominates airport (recreate a monopoly)
→ price much more expensive again

#13 oligopoly

(ex) automobile industry

(I) Oligopoly ≈ monopoly

firm can behave [cooperatively : cartel OPEC (especially in the past)
non cooperatively

↕ Something in between

(II) Game theory

- Strategy
- equilibrium (timing of game over) ~ Nash equilibrium
  (not well-defined)
  (point at which no player wants to change their strategy given what the other players are doing)

(ex) prisoner's dilemma

payoff matrix

		prisoner B: silent	prisoner B: talk
cooperative equilibrium	prisoner A: silent	(1, 1)	5, 0
	prisoner A: talk	0, 5	(2, 2) ← non cooperative equilibrium

"Competition can lead to worse outcome"

(ex) Advertising Coke vs. Pepsi

		Pepsi: Adv (C)	Pepsi: not (P)
Coke	Adv	(3, 3)	13, -2
	not	-2, 13	(8, 8) ← Cooperative ⇒ usually don't advertise...

non-cooperative

(ex) Girl you like is say a cat?
Not saying ⇒ dominant strategy

* Repeated game (try to solve prisoner's dilemma)

Coke → Pepsi "I will ad if you don't. But if you do ever, I will, forever"

Pepsi Adv: 13, 3, 3, ...

vs Adv: 8, 8, 8, ...

Only works when the game goes forever.

3, 3, 3, ... 3

~~8, 8, 8, ...~~ ~~8~~ 3

advertise ↑ Airlines entering year

(III) Cournot Model

(of non-cooperative model of oligopoly)

United & American (Hub & Spoke system)

Chicago - Boston

- Cournot equilibrium: ∀ firm choosing profit maximization given other firms' choice

Dominant demand function

② MR = f(q, other firms' quantity)

③ MR = MC : q^* (other q)

④ other firm

⑤ solve

Reaction / Best response curve

$P = 339 - q_A - q_U$

$R_A = 339 \cdot q_A - q_A^2 - q_A q_U$ (new term)

$MR_A = 339 - 2q_A - q_U = 147$ (MC)

$q_A^* = 96 - \frac{1}{2} q_U$ ⇝ blue line (figure 13-3)

$q_U^* = 96 - \frac{1}{2} q_A$ ⇝ red line

↑ might not be symmetric

$P = 339 - 128 = 211$

In reality, you might not get intersecting point.

or multiple intersections

#14 Oligopoly

I) Cartels

$P = 339 - Q$

$MC = 147$

$MR = 339 - 2Q = 147 = MC$

$Q = 96 \quad P = \$243$

$48(243 - 147) = \$4608$ each.

Before: $Q = 64 \quad P = \$211$

$64 \times (211 - 147) = \$4096$

A) Unstable (Cheating) ⇒ As a solution firms used to have trust board (got illegal afterward)

American 2 more secretly

$\pi_A = 50 \times (241 - 147) = \$4700$ ↷ get all the benefit. half poisoning effect

$\pi_U = 48 \times (241 - 147) = \$4512$ ↷ benefits, half poisoning effect

B) Illegal (Antitrust laws ...)

(ex) Movie productions ⇒ started buying theater by appointment

(ex) early 2006's $oil ↑

⇒ cartels charge "fuel surcharge" $10 ~ $120 ← secretly

⇒ Virgin Atlantic ratted. British airline paid penalty

(ex) NFL ⇒ sell televising rights in package together (1957, blitted but exempted)

1980's car production businesses: US set limit in Japan

⇒ "voluntary export restraints"

⇒ Japanese firms form cartels price ↑

(II) Comparing Equilibria

	Q	Profits per firm	
Cartel/Monop	96	$4608	
Olig	64×2	$4096	↑ higher price, smaller market

game theory ↑ ↑ Duopoly

Comp 19k

(339-147)

Competitive → welfare ↑

(II) Many firms

$\frac{P-MC}{P} = -\frac{1}{n\varepsilon}$; Cournot equilibrium

(ex) OPEC, Mercury $n\uparrow$: not easy to form cartel

Mergers

Econ of scales vs. Market power

(cost efficiency ↑) ($n\downarrow$, worse for consumers)

(ex) hospital merge (empty beds in 1 hospital ⇒ more efficient than for multiple hospitals)

⇒ hospital tried. just raised prices

IV price competition

Bertrand competition

2 firms enough to get competitive equilibrium

(one will always lower the price than the other)

Cournot vs. Bertrand

{ lag in production ⇒ quantity competition (automobile)
{ no lag ⇒ price competition (cereal)

Bertrand competition solve by... product differentiation

Cereal · 3 → 150

$P > MC \Rightarrow Q\downarrow$

But demand curve also shifts to right } DWL ↑? ↓?

↳ want this to be high for welfare

#15 Input Market I

I) Factor market

II) Factor Demand Many buyers & sellers

- perfectly competitive input market ; workers shop firms exist
- perfectly competitive output market ; lots of companies

A) Short run labor demand

how many more selling price

capital fixed → $MRP_L = MP_L \times MR = W$

marginal revenue per product of labor What it's worth

$\Rightarrow MP_L \times P = W$ in competitive market

workers hiring

(ex) $MP_L \uparrow$ $P \downarrow$ Basketball example...

B) Long run

C) Capital demand

$MP_K \times P = r$

(III) Market supply

leisure

$H = 24 - l$

hours of work

(modeling trick ① model good not the bad)
(② Normalization: 1 good, $1)
("numeraire good")

price = opportunity cost in economics

So wage = price of leisure

Wage ↑ ⇒ price of leisure ↑ → { want $l \downarrow$ (Subs. effect) ⇒ $H \uparrow$
Income effect : income ↑ ⇒ want $l \uparrow$ ⇒ $H \downarrow$ }

IV Evidence

$H \times \frac{dH}{dy}$ ⇐ from the fact that $H(w, y)$ constant to scale...

(ex) (w↑)

	Subs.	Income
Men	$l \downarrow$	$l \uparrow\uparrow$ (already achieved target income & H effect)
Married women	$l \downarrow\downarrow$	$l \uparrow$

(more substitution)

Married women have upward sloping supply curve (wage ↑ ⇒ labor supply ↑)
pretty elastic $\varepsilon = 0.5 \sim 1$

Men → pretty much 0 (work & hrs & go here)

Since then...
women → o.2 elasticity ; ↓↓ ↑↑ how primary role
Men pretty inelastic still
kids now in childcare

Two people working → real income didn't go up much...
avg

(ex) Child Labor ① bad for health
② can't go to school

16 Input markets

(I) Labor market equilibrium + Minimum wage

(II) Capital market - "diversion of current consumption toward future consumption"
Financial asset

Many from Capital market (Supply of capital ↶ comes from saving)
① Corporate bond
② Equity
③ Bank

Supply curve comes from "Intertemporal choice" : Choosing over time
$ 80k

#14 Making choice over time

(I) present value

$i = 10\%$ $\quad Y \times (1+i) = 100$

$\Rightarrow Y = 90.9$

$PV = \frac{FV}{(1+i)^t}$

$PV = f\left[\frac{1}{(1+i)} + \frac{1}{(1+i)^2} + \cdots\right]$

$= f \frac{\frac{1}{1+i}}{1 - \frac{1}{1+i}} = \frac{f}{i}$

$FV = Y(1+i)^t$

* Compounding

(ex) Plan 1

(II) Inflation

CPI

$r = i - \pi^e$

real goods

(III) choices over time

Just compare PV

(IV) Investment decisions

$NPV = (R_0 - C_0) + \frac{R_1 - C_1}{1+i} + \frac{R_2 - C_2}{(1+i)^2} + \cdots$

$C_0 = 100$ $\quad -100 + \frac{60}{i}$

$R_{1\infty} = 200$

$C_{1\infty} = 60$

discount rate: next best thing you can do

(ex) Insulation

$2000/yr

$50%/yr reduction if I insulate

$4000 insulation cost

- Food $50
  T

Sell the house ⇒ does not matter
Still get $50 additional price
  T

(ex)
Human capital
$35000

#18 Savings & Trade

If Savings ↑ ⇒ Capital supply shifts out ⇒ r ↓ ⇒ NPV ⇑ ⇒ investment ⇑

* tax subsidy to retirement savings (A way to increase savings)

real interest rate → r(1−τ) ← tax rate

(ex) 10% interest rate, tax rate 50% ⇒ take 5%

Assume that Substitution effect ⇒ save ⇓
⇓
income effect ⇒ save ⇑

So saving ⇓ overall

to combat this.
⇒ If you save for retirement, we won't tax

- pensions
- 401(k) ← you control where it goes
- IRA

Tax deferred (Not tax free, but taxed when you take it out)

Individual retirement accounts

① Money market → Government bonds
② Bond → Corporate bond
③ Stock → Cap. equity

risk ↑ ⇒ highest return
"risk return tradeoff"
7%

economists recommendation
⇒ diversification

(II) International Trade

Exports → $1.6T
Imports → $2.4T
} $800bn trade deficit

Surplus vs. producer of currency

III PPF (production possibility frontier)

IV Comparative Advantage

making rose by computer: US > Colombia
making computer by rose: US < Colombia

"Colombia has the comparative advantage in roses"

⇒ Specialization in a world of comparative advantage

#19

(I) Comparative Adv.

Comp. adv. —specialization→ gain from trade

Why comparative adv? Two sources

① Factor endowments

(ex) Canada: Lumber
China: Cheap labor

② Technology

(II) Welfare + Trade

Domestic welfare only

(III) Trade policy

Quota
tariff → tax for import

Oppose to tariff:
① trade wars
② Other countries welfare

NAFTA: Cooperative olygopoly from US, Mexico & canada

Why some don't like free trade?

① Must compensate the losers (and they get political attention) ← producers

② Socially damaging routes to comparative advantage (like bad environmental implication etc)

③ Trade policy as a tool of foreign policy

#20 Uncertainty

(I) Expected Utility Theory $E = Pr(win) \times win + Pr(lose) \times lose$

: $0.5 \times 125 + 0.5 \times (-100) > 0$ "more than fair bet"

$EU = Pr(win) \times U(win) + Pr(lose) \times U(lose)$

Diminishing marginal rate of substitution

$C_0 = 100 \Rightarrow U_0 = 10$

$U = \sqrt{C}$

$EU = 0.5 \times \sqrt{225} - 0.5 \times \sqrt{0} = 7.5 < U_0$

"Risk averse"

(II) Extensions

$U = 0.1 \times C$

$C_0 = 100 \quad U_0 = 10$

$EU = 0.5 \times 22.5 - 0.5 \times 0 = 11.25$ Yes, take a bet (same as expected value)

$U = C^2/1000$

$C_0 = 100 \quad U_0 = 10$

$EU = 0.5 \times \frac{225^2}{1000} - 0.5 \times 0 = \frac{225^2}{2000} = 25.3 \gg 10$ (take a bet)

$\frac{175^2}{2000} = 15.3 \gg 10$ (take an unfair bet)

$0.5 \times \sqrt{112.5} + 0.5 \times \sqrt{90} = 10.5 > 10$

* Loss aversion

- Mug experiment : loss aversion sell at $7 buy at $3 "biased by their starting point"

(II) Applications

A) Insurance

$1.5 trillion a year on insurance
(10% of GDP)

$40000 income 1% hit by a car $30,000 medical bills

$u = \sqrt{c}$ Expected cost = -300

$EU_{no} = 0.01 \times \sqrt{10000} + 0.99 \times \sqrt{40000} = 199$

↑ no insurance

$EU = 0.01 \times \sqrt{40000 - x} + 0.99 \times \sqrt{40000 - x} = \sqrt{40000 - x}$

$\sqrt{40000 - x} = 199$

$x^* = 399$

$99 risk premium ($300 expected cost)

↖ for avoiding the risk

Clike (avoid hitting by a car : $99
⇔ pay moderator to avoid betting : $43.75)

* the bigger the risk is relative to your income → more risk averse

Insurance by manufacturers → take it if your income is low

↖ always have risk premium

B) Lottery

Ø Risk loving : why would people buy insurance?

② Risk tolerance varies

③ Entertainment → government should encourage
(ritual)

④ Ignorance → government should discourage
(irrational)

#21 Efficiency and Equity (price doc. Monopolist case is rare, no tradeoff)

vs. perfect competition

I) Equity + Efficiency

Equity efficiency tradeoff

Okun: leaky bucket

① Valuation

② Inequality

③ Sources of leakage

④ Transfer mechanisms

II) Choosing Social optimum

Social welfare function: $f(u_1, u_2, \cdots, u_n)$

A) utilitarian

$Stuf = u_1 + u_2 + \cdots + u_{350,000}$ Assume resource is fixed. u_i's are same

Bentham ↗ ⇝ will want to perfectly redistribute the income

B) Rawlsian $Stuf = \min(u_1, u_2, \cdots)$ another example of extreme liberalism

C) Nozickian: let's distribute opportunity equally, not income

- What is equal opportunity? unrealistic
- ignores luck

D) Combating egalitarianism: Cons of B and C.

equal access to necessary goods and resources.

III) Inequality

with free ↘ Inequality: Relative

Poverty line: Absolute Definition ⇝ hard, inaccurate.

Cost of nutritionally adequate bundle of food ×3

Sad people make loud noises so it's hard to discriminate based on the noise as well.

(IV) Efficiency costs of redistribution

① Administrative cost (Okun style digit, not a (or))

② Efficiency costs of taxation ⇒ work less

③ Efficiency cost of transfers

#22 Government redistribution and Taxation

I) Taxation in US

A) Who bears taxes?

Tax incidents

{ consumer: .30
  producer: .20

tax salience - how the tax is presented affect people's demand

(ex) Raise tax E-Z pass since cost noticeable

B) Side of market is irrelevant

c) Elasticities

(ex) AirBnB ⇒ Compare price w. diff. tax rates
⇒ Found out hotels bear a lot of taxes

D) What to tax?

Y C
↗ ↗
Income Consumption
↑
Europe (value added tax)

$Y = C + S$

engine of economy: S↑ ⇒ r↓ ⇒ I↑

⇒ Economists favor taxing on just consumption

Counter argument: Fairness ⇒ rich save, and no one else does

⇒ maybe tax the same when they die?

II) Transfers

$T = \max(0, 10000 - y)$

A) Categorical transfers

SSI program: $80 billion a year to low income w. disabled children
(Supplemental Security Income)

TANF program: cash grants to low income single parent households

way of reducing the distortion that arises from transfers

things that they didn't choose

In fact. behavior changing SSI > TANF (tradeoff)

↑ people start showing up can claim they are disabled.

Universal basic income (UBI) "hard to measure" so just give cash money to poor people.

B) In-kind transfers (particular kind)

Self-reveal ⇒ give them the stuff (government health care (medicare apx, etc) than cash. (economic reason)

Why politicians do it

⇒ paternalistic (afraid poor people will waste money) cocaine...

EITC (earned income tax credit): conditional transfer = wage subsidy

Overall. positive supply effect. Reverse leaky bucket

(reason unclear. income distribution? tax salience?)

Cons: Still don't help people who don't work.

23 Externalities

Source of market failure (not maximum welfare)

① Imperfect competition

② Imperfect information

③ Externalities

"one party makes another party better or worse off but I don't bear the consequence of that"

A) Negative production externality

(ex) River: steel plant ⇝ produce steel ⇝ dump bad stuff to ocean ⇝ fish die ⇝ fisher can't fish

Adam Smith: self-interest ⇒ best outcome for society

⇒ Externality says "No!"

B) Negative consumption externality

ex) Smoking ⇒ other people get sick ⇝ health care cost } not bear consequence ⇓ externality
⇒ I get sick ⇒ MIT health insurance
⇒ fires
⇒ less productive at work ⇒ paid less ⇒ not externality

Internalize the externality : if smoking is optimal for the whole family
and you care about the whole family

Study: check given to wife/husband matters
consumption of alcohol ↑
So maybe, ∃ externality

c) positive consumption externality

ex) Moment of dust

C=1000
B=800
+300 (to me)

Why don't I pay the world?
① dust knows his costs & benefits, dust want to pay more
② He doesn't know how I feel (This is asymmetry)
③ deeply weird (not how it works)
⇒ "Coase economics"

Students pay prof. to not smoke?

⋮

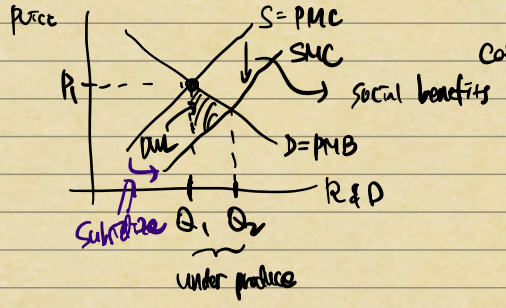
D) positive production externality

ex) R&D

Social return = private return × 2.5

So firms under invest

Statin (cholesterol reducing medicine) 5 yrs later than it should've, by academics



Cost → well below than what it truly costs

(II) Government Solutions

Corrective taxation / regulation

(III) practice

(A) Environmental externality — global warming

① Tax ⇒ politically not easy

② Quantity regulation

(B) Health externality — drunk driving, cigarette, obesity

① Information — drunk driving only by few minority

② Taxation — tricky (drink, food)

③ penalty (can't enforce perfectly)

④ Illegality (ex) Marijuana

#24 Market Failures II :

- Imperfect competition
- externality
- info asymmetry

I) Why Social insurance ?

Info asymmetry (not only imperfect, parties involved have different levels of info)

"Lemon problem"

Buyers think people sell a used car since it's not good lemon. ⇒ willing to pay less

(ex) 10 yr old pristine car ⇒ transaction ✗

willingness to sell: 5k

willingness to pay: 6k → 4k ← only the worse cars will participate in the market

• Most 10 yr car is not in good shape. perhaps need additional $4k

1970 info asymmetry ⇝ market failure (transaction didn't happen)

Insurance : buyer has the info.

(ex) MIT grads 90 healthy 10% $10,000, 90% $0 ⇝ $1000

10 sick 50% $10,000 50% $0 ⇝ $5000

Assume insurer is risk neutral

EC = 0.9 x 1000 + 0.1 x 5000 = $1400 p = $1500

Say Sick people + risk averse ppl = 60 ppl

Revenue = 60 x 1500 = $90k

Cost = 5000 x 10% of 1000 = $100k ⇒ lost money

Adverse selection ← due to info asymmetry

Q. How about raising the price?

Healthy people will drop out. "death spiral"

⇒ Market failure

(ex) Fact : Ones left at the end of the day must be good

Apples ⇝ market still exists

Health insurance ⇝ out of business

Why you fill lots of fars.

Genes ⇝ know the potential disease

⇝ There must be insurance company ← two issues example

insurance

If we have for contracting, the insurance market fails

"more information is more"

Gov't Solutions (to get healthy people to have insurance)

① Subsidization ex) Give everyone $500 tax credit if you enroll in MIT grad insurance

expensive ↗ Tax subsidy to Employer Health Insurance (raise vs. non-taxed insurance subsidy)

② Mandate (can piss healthy people) : (ex) Workers' Comp insurance ← for job injury

③ provide the insurance (Social Security, Medicare, Unemployment insurance, Disability insurance)

↖ tax expensive

(III) Tradeoff

Moral Hazard : adverse behavioral due to insurance

(ex) insurance ⇝ ride bicycle less carefully

⇝ fire extinguisher

search for new job

① lower efficiency

mvl = w ⇒ social efficient outcome

(mvl > w rather be at home
mvl < w worry my time at home)

mvl + government check = w

mvl = w − government check

⇒ work less harder

⇒ shift supply curve ⇒ DWL

② passes taxation (other ppl work less too)

Due to these trade-offs we don't want too much social insurance

even if we need it due to adverse effect (asymmetric info)

(eg) 0 ~ 50% ~ 100%

↑ prevent starving ↑ moral Hazard not working

(Ex) Social Security program ($800 b /yr)

: prevent income loss when you retire

FICA : 12% of payroll

⇒ get a check from government from age 62 until you die (annuity)

→ cause you to retire?

well... annuity ↓ as you collect later in the US

In netherlands, you don't increase annuity after age 65 ⇒ No work.

#25 Health Economics

US — spending is too high
└ access is too unequal

Two problems: [market failures
redistribution

6% Employer Sponsored Insurance

6% Individual / Non group health insurance

market failure through adverse selection { — pre-existing conditions exclusions (not cover symptoms from pre existing condition)
— Medical underwriting (exam → deny if you're sick)

20% government sponsored insurance ⇒ { medicare - for elderly / medicaid - for poor } (you're rich)

15% uninsured ← near poor ppl

Sick, near poor ppl ⇝ trouble

① Subsidization

Some problems...

- hard to give money to non-poor ppl politically
- how big? Enough?

② Single payer 1) paying for it (large tax → ouch...)

hidden tax → non-hidden tax ⇒ politically hard (people don't understand)

↑ when you do ESI: you essentially get lower wage

2) Status quo bias ← take away what you have for sth you're uncertain about is difficult

3) Insurance companies → lobby

3 legged stool approach

① Ban insurer discrimination ← insurer goes bankrupt they're like Brooke

② Individual mandate

③ Subsidies low income → offset the cost of insurance

⇒ 47% of uninsured ppl covered now { 25% unbeknownst / certain exemption (political/humane reason) 8↑ % of income / rather pay penalty

In some sense... Coverage increase ⇐ bring people already eligible but did not due to unknown reasons

Costs : 1950 - Now US health care 4% → 17% of GDP (worth it (health ↑)) but wasteful

1) Regulatory path

[1] technology regulation

(ex Europe: NICE over 75, no kidney implant tell hospitals they shouldn't do sth...

[2] Supply regulation limit # of machines etc

[3] price regulation ↑ market failures 1) imperfect information

Cities except for US do this 2) imperfect competition (even ∃ regulated monopoly)

regulating monopoly → cares w. prices though at less scale in 1990's

2) Incentives route

ACO (accountable care organizations)

hospitals & doctors get together, make them decide costs per person

but incentive won't rise that much

1) politically nightmare

2) conduct figure out in practice