CHAPTER 06: DEMAND AND DEMAND FUNCTION

- Demand function: Note that this is the relationship between quantity demanded of a commodity and all the factors that influence it (not only price). (different from demand 'curve').

- Law of demand: Ceteris Paribus, price of a commodity and its quantity demanded are inversely related.
  (Proof uses income effect and substitution effect of a price change, and assumes that substitution effect is stronger).

- **EXCEPTIONS** to the law of demand:
  → Veblen effect (conspicuous consumption): Some people define the worth of a good w/ its price; ⇒ ↑P, ↑Q_D ⇒ up-sloping dd curve
  → Giffen goods: Strongly inferior goods; income effect stronger than substitution effect ⇒ dd curve upward sloping

- Relⁿ b/w demand function and demand curve: Demand curve is drawn by holding all determinants of demand function, apart from price, constant (⇒ ceteris paribus assumption).

- Shift factors of dd curves: Tastes, Income, Changes in prices of other goods, advertisement expenditure, population etc.

- **DERIVED DEMAND**: Demand for goods that are not demanded by individuals to satisfy their wants directly, but for using them to produce other consumer goods which directly satisfy their wants. Thus,

- Arrow's criteria (desirable) for an SWF can be written as:
  - → Unrestricted Domain
  - → IIA
  - → Pareto Principle
  - → Non-Dictatorship

AMARTYA SEN'S SWF:

$$W = \pi(1-G)$$

(Proof : Gini coefficient, Lorenz dominance, Atkinson's Theorem, Generalized Lorenz curve, 'S's' Theorem, Final Proof).

demand for factor inputs, such as labour, is also derived demand I guess.

demand for these goods is 'derived' from the demand for other goods. (eg: Producer goods such as capital equipment, spare parts etc.)

- Network externalities:
  - → BANDWAGON EFFECT: Dd ↑ if more people already own a good ('fashion/fad'). Makes dd curve more elastic.
  - → SNOB EFFECT: Negative network externality; arises from desire to possess a unique commodity having some prestige value. Makes demand curve less elastic.

CHAPTER 07 CONSUMER'S BEHAVIOUR – CARDINAL UTILITY ANALYSIS

There are several theories that try to prove the Law of Demand:

- → Cardinal utility analysis
- → Indifference curve analysis
- → Samuelson's Revealed Preference Theory
- → Hicks's Logical Weak Ordering Theory

All aim to establish inverse relⁿ b/w price of a good and quantity demanded

- <u>ASSUMPTIONS:</u> (for Marshall's Cardinal Utility Analysis).

(1) Utility is cardinally measurable: Marshall said that MU is measurable in terms of money – the amount of money that a person is willing to pay for a good rather than go without it is a measure of the utility he derives from that good.

(my utility only depends on my consumption).

(2) Individual utilities are 'independent' and 'additive'

(3) Marginal utility of money is <u>constant</u> (<u>HUGE</u> drawback to the theory); however (4) MU is diminishing for commodities.

- <u>PRINCIPLE OF EQUI-MARGINAL UTILITY:</u> [6] The consumer will distribute his money income between goods in such a way that the utility derived from the last \$ spent on each good is equal.[9]

i.e., $$MU_m = \frac{MU_x}{p_x} = \frac{MU_y}{p_y} \ldots \text{(and so on)}$$

<u>Criticism</u>: → Cardinal measurability required
→ Indivisibility of goods
→ MU_m is not constant! (in reality).

- PROOF OF LAW OF DEMAND USING EQUI-MARGINAL UTILITY :

For equilibrium, $MU_m = (MU_x / p_x) = (MU_y / p_y)$

Now, if $p_x \downarrow$, equilibrium would be disturbed, and MU_x would need to fall to restore this equilibrium (remember, MU_m is assumed constant!) $\Rightarrow Q_x$ will need to $\uparrow$ ($\because$ of diminishing $MU_x \rightarrow$ as $Q_x \uparrow$, $MU_x \downarrow$).

$\Rightarrow$ As $p_x \downarrow$, $Q_x \uparrow$ (ceteris paribus).

(NOTE that income effect is ignored here – as $p_x \downarrow$, real income of consumer will $\uparrow$, and MU_m will change. But this is assumed away). 2 cases where constancy of MU_m is true:

→ Price elasticity of demand is unity ; i.e., even with $\uparrow$ in purchase of a commodity following a fall in price, the money expenditure made on it remains the same

→ MU_m will remain approximately constant for relatively less important goods that account for a negligible portion of the consumer's expenditure.

- CRITICISM OF MARSHALLIAN ANALYSIS:

(1) Cardinal measurability is unrealistic

(2) Individual utilities are not independent and additive

(3) MU_m is not constant

(4) Ignores income effect (SEE HOW (above))

(5) Cannot explain Giffen goods

(6) $\boxed{\text{IMPORTANT}}$ Marshallian demand theorem cannot be genuinely derived except in one-commodity case:

<u>Proof</u>: Assume an equilibrium position $\Rightarrow$ $MU_m = (MU_x / p_x^1) = (MU_y / p_y^1)$

$\Rightarrow$ $MU_x = MU_m \times p_x^1$

Now, say p_x^1 rises to p_x^2; now, $[MU_x < MU_m \times p_x^2]$

$\Rightarrow$ If initially consumption of x was q_x^1, now it will need to <u>fall</u> to q_x^2 (so MU_x can rise and equal $MU_m \cdot p_x^2$).

Now, MU_m will remain constant <u>only</u> if

$(p_x^1 q_x^1) = (p_x^2 q_x^2)$; i.e., if price elasticity of demand = 1.

But this is a restrictive assumption, unlikely to be true.

$\Rightarrow$ If the above doesn't hold, (say, $p_x^1 q_x^1 < p_x^2 q_x^2$) $\Rightarrow$ consumer is left w/ <u>lesser</u> money for other goods

$\Rightarrow$ Demand for other goods will change

BUT price of other goods hasn't changed; thus, in Marshall's theory, MU_m must have changed to necessitate change in demand for other goods (i.e, income effect must have operated).

$\rightarrow$ This contradicts assumption of constant MU_m

$\Rightarrow$ Marshallian cardinal analysis <u>only</u> valid for one-good <u>case</u>.

(<u>or</u> when there is <u>unit</u> price elasticity of demand).

Review Points:

→ Note that Marshallian approach to law of demand, is

(i) Cardinal, independent, additive individual utilities

(ii) MU_m = constant (iii) law of equi-marginal utility.

CHAPTER 08: INDIFFERENCE CURVE ANALYSIS OF DEMAND

Hicks and Edgeworth criticized Marshall's cardinal utility analysis, and introduced the IC approach. They assumed that consumer preferences are:

(1) Complete: Defined over all possible bundle alternatives

(2) Transitive

(3) Unsatiated: More is preferred to less

(4) Follow diminishing marginal utility to a single good.

They further assume that utility is ordinal (consumer can rank various bundles), and that consumers have perfect information.

Given this, Hicks-Allen approach maps ICs as curves that represent bundles of good that provide the same level of utility to consumers.

MRS: MRS_{xy} is the amount of y that a consumer is willing to give up to gain one additional unit of x while staying on the same IC.

MRS_{xy} is given by the slope of the IC. Now, assuming:

(Imp.) → Goods are imperfect substitutes

→ Want for any one particular good is satiable, we can show that preferences will follow diminishing MRS (as consumer has more of x, less and less amount of y is required to compensate him for loss of one unit of x).

Now, along an IC, $U(x,y) = a$

$$\Rightarrow \left(\frac{\partial U}{\partial X}\cdot dX + \frac{\partial U}{\partial Y}\cdot dY\right) = 0 \quad \Rightarrow \frac{dY}{dX} = -\frac{\partial U/\partial X}{\partial Y/\partial X}$$

V. Imp.

⇒ $\boxed{MRS_{xy} = -\dfrac{MU_x}{MU_y}}$ (Note the signs; $MRS_{xy} = \Delta y/\Delta x = -MU_x/MU_y$).

(*) Corollaries: Properties of ICs →

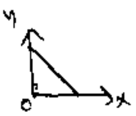
(1) ICs are downward sloping: To stay on same level of utility, as consumption of one good ↑, that of the other will ↓.

(2) ICs are convex to the origin: Imply diminishing MRS.
$\boxed{\text{IMP}}$: If ICs are concave, it would imply ↑ MRS, and consumers will only consume one good ('MONOMANIA') / (corner solutions)

(3) ICs never intersect: will violate transitivity if they did

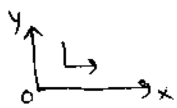
(*) Perfect Substitutes and Perfect Complements: The curvature of an IC defines the degree of substitutability b/w 2 goods. Higher the curvature ⇒ lower the substitutability. 2 extreme cases:

→ P.S.:



$U(x,y) = (ax+by)$.

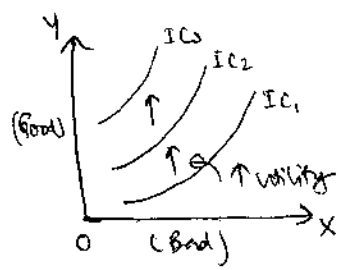
→ P.C.:



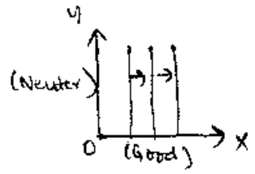
$(U(x,y) = \min(x,y))$

(*) Non-'normal' IC shapes:

(1) ICs b/w a 'good' and a 'bad':
As q_{bad} ↑, need more q_{good} to stay indifferent ⇒ ICs up-sloping



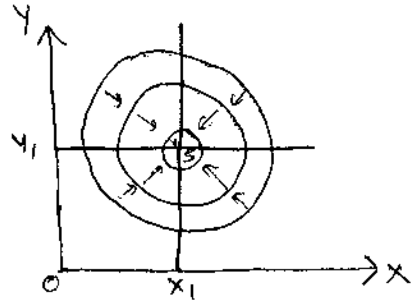
(2) Neutral goods:



(3) Satiation and 'Bliss Point':

After x_1, good 1 turns 'bad' (||ly, y_1)

⇒ S is 'Bliss Point', & ICs are circular.



(*) CONSUMER'S EQUILIBRIUM: Maximizing ~~satisfaction~~

Budget line: $(p_x \cdot x + p_y \cdot y) = M$ ← income (constant)

⇒ Slope of budget line $= \left(\frac{dy}{dx}\right) = \boxed{-p_x/p_y}$.

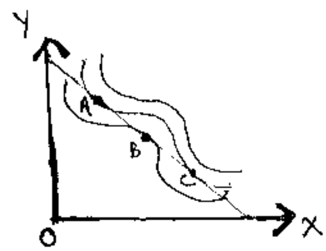
Constrained maximization:

→ FOC: IC is tangent to budget line

⇒ Slope of IC = Slope of budget line

⇒ $$\boxed{MRS_{xy} = \frac{MU_x}{MU_y} = \frac{p_x}{p_y}}$$

→ SOC: At the equilibrium point, IC must be convex to origin (⇒ MRS must be falling) (In figure, B is NOT an equilibrium; A, C are



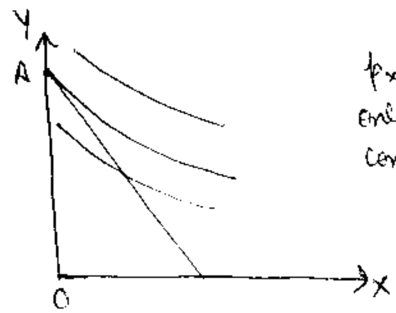
NOTE IC doesn't need to be uniformly convex to origin. Needs to be convex only at equilibrium point (of tangency) (for SOC to hold).

2 cases

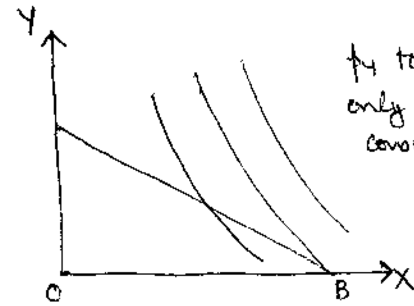
(*) CORNER SOLUTIONS ~~to~~ Consumer's equilibrium:

Usually, consumer preferences are such that the constrained optimization problem leads to an 'interior solution', i.e., the point of tangency b/w IC and budget line lies within the commodity space; consumer consumes some quantity of each good. Exceptions:

→ With Convex ICs: If the price of one of the two commodities is ~~so~~ high that $MRS_{xy} \neq (p_x/p_y)$ at any point in the interior commodity space, a corner solution will result, where the consumer consumes no quantity of the expensive good:

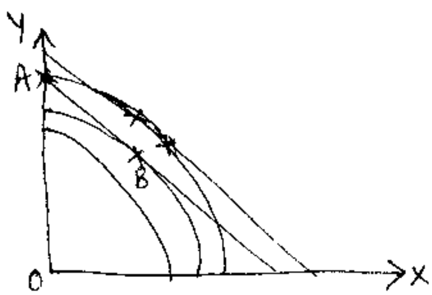


p_x too high; only y is consumed

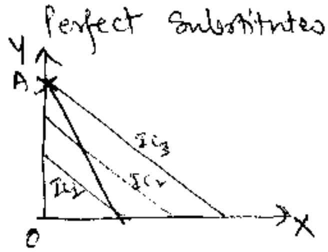


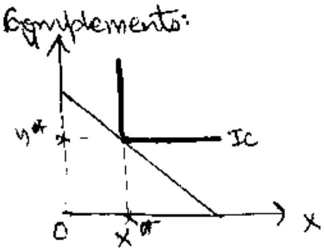
p_y too high; only x consumed

→ With concave ICs: Concave ICs imply that $MRS_{xy} \uparrow$ as $x \uparrow$ ⇒ more of either commodity a consumer has, the more valuable the commodity becomes to the consumer (unlikely, unusual behaviour → violates satiation)



→ Perfect Substitutes and Perfect Complements:





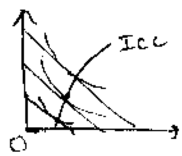
(non-corner soln; just unusual shape).

(*) INCOME EFFECT: INCOME CONSUMPTION CURVE

"Income effect" measures changes in consumer's purchases of goods as a result of a change in his money income (holding prices constant). Income effect is positive if with $\uparrow$ in income, a good's consumption $\uparrow$ (vice-versa for inferior goods)

- Income consumption curves:

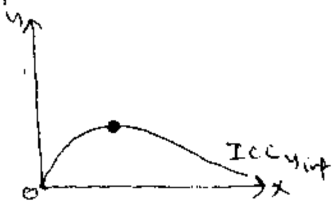
→ Normal goods:



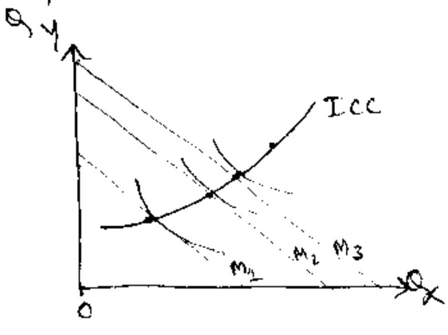
→ Good X is inferior:
As income $\uparrow$, after a certain consumption level is reached, $q_x \downarrow$ as $M\uparrow$

|| Note that in both these cases, ICC is upward-sloping for a range of income; beyond that, income effect turns -ve

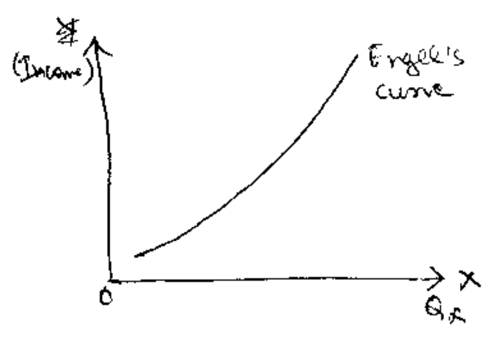
→ Good Y inferior:



- From ICC to ENGEL'S CURVE: Engel's empirical work studied the changes in families' consumption basket as their income changes (holding prices constant). He showed that as $M\uparrow$, expenditure on food & other necessities $\downarrow$, while that on 'luxuries' $\uparrow$:



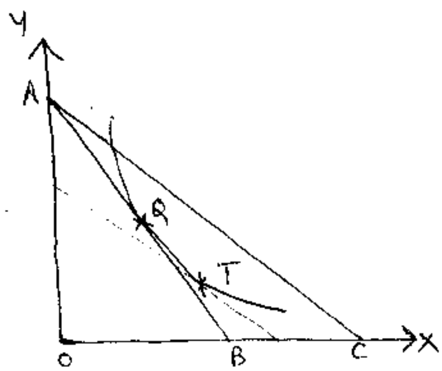
→



- Income Consumption Curve is drawn on ((X-Y) goods) axes
- Engel's curve is drawn on (Income - good) axes.

Thus, '<u>Engel's curve</u>' shows relationship b/w <u>INCOME</u> and <u>Qdemanded</u>.
(Corollary: Engel's curve for normal goods is upward-sloping; for inferior goods is downward sloping).

<u>SUBSTITUTION EFFECT:</u> Measures the change in Q_d of a good due to a change in its relative price alone; <u>real income or level of satisfaction remaining constant</u>. (IMP. - what are you holding constant ?)
→ Hicks: Remain on same IC
→ Slutsky: Remain on same <u>consumption bundle</u>.



→ Hicksian Substitution effect
Initial consumption bundle: Q.
Now, suppose $p_x \downarrow \Rightarrow$ AC is new budget line.
In HICKSIAN FORMULATION, we neutralize this ↑ in <u>real</u> income of the consumer due to the price fall, and in a thought experiment, 'take away' just enough income (at new prices) so that the consumer remains on the same IC as before. (this is known as a 'COMPENSATING VARIATION'. Note that after such a compensating variation, new equilibrium is at bundle T.

⇒ Move from Q to T is purely because of substitution effect.
$p_x \downarrow, \Rightarrow Q_x \uparrow$. Substitution effect, unlike income effect, is <u>always</u> negative. (relative to price).

Now, 'Price consumption curve' traces the relationship b/w the price of a good and its Q_D, holding prices of <u>all</u> other goods, and the money income, constant.

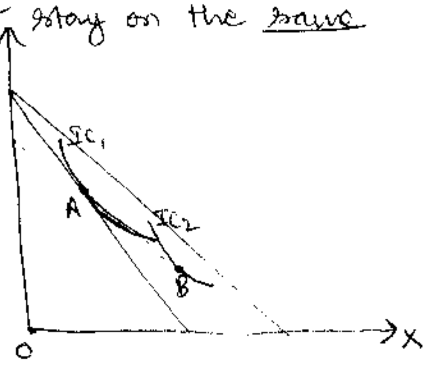
'Price effect' can be broken down into a 'substitution effect' (always −ve) and an 'income effect' (−ve (w.r.t. price change) for normal goods ; +ve for inferior goods).

Thus, when the price of a good changes, whether Q_D of the good ↑, ↓, or remains constant depends on the nature of the good:

	Price effect	Subst^n effect	Income effect	Relative Magnitude
→ Normal goods :	−ve	−ve	−ve	(Doesn't matter)
→ Inferior goods :	−ve	−ve	+ve	(SE > IE)
→ Giffen goods :	+ve !	−ve	+ve	(SE < IE)

Thus, LAW OF DEMAND is valid for all cases, except for Giffen goods (where goods are strongly inferior). (This case is only likely to be true when a consumer is initially spending a very large proportion of his income on an inferior good).

→ SLUTSKY Substitution effect: Derivation of law of demand remains exactly the same as in Hicksian case. Difference is that unlike a 'compensating variation' in Hicksian case (that lets the consumer remain on the same IC), Slutsky suggests a 'cost difference compensation' that enables the consumer to stay on the same consumption bundle as before: thus, consumer can move to a higher IC (real money income is kept constant, instead of utility, as in Hicks).



- Benefit of Slutsky: More practical and hence useful in policymaking
- Benefit of Hicks: Slutsky's variation 'over-compensates' the consumer; the resulting substitution effect is not 'pure'. Hicksian approach is better for analysis of consumer surplus and welfare economics.

THUS, under Hicks, we keep utility constant; under Slutsky, we keep purchasing power/real income constant.

- Mathematical version of Slutsky equation:
  Need to find: ~~dp~~ (dq_x/dp_x).

Substitution effect: $\partial q_x / \partial p_x \big|_{U=\bar{U}}$ → Note. This is confusing; just learn this.

Income effect: $\partial q_x / \partial I$; but magnitude of change in income = $q_x\,(\partial p_x)$

⇒ Total income effect = $q_x\,(\partial p_x)\cdot\left(\dfrac{\partial q_x}{\partial I}\right)$

$$\Rightarrow \quad \left(\cancel{\partial q_x}\right) \; - \frac{d q_x}{d p_x} = \underbrace{\left(- \frac{\partial q_x}{\partial p_x}\bigg|_{U=\bar{U}}\right)}_{\text{Substitution effect}} + \underbrace{\left(-(q_x \cdot \partial P_x)\left(\frac{\partial q_x}{\partial I}\right)\right)}_{\text{Income effect}}$$

⇒ Price effect = (Substitution effect) + (Income effect).

CHAPTER 09 Demand for Complementary & Substitute Goods

Traditionally, substitutes and complements were explained in terms of total price effect (w/ the concept of cross-price elasticity of demand)

→ Substitutes: cross-price elasticity is ~~negative~~ positive.

→ Complements: " " " " ~~positive~~ negative

- HICKSIAN APPROACH: Hicks said that the traditional definition is fallacious because the strength of income effect might mask the actual relationship between 2 goods. For example, say X and Y are substitutes, and $p_x \downarrow$:

  → $p_x\downarrow$ → Substitution effect leads to $\uparrow$ in consumption of x, $\downarrow$ in consumption of Y.

  → BUT, income effect might be so large that overall, after $p_x\downarrow$, $q_y \uparrow$. Traditional approach here would have us believe that X & Y are complimentary, which is not true in our example.

Thus, Hicks said that substitutability or complementarity b/w 2 goods must be decided solely on the basis of the substitution effect; income effect must be eliminated by making a compensating variation in income after the price change.

(*) PROBLEM: According to the above method, any 2 goods will always be substitutes! Thus, 2 understand the true relationship b/w 2 goods, we need atleast 3 goods in total. Let's assume that the 3rd good is money (i.e., the consumer doesn't necessarily consume all of his income - he might hold onto some of it. In such a scenario:

→ Y is a substitute for X if the MRS of Y for money is diminished when X is substituted for money in such a way so as to leave the consumer no better off than before (i.e., after a compensating variation in income is made)

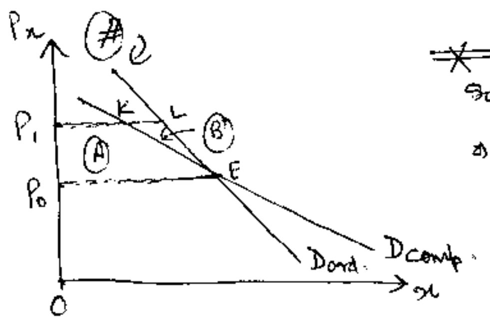
→ $MRS_{Y,money} \uparrow \Rightarrow$ X & Y are complements.

Thus, while substitutes can occur in the case of 2 goods, complements can only exist in the (3+)good case.

(#) COMPENSATED DEMAND CURVE: Ordinary demand curves describe the total price effect (substitution + income); compensated demand curves demonstrate the effect only of the substitution effect.

• Along an ordinary dd curve, nominal income is held constant; along a compensated demand curve, real income is held constant (⇒ compensated demand curves are more appropriate for measuring consumer surplus) (REMEMBER)(#)

• Ordinary demand curves (FOR NORMAL GOODS) are flatter than compensated curves (∵ Total Price effect for normal goods > Substitution effect alone).



Say, initial price P_0; rises to P_1

⇒ loss in CS based on ordinary dd = Area (A)

" " " " " comp. dd = Area (A) + (B).

⇒ for normal goods, ordinary curves lead to under-estimation of loss (v.v. for inferior goods)

CHAPTER 10: MARSHALL (CARDINAL) V/S IC ANALYSES

(*) SIMILARITIES:

(1) Both assume rational consumers who maximize utility.

(2) Marshall's equilibrium condition: $MU_x/p_x = MU_y/p_y$ ($= MU_M$)
Hicks' (IC) condition $\left(MRS_{xy} = p_x/p_y\right) \Rightarrow MU_x/p_x = MU_y/p_y$

(c) Both assume some form of diminishing utility (diminishing MRS is ~~an improvement over~~ equivalent to Marshallian law of diminishing marginal utility).

(*) WHY IC ANALYSIS WINS OVER MARSHALL:

(1) Assumes ordinal utility, not cardinal
(2) Doesn't assume constant marginal utility of money
(3)✓ Explains Giffen goods case – greater insight into price effect
(4) Doesn't assume that individual utilities are independent/additive

(*) CRITICISM of IC approach:

(1) Cardinal utility is implicit: How to measure MRS w/o MU_x & MU_y?!
(2) Strong assumption that consumer preferences are defined over the entire scale of available bundles.

CHAPTER 11: APPLICATIONS OF INDIFFERENCE CURVES

- **SUBSIDIES:** Analyze –

(a) Price subsidy (show that the cost to the government exceeds the 'money equivalent' to the consumer). (this is always true as long as the IC has a smooth curvature).

(b) Lump-sum income grant (show that in this case, the consumer will overall be better-off than in the case of price subsidy, but will ↳ might consume relatively lesser food. Give justifications for this).

- **RATIONING:** Using ICs, show the following cases:

(a) Both ~~of~~ commodities are being rationed; ration limit is such that it is not binding for either commodity

(b) Binding for X

(c) Binding for Y.

- **INCOME – LEISURE CHOICE:**

(a) Backward – Bending supply curve of labour

(b) Show diagrammatically the need for a higher 'overtime' wage rate.

- Differentiate between the effects of a food-stamp programme with those of a cash grant.

- Analyze the welfare effects of direct and indirect taxes. Which one is better (if the same amount of revenue is to be raised) and why?

NOTE: An important point to note in all of the above is that any government policy that messes with relative price will be inferior to one that doesn't change relative prices. This is because policies that change relative prices have an induced <u>substitution effect</u> in addition to the income effect, and this has adverse effect on welfare.

CHAPTER 12: REVEALED PREFERENCE THEORY

So far, we've seen the following approaches to determination of the law of demand:

- Marshall's cardinal utility theory
- Hicks-Allen Indifference curves analysis

Given that the IC approach, though an improvement over Marshall, still has very restrictive assumptions, Samuelson devised the RP theory to establish the law of Demand. 2 advantages:

- Doesn't require ICs to establish law of demand
- Can still help us theoretically derive the shape of ICs (convex to origin), rather than assume it (as in Hicks-Allen)

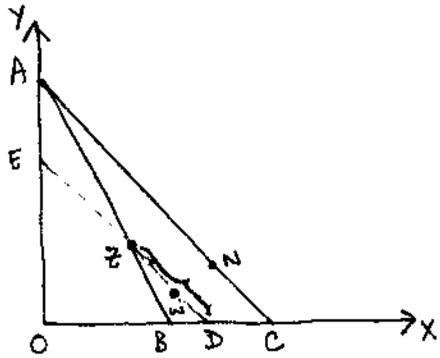
• ASSUMPTIONS: Consumer preferences are:

- Rational (more is preferred to less)
- Consistent ($A > B \Rightarrow B \not> A$)
- Transitive

Given these, the [[Revealed Preferences Hypothesis]] states that by choosing a collection of goods in a given budget situation, the consumer 'reveals' his preference for that particular collection. The revealed preference for a particular collection of goods implies (axiomatically) the maximization of the consumer's utility.

• Derivation of demand curve: Consider that initial budget line is AB. Now, $p_x \downarrow \Rightarrow$ new budget line is AC.

(Using 'WARP').



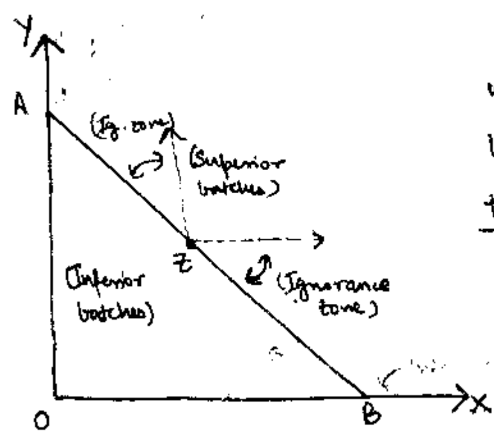
To prove: After $p_x \downarrow$, new bundle chosen will be such that $q_x \uparrow$.

Proof: After the price drop, do a 'compensating variation' to study the substitution effect. Now, the compensated budget line is ED. Given that 'Z' was chosen when all bundles on EZ were available ($\because$ EZ lies below AB), Z is 'revealed preferred' to all bundles on EZ. Thus, the consumer will, due to substitution effect, consume somewhere on the portion ZD.

Next, incorporating income effect (and assuming a normal good) we can show easily that if consumer consumed 'w' on the compensated budget line, he will now consume even further to the right of w. Thus, q_x certainly $\uparrow$ for a normal good after $p_x \downarrow$.

- Demand curve is downward sloping.

- Derivation of shape of ICs:



From the figure, we can show that ICs will be convex to origin using successive budget lines that 'pass' above and below Z, to narrow down the preferred bundles.

Resulting ICs will be convex; $\because$

- Can't be straight line AB (RP violated)
- Can't be concave (RP violated).

• CRITIQUE :

→ Positives: – Gives up the (rather strong) utility-maximizing postulate.

– Abandons the assumption of 'continuity', that the consumer is able to rank all ~~his~~ possible combinations of goods

– Establishes, rather than assumes, Convexity of ICs.

→ Negatives: – Samuelson's substitution effect, like Slutsky's, overcompensates the consumer.

– Cannot account for Giffen's Paradox.

CHAPTER 14: ELASTICITY OF DEMAND

Topics:

→ Price elasticity of demand: elastic ⇒ $e_p > 1$; inelastic ⇒ $e_p < 1$.

- Midpoint method (why needed? see P. 282)

- e_p and change in total expenditure:

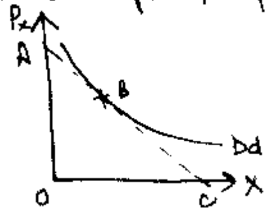
  $e_p > 1 \Rightarrow$ (TE ↑ as p ↓); $e_p < 1 \Rightarrow$ (TE ↓ as p ↓)

  ↳ (∵ price would fall by more than quantity would ↑)

- Measurement of e_p at a point on the demand curve:

  – LINEAR demand curve: $e_p = \text{(lower segment)}/\text{(upper segment)}$

  – NON-LINEAR demand curve: Draw a tangent to the dd curve at the relevant point; $e_p = \text{(lower segment)}/\text{(upper segment)}$ of the tangent:



$e_p = (BC/AB)$.

→ Cross-price elasticity of demand: In generalist parlance, we say that if cross-price elasticity of 2 goods is ~~positive~~ negative, then they are complements, and if +ve, they are substitutes (if A & B are substitutes, then as p_A ↑, q^d_A will ↓, and q^d_B will ↑).

HOWEVER, while we can be sure that +ve e_p^{cross} implies substitutes, we can't be sure that −ve e_p^{cross} implies that the goods are complements.

This is because the cross-price elasticity is based on the TOTAL PRICE EFFECT, without compensating for the change in income. To truly determine complementarity, we only need to consider the substitution effect (but this is empirically not possible).

→ INCOME ELASTICITY OF DEMAND:

- Goods having negative e_M are inferior goods.
- Goods with $e_M > 1$ are called 'luxuries' and $e_M < 1$, 'necessities'

- e_M in terms of expenditure:

$$e_M = \left(\frac{\Delta Q}{Q} \times \frac{M}{\Delta M}\right) = \left(\frac{\Delta Q \cdot P}{Q \cdot P} \times \frac{M}{\Delta M}\right) = \left(\frac{\overset{\text{expenditure}}{\Delta E}}{\Delta M} \times \frac{M}{E}\right)$$

- Show that when income elasticity of a good equals the reciprocal of proportion of consumer's income spent on a good, then the whole of the ↑ in a consumer's income will be spent on the ↑ in quantity purchased of that good.

Proof: Say, $K_x = (E/M)$ (proportion spent on E).
Now, $e_M = (M/E)(\Delta E/\Delta M)$. Assume that entire ↑ in M is spent on X. Then,

$$\Delta E = \Delta M \quad (\text{if } p_x \text{ is same})$$

$$\Rightarrow e_M = (M/E) = 1/(E/M) \Rightarrow \boxed{e_M = 1/K_x}$$

- e_M at a point on the Engel curve: If Engel curve when extended downward meets X-axis to the right of origin, then $\underbrace{e_M < 1}$, and v.v. (use tangents in case of non-linear Engel curve)

⇒ Commodity is a necessity.

- The sum of income elasticities for <u>all</u> goods in a consumer's consumption bundle (ceteris paribus) must be <u>one</u>.

→ <u>THE ELASTICITY OF SUBSTITUTION:</u> $e_S^{xy} = \dfrac{(\%\text{ change in amount of } X \text{ w.r.t } Y)}{(\%\text{ change in } MRS_{xy})}$

- Thus, e_S is a <u>relative measure of the substitution effect</u>. When it is difficult to substitute one good for another, small change in the proportion of the 2 goods will lead to a large change in the MRS, and vice-versa.

- For perfect complements, $e_S = 0$.
- Price elasticity (e_p), is in a way a 'compromise' between e_M and e_S:

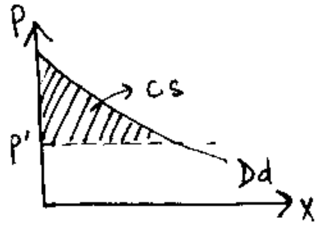
$$e_p = [K_x \cdot e_M + (1-K_x) \cdot e_S]$$, where K_x: proportion of the consumer's income spent on good X.

CHAPTER 15: CONSUMER SURPLUS

- Marshall's definition: Marshall worked with the assumption that utility was cardinally measurable; given that MU_M was assumed constant, the utility derived from a good could be measured as being equal to the amount of money spent.

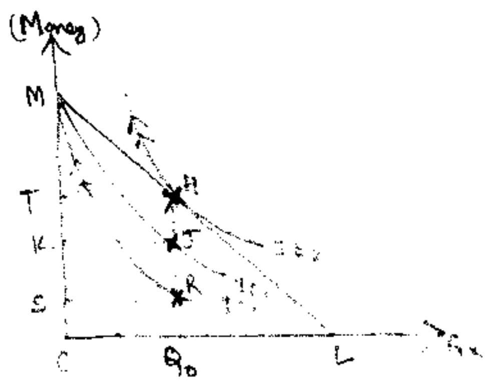
Consumer surplus, then, was simply the difference b/w the price that a consumer is willing to pay and what he actually pays.

$\Rightarrow$ CS = Σ MU − (Price × No. of units purchased)



However, given that this approach assumes constant MU_M, Hicks discredited it, and showed CS using ICs:

- CS using IC analysis:



Given budget line ML, consumer consumes at point 'H' (note that Y-axis is money), thus paying MT for Q_0 units of X.

Now, consider IC_1, that passes through M. For consuming quantity Q_0, we can see that the consumer would be willing to pay upto MK. Thus, consumer surplus = TK (MK−MT).

- Note: Hicksian CS (TK) < Marshallian CS (TS) (IC_0 is 'Marshallian' assumes constant MU_M & IC_0 is 'vertically parallel' to IC_2).

Hicksian IC (IC_i), on the other hand, assumes diminishing MUM.

(See four Hicksian concepts of CS later, if you have the time).

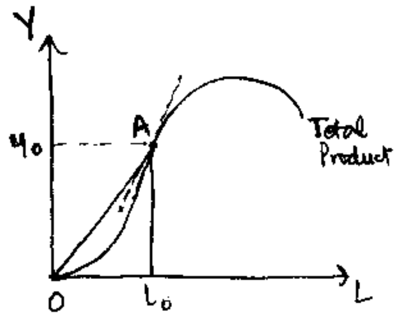
CHAPTER 18 : THEORY OF PRODUCTION – RETURNS TO A VARIABLE FACTOR

- Supply of a product depends upon its cost of production, which in turn depends on:
  - Production function
  - Cost of the factors of production

- Short Run: Atleast one factor of production is fixed; production can only be ↑ by ↑ employment of the variable factor, which is definitely subject to diminishing returns ('law of variable proportions')

  Long Run: All factors flexible; diminishing returns (overall) need not apply. (because of possible substitutability of factors).

- AP_L & MP_L:



AP_L = slope of line connecting point to origin

MP_L = slope of tangent at point

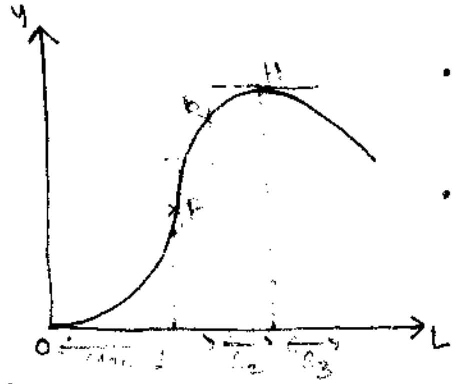
Output elasticity of input, $E_L = (\%\Delta Q / \%\Delta L)$

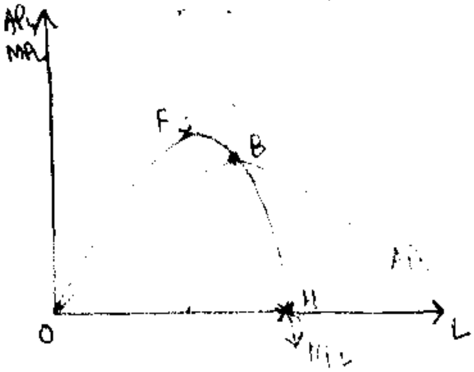
$\Rightarrow E_L = \left(\frac{\Delta Q}{Q}\right) \times \left(\frac{L}{\Delta L}\right) \Rightarrow \boxed{E_L = \frac{MP_L}{AP_L}}$

$\Rightarrow$ Diminishing returns will apply when $\boxed{E_L < 1}$. ($\Rightarrow$ when $MP_L < AP_L$)

E_L can be variable along the PF, ofcourse.

- THE 3 STAGES OF PRODUCTION: ASSUMING ONE FIXED FACTOR, when production starts, the variable factor will be in such abundance relative to the fixed factor that if some of the fixed factor is removed, the MP of the variable factor can ↑. In this first stage, MP_L (L being variable factor) is thus ↑.





- Stage 1: (↑ returns) → Till F, MP_L ↑ ; $MP_{fixed factor}$ is −ve ⇒ uneconomical
- Stage 2: (↓ returns): (MP_L ↓, but > 0)
  ⇒ TP ↑, but at a ↓ rate
- Stage 3: Too much labour relative to fixed factor; $MP_L < 0$ ⇒ TP ↓

Thus, any rational producer will produce only in STAGE 2, where:

(i) $MP_{fixed factor} > 0$

(ii) $MP_{variable factor} > 0$, but MP_{VF} ↓

THUS, IN CASE OF ATLEAST ONE FIXED FACTOR, production will only take place in the 'economic region of production' (Stage 2), where MP_L & AP_L are both falling. (Within this region, the actual point of production will be determined by the cost of factors).

⊙ The importance of assuming that factors are indivisible, and imperfect substitutes to each other:

- If the fixed factor were perfectly divisible, it could be employed in a quantity appropriate to ensure that MP_L is not ↑ in Stage 1
- If the variable factor were perfectly divisible, too, MP_L ↓ would not apply either, & law of Variable proportions wouldn't hold.
- In sum, diminishing returns to the variable factor apply because the factors are not perfect substitutes for each other.

CHAPTER 19 PRODUCTION FUNCTION WITH TWO VARIABLE INPUTS

- Isoquants: 'Bundles' of L & K that can be used to produce a given level of product ('Production Indifference Curves')

- MRTS: No. of units of capital which can be replaced by one unit of Labour to keep the level of output unchanged.

$$\boxed{MRTS_{L,K} = MP_L / MP_K}$$ Proof:

Euler's Theorem states that if each factor is paid its MP, then the total product will be 'exhausted'; i.e.,

$$Q = (MP_L \cdot L + MP_K \cdot K) \Rightarrow \Delta Q = \Delta L \cdot MP_L + \Delta K \cdot MP_K$$

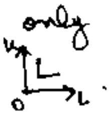
On the same isoquant, $\Delta Q = 0$

$$\Rightarrow \Delta L\, MP_L = -\Delta K\, MP_K \Rightarrow \left(\Delta K / \Delta L\right) = -\left(MP_L / MP_K\right)$$

or $|MRTS_{L,K}| = MP_L / MP_K$ (proved)

(Isoquants are convex to the origin - represent diminishing $MRTS_{L,K}$).
(This generally holds because factors are imperfect substitutes for each other - along an isoquant, it becomes progressively harder to substitute one factor for another).

- 'Fixed and Variable Proportion Production functions': Convex & smooth Isoquants represent variable proportion PFs; for perfectly complementary factors (that can only be used in strictly fixed proportions, isoquants ~~for~~ would look like:



- COBB-DOUGLAS PF: $Y = AL^{\alpha} K^{\beta}$ Popular because:
- Can easily incorporate fixed, ↑, or ↓ returns to scale
- Can be easily extend to incorporate multiple factors ($Y = AL^{\alpha} K^{\beta} H^{\gamma} N^{\theta}$ etc.)
- Easy to empirically estimate; just take logs!
  ($\log Y = \log A + \alpha \log L + \beta \log K$)

- In Cobb-Douglas P.F., elasticity of substitution of factors is 1:
  $$eos = (\%\text{ change in } K/L) / (\%\text{ change in } MRS_{LK})$$

$$\Rightarrow eos\ (\sigma) = \partial(K/L)/(K/L) \Big/ \partial(\alpha/\beta \cdot K/L)/(\alpha/\beta \cdot K/L)$$ { Notice subscripts above: % chg in K/L, MRS_{LK}. }

$$= \frac{\cancel{\partial(K/L)}}{\cancel{(K/L)}} \times \frac{\alpha/\beta\ \cancel{(K/L)}}{\alpha/\beta \cdot \partial(K/L)} = 1$$

$$\Rightarrow \boxed{eos_{Cobb-D} = 1}$$

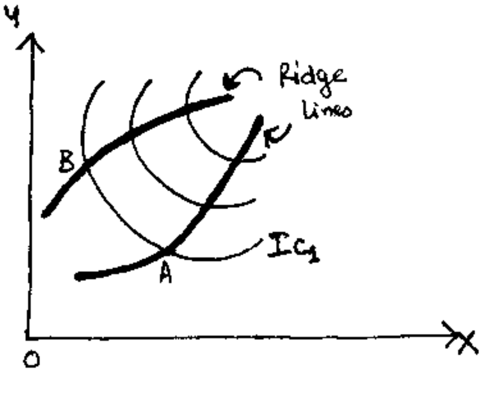
Geometrically, $\because$ $eos = \dfrac{(\text{Proportionate change in factor-proportions})}{(\text{Proportionate change in } MRTS_{LK})}$

$= \dfrac{(\text{Prop. change in slope of 2 rays to 2 points})}{(\text{Prop. " " " " tangents drawn to isoquants at these 2 points})}$.

- In equilibrium, $MRTS_{LK} = (w/r)$; $\therefore$,
  $$eos = \frac{\Delta(K/L)/(K/L)}{\Delta(w/r)/(w/r)}$$
  } Relationship b/w eos and factor prices

- NOTE: eos measures the curvature of an isoquant - how 'easy' is it to substitute one factor for the other.

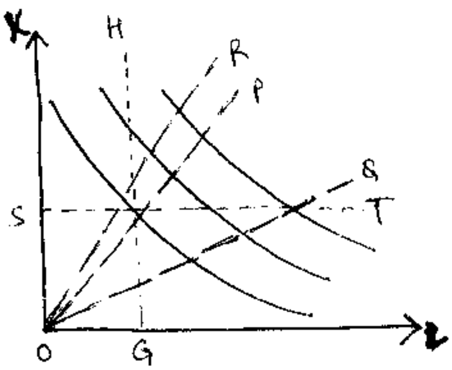
- **ECONOMIC REGION OF PRODUCTION AND 'RIDGE LINES':**



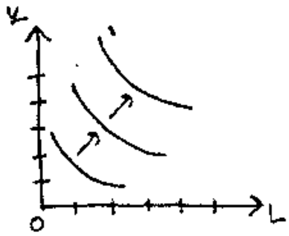
Given that the factors of production are imperfect substitutes, after a while, the marginal product of one of the factors turns negative (keeping other factor fixed). After this point, both factors will need to be ↑ to keep production at the same level. Given that the same level of output can potentially be produced at a lesser cost (by using a more optimal combination that requires lesser quantities of both goods), it makes no sense to produce in the regions beyond the RIDGE LINES, which mark the extremities of the ICs such that MRTS b/w the factors is negative.

Thus, economic region of production is given by the range of ICs where MRTS is negative.

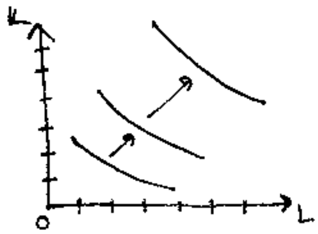
- **RETURNS TO SCALE**: It is important to differentiate between 'proportion' and 'scale'. An ↑ in scale means that all inputs or factors used in a production process are ↑ in the same proportion.



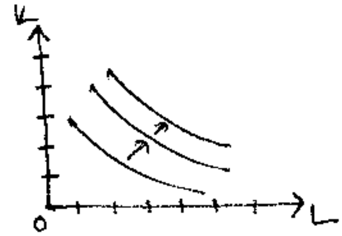
Along the lines ST and HG, the quantity of one factor is fixed (K in ST, L in HG), while that of the other changes ⇒ changing factor proportions. Along lines OR, OP, OQ etc., proportions remain fixed; scale changes.



Constant Returns



Decreasing Returns



Increasing Returns
(lesser ↑ in scale
required to ↑ production)

• Relationship between returns to scale and marginal productivity of a single factor (keeping the other factor fixed):

– Constant Returns to Scale: $MP_{var.fac.}$ will ↓ as more of the var. fac used

– Decreasing Returns to scale: MP_{VF} will ↓ rapidly

– Increasing Returns: MP_{VF} will still ↓, unless in the unlikely event that ↑ returns to scale are so strong that they offset the law of variable proportions.

• Examples of constant RS PFs with different eos's:

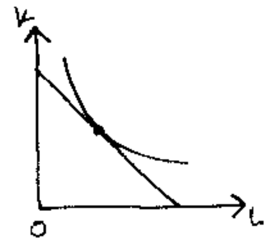
(1) eos = ∞ ⇒ % change in MRS = 0 ⇒ Constant MRS ⇒ ($Y = aK + bL$)
linear production function
⇒ perfectly substitutable L & K.

(2) eos = 0 ⇒ % change in (K/L) = 0 ⇒ fixed-proportions PF ⇒ ($Y = \min(aK, bL)$).

(3) ~~eos = (constant)~~ eos = 1 ⇒ $Y = (AK^{\alpha}L^{\beta})$ (Cobb-Douglas)

CHAPTER 20 OPTIMUM FACTOR COMBINATION

So far, we've seen that different combinations of factors can be used to produce a given level of output. To determine which one of these many bundles will be chosen, we introduce the 'ISOCOST LINE' to our analysis:

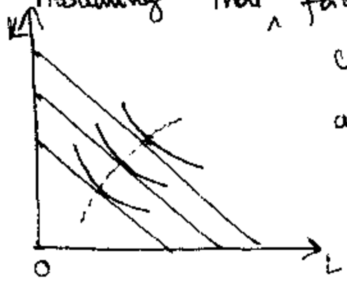


→ Assuming factor prices are given (w and r),

- Entrepreneur can decide that he wants to produce a level of output, then minimize costs (i.e., fix an Isoquant, then choose tangential isocost line)
- Alternatively, in case there's a budget constraint, he can fix the isocost line (= budget constraint) and choose the highest isoquant possible.

In either case, equilibrium condition: $\cancel{MRTS_{K,L}}\ MRTS_{L,K} = \cancel{MRS}\ \boxed{\dfrac{MP_L}{MP_K} = \left(\dfrac{w}{r}\right)}$

- EXPANSION PATH: [Also known as the 'SCALE LINE']



Assuming that relative factor prices remain the same (or atleast ($^w/_r$) doesn't change → proportion of factor prices doesn't change), and that money is not a constraint, the expansion path shows the locus of the points along which a producer will expand output (i.e., the locus of the points of tangency b/w isoquants and isocost lines).

- Effects of changes in factor prices can be studied via the usual substitution and $\underbrace{\text{income effect}}_{\text{called the 'output effect' here}}$ breakdown.

• Complementary factors: When a fall in the price of one of the 2 factors causes an ↑ in quantity purchased of both factors, they are said to be complementary.

2 factors X and Y are substitutes if the substitution effect on Y of the change in price of X is greater than the output effect (DRAW these)

• EXPANSION PATH OF THE LINEAR HOMOGENEOUS PRODUCTION FUNCTION:
linear homogeneous P.F. = P.F. w/ constant returns to scale.
In case of such P.F.s, expansion path is always a straight line through the origin. (Prove using Cobb-Douglas P.F.)

CHAPTER 21: COST ANALYSIS

- Cost function: Given the factor prices and the state of technology, and assuming that the firm uses the least-cost combinations of inputs to produce a given level of output, the cost function determines the cost incurred by a firm in producing a given level of output.

- Difference b/w Technological and Economic efficiency:
  - Tech. efficiency means using a given set of inputs to determine the maximum possible output using those inputs. All isoquants thus capture technically efficient bundles
  - Economic efficiency means: either minimizing cost for a given level of output, or maximizing output for a given level of cost.

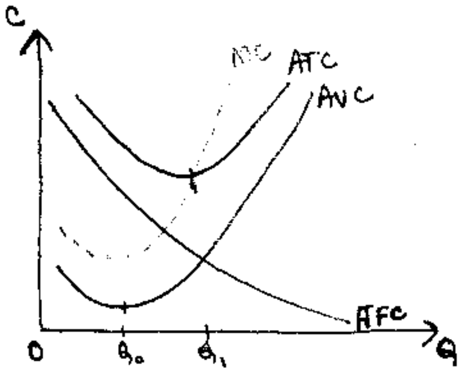
- Types of costs:
  - Opportunity costs
  - Accounting costs
  - Economic costs (= Accounting costs + Implicit costs (like return on capital, entrepreneur's personal profit etc.))

- Short & long Run cost functions:
  - SRCF: Some factors are fixed (inelastic supply of some factors)
  - LRCF: All factors are variable (elastic supply of all factors)

- Short Run analysis: Costs can be split up into:
  - Fixed costs
  - Variable costs

• Remember: – $AVC = (W/AP_L)$

– $MC = (W/MP_L)$.



– ∵ TFC is fixed regardless of quantity, AFC ($= TFC/Q$) will smoothly ↓ as Q↑

– Given that

$AVC = (TVC/Q) = (L \cdot W/Q) = w(L/Q)$

$\Rightarrow \boxed{AVC = W/AP_L}$

(i.e., AVC is inversely related to Avg. Product of variable factor), and ∵ AP_L will initially ↑ and then ↓ (due to law of variable proportions), AVC will initially ↓ and then ↑.

– ∵ $ATC = (AFC + AVC)$, ATC will also be 'U'-shaped, but the 'turning' point will be reached at a quantity beyond the turning point of AVC (compare points Q_0 and Q_1)

– MARGINAL COST: $MC_n = (TC_n - TC_{n-1})$ or $MC = \Delta TC/\Delta Q$

$\Rightarrow MC = (\cancel{\Delta TFC}^{0} + \Delta TVC)/\Delta Q \Rightarrow MC = (\Delta TVC/\Delta Q)$

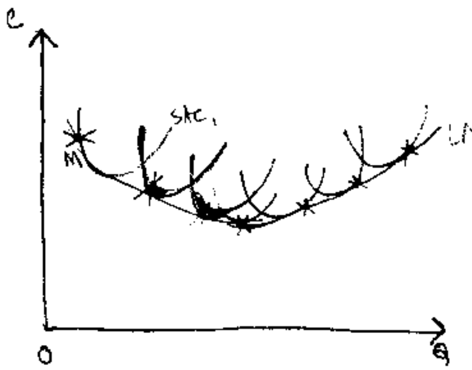
$\Rightarrow MC = (W \cdot \Delta L/\Delta Q) \Rightarrow \boxed{MC = W/MP_L}$

⇒ MC is also U-shaped.

Note that MC will be below the ATC (AC) curve when AC curve is falling, and above the AC curve when it is rising. MC curve will thus 'cut' the AC curve from below at the lowest point of AC curve.

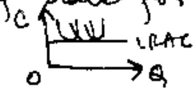
⇒ [[MC is equal to AC at AC's minimum point]]

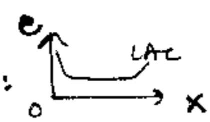
• <u>Long-Run Costs:</u> The LRAC represents only a PLANNING HORIZON; however, remember that <u>all</u> production is done in the short-run during which the size of the plant is fixed.



In the LR, the firm has the option of varying the plant size ∴ an ∞ number of short-run curves are possible, LRAC curve is nothing but the locus of all the tangency points of LRAC w/ various SRACs.

<u>**NOTE:**</u> LRAC is <u>NOT</u> tangent to the minimum points of SRACs. When LRAC is falling, it is tangent to the falling part of the SRACs, and vice-versa. (See P. 505 - I <u>finally</u> get it!) {output larger than, say, point M on SAC1 can be produced more cheaply on a ~~larger~~ ~~SAC~~ different SAC curve in the LR).

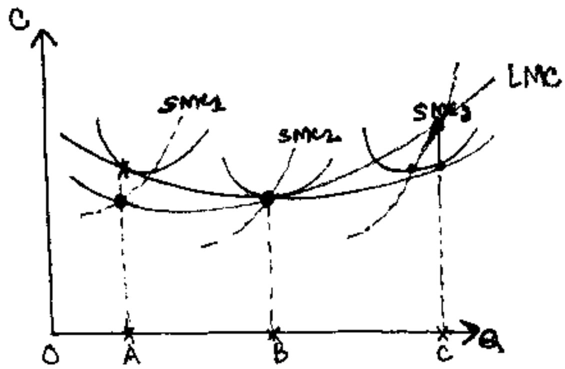
• LRAC in case of <u>constant returns to scale</u>/ linear homogeneous Producⁿ function: With CRS, given the prices of inputs, <u>average</u> cost per unit of output remains the same (there are no ~~di~~ economies or diseconomies of scale for any range of output). Thus, LRAC is a <u>straight</u> line:  (SRACs are still U-shaped).

<u>Empirically</u>, many studies have found a **saucer-shaped** LAC: 

This implies that economies of scale are exhausted at a very modest scale of operation, and then for a relatively large further expansion in output, diseconomies do not occur. That happens only after a <u>very large</u> ↑ in output.

* **MINIMUM EFFICIENT SCALE**: This is the level of output at which the long-run Average Cost is minimum. A.k.a. the '<u>optimum size</u>' of the <u>firm</u>. (Note that there's a <u>unique</u> SAC that this corresponds to).

* <u>LMC curve</u>:



As can be seen, the LMC curve is <u>flatter</u> than the SMC curves. (Pay attention to <u>how</u> it is derived from SMCs). THUS, <u>EVERY</u> POINT OF THE LRMC CORRESPONDS TO <u>SOME</u> POINT ON AN <u>SRMC</u>.

* Long-Run cost curve can be easily derived from the 'Expansion Path'. (How? See P. 515)

* <u>NOTE</u>: 'Internal' and 'External' economies of scale are very different. (How? Think). External economies are not determined by the actions of an individual firm. They apply to the industry as a whole; as the <u>industry</u> expands its production. Some important causes:
  - Cheaper materials and capital equipment
  - Technological external economies
  - Development of skilled labour
  - Growth of subsidiary and correlated industries
  - Improved transportation and marketing facilities

* LRAC curve can theoretically also smoothly decline (will imply consistent economies of scale). This can potentially be the result of:
— Production / Technical economies
— 'Learning by Doing' hypothesis of Arrow

* A quadratic cost function is generally used when we want to work with U-shaped cost curves. eg: ($TC = a + bQ + cQ^2 + dQ^3$)

* Mathematical derivation of ~~LRAC~~ long-Run cost function:
'Cost function' is the relationship b/w C & Q, such that factors are chosen to ensure that the given Q is produced at minimum C (or equivalently, the given C is used to produce maximum Q).

Now, $C = (L \cdot w + K \cdot r)$ // ALWAYS.
and $Q = A L^{\alpha} K^{\beta}$ (say).
Problem is to express C in terms of Q.

We know that in optimum situation, $MRTS_{L,K} = (w/r)$
$\Rightarrow \left(\frac{MP_L}{MP_K} = \frac{w}{r} \right)$ — this will give us a rel^n b/w factors & their prices
– These can then be substituted into the production func^n to obtain L & K as functions of Q.
– Then substitute these into C, to get C as a function of Q.

CHAPTER 24 : MARKET STRUCTURES AND CONCEPTS OF REVENUE FOR A FIRM ~~SUPPLY AND ITS ELASTICITY~~

Classification of market structures is usually done on 3 factors:

(i) Number of firms producing a product in the market

(ii) Nature of products produced by firms (homogeneous/differentiated)

(iii) Ease of entry and exit of firms from the market

(Additional factors: (iv) Price elasticity of demand for an individual firm
(v) Degree of control over price).

- <u>Relationship b/w TR, AR, and MR curves:</u>

- $TR = \Sigma MR_i$ (NOTE)
  - TR ↑ when MR is positive ; is maximized when $MR = 0$
- When $MR > AR$, AR ↑, & vice-versa

- <u>e_p, TR, and MR:</u>

When demand is unitary elastic ($e_p = 1$), a given % fall in price (P) is offset by an equal % ↑ in the quantity demanded, and thus the TR remains unchanged. If $e_p > 1$, TR↑ when P↓ (and v.v.)

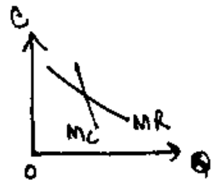
(<u>Corollary</u>: for a linear demand curve, MR is +ve in the range of the demand curve above the mid-point, where $|e_p| > 1$ and MR is -ve below the mid-point where $|e_p| < 1$

$\boxed{\text{CHAPTER 25}}$: THE FIRM - A GENERAL ANALYSIS

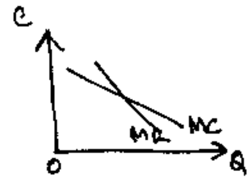
For a firm in <u>any</u> market structure (doesn't matter if its Perfect Competition, Monopoly etc.), the profit-maximization conditions <u>always</u> remain the same:

(a) MR = MC (for Perfect Competition, P = MC) ($\because$ P = MR).

(b) ($\partial^2\pi/\partial q^2 < 0$) (ensures that MC 'cuts' MR from below at point of equilibrium).



: (No equilibrium exists)



: (Equilibrium exists)

$\boxed{\text{CHAPTER 26}}$: PRICING IN COMPETITIVE MARKETS - (Dd-Ss Analysis)

So far, we've seen how demand and supply decisions of consumers and producers (respectively) are determined. In all of this analysis, we've assumed that <u>individual</u> consumers take prices as given (and consume to ensure MRS = Price ratio); similarly, individual firms <u>also</u> take prices as given, and equate MRTS w/ price ratio.

These prices are, in turn, determined by the intersection of the <u>market</u> supply and demand curves for various products.

- MARSHALLIAN price determination is based on the assumption of 'ceteris paribus'; it is assumed that changes in the market for a single good do not significantly affect the rest of the industries.

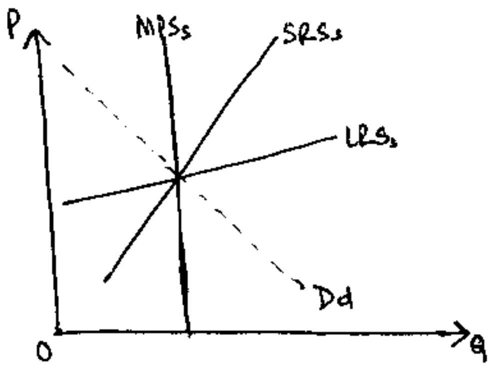
WALRASIAN general equilibrium approach explains, on the other hand, the simultaneous determination of prices of <u>all</u> goods and factors.

- MARSHALL believes that any disequilibrium in the market for a good is corrected by ~~the~~ 'quantity adjustments.' WALRAS says 'price adjustments' are responsible to restore equilibrium. The jury is still out on this question.

- Note that demand and supply by themselves are not the 'ultimate' explanations of price – they themselves are determined by numerous factors, and in the final analysis, we can only say that these factors that affect demand and supply ultimately affect market price.

- MARSHALL'S THEORY OF VALUE : TIME-PERIOD ANALYSIS

Marshall made a distinction b/w short and long-run, based on possible supply responses in a particular timeframe. Supply curve is near-inelastic in the "Market Period", somewhat more elastic in SR, and most elastic in the LR:



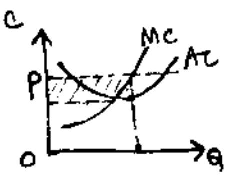
This time-analysis also helped Marshall answer the question of what determines price – supply, or demand? According to Marshall, the shorter the time period, the higher the role of demand, and vice-versa. ||✓

CHAPTER 2B – Equilibrium of the Firm and Industry under Perfect Competition

Conditions in a perfectly competitive market:

i) large number of firms and buyers
ii) Product of all firms is homogeneous
iii) Free entry & exit for all firms
iv) Buyers and sellers all have perfect information about prevailing market prices.

• Demand curve facing an individual firm is perfectly elastic; demand curve facing the industry is downward sloping.

• SR equilibrium:  (Economic Profits are possible)

eqlb: MR = MC

⇒ $\boxed{P = MC}$

• LR equilibrium: Free entry of firms ⇒ industry supply ↑, price ↓ till no economic profits possible. Condition:

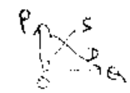
$\boxed{P = MC = AC}$

• In the SR, the firm will continue producing even if it is making losses, as long as the market price is enough to cover the firm's variable costs. Thus, in the Short-Run, ONLY THE PART OF THE MC CURVE WHICH LIES ABOVE THE AVG. VARIABLE COST FORMS THE SHORT-RUN SUPPLY CURVE OF THE FIRM.

• NOTE: The SR supply curve of the PC industry is ~~thus~~ obtained by the lateral summation of SR supply curves of all individual firms (ASSUMING that in the SR, the simultaneous expansion of output by

all the firms in it (i.e. expansion of industry output) will have <u>no</u> effect on factor prices of inputs ; i.e., assuming that for the industry as a whole, these resources/inputs are perfectly elastic in the SR.)
↳ This means costs don't change
⇒ Cost curves (AC, MC) don't move <u>around</u>.

- LR <u>INDUSTRY</u> equilibrium conditions:

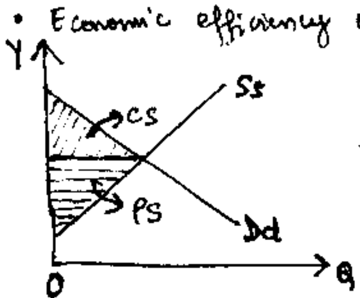


i) LR Ss & Dd for products should be in equilibrium
ii) for <u>each</u> firm, P = LMC = LAC (min LAC)
iii) There is no tendency towards entry or exit. (∵ no firm is making profits).

- <u>NOTE</u>: <u>ALL</u> of the above analysis is based on the assumption that <u>all</u> firms have identical cost structure. In case firms have differential cost structures, in the SR, there can be firms making losses, profits, or just breaking even. In the LR, however, no firm making losses will stay in the market. Thus, equilibrium conditions:
  - P = MC for <u>all</u> firms
  - P = AC of the <u>marginal</u> firm.

(Thus, some firms (with lower cost structures) will make economic profits over and above their 'transfer earnings' (∵ these are incorporated within the cost curve) ; these extra economic profits are called 'RENTS'). → But I think this goes against the Perfect Competition assumption that all firms are <u>identical</u>.

- Economic efficiency of PC markets: PC markets result in <u>allocative efficiency</u>, i.e., they enable use of resources for production of goods that ensures maximum welfare benefits to people in a society.



From the society's viewpoint,

Total welfare = (Consumer Surplus + Producer Surplus)

This is maximized under the quantity determined by perfect competition.

CHAPTER 29 LONG-RUN SUPPLY CURVE OF THE COMPETITIVE INDUSTRY

Unlike in the short-run case, the LR supply curve of an industry cannot be obtained by horizontal summation of individual firms' supply curves. This is because for a competitive firm under long-run equilibrium, there is a unique level of output and price, where

$P = LMC = \min.(LAC)$. (The ($= \min.(LAC)$) condition ensures that the firm stays in the industry in the LR only if it is making zero economic profits).

Now, long-run relationship b/w Q and P for the industry supply will depend on what happens to the cost-curves of firms in the industry as more & more output is demanded. If there are decreasing returns to scale (↑ costs), LRS curve will be upward sloping. For CRS, horizontal, and for ↑ returns to scale LRS curve will slope downward!

↳ Remember, in the short-run case, we assumed that cost structure of the firm was fixed.

(Reasons) why lateral summation of individual firms' supply curves cannot be done to obtain industry LRS curve: (V) Imp.

(i) For individual firms, the LRS curve is only a single point (NOT the entire LMC curve for that firm)

(ii) No. of firms in LR vary at different prices / different demand conditions

(iii) In the LR, w/ the expansion of the industry, cost curves of the firms shift due to external economies or diseconomies of scale.

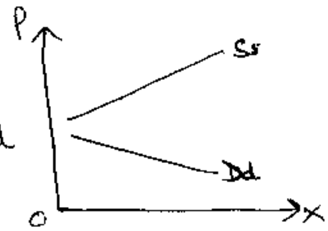
• Show that under Perfect competition, the whole burden of a rise in costs caused by a rise in price of inputs has to be borne by the consumers in terms of higher price of the product that they have to pay.

- 4 characteristics of Perfectly Competitive Markets
- Difference b/w demand curve faced by industry and by a single firm (slope)
- SR supply curve of a firm under PC (& for industry)
- 3 'conditions' for long-run equilibrium in PC?
- Case where firms don't have the same cost structure?
- In what sense are PC markets 'efficient'?
- Difference b/w long & short run industry supply curves under Perfect Competition, and 4 reasons why these differences arise.

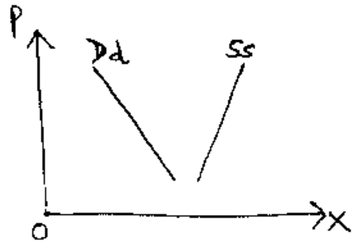
CHAPTER 30 | EXISTENCE AND STABILITY OF EQUILIBRIUM UNDER PERFECT COMPETITION

* <u>EXISTENCE OF EQUILIBRIUM:</u> There might be cases where demand and supply curves do not ~~exist~~ intersect for any <u>positive</u> price-output combination. 2 particular cases.

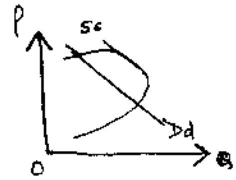
(a) Goods that are so expensive to produce that supply curve is everywhere above the demand curve; such goods are not produced at all, and thus the equilibrium doesn't exist.

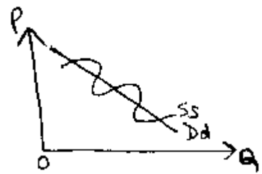


(b) Free goods: Goods such as air are present in such large quantities that the marginal cost of supplying them is either zero, or in any case, extremely small. No intersection of Dd & Ss curves, thus no equilibrium



* <u>MULTIPLE EQUILIBRIA:</u>

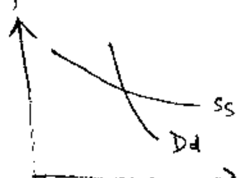




In cases such as backward-bending supply curve of labour, there might not exist a <u>unique</u> equilibrium.

* <u>STABILITY OF EQUILIBRIUM:</u> Equilibrium is said to be stable if following a disturbance from the equilibrium situation, market forces are such that the automatic tendency is for the system to revert back to the equilibrium point.

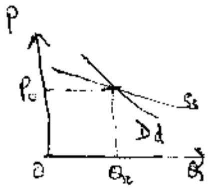
- At higher than equilibrium prices, if (S > D), & v.v., then equilibrium is stable; else unstable (Excess dd < 0 at 'high' prices; Ed > 0 at low).



(Unstable)

- <u>Walrasian</u> Price adjustment
- <u>Marshallian</u>: Quantity adjustment
  ↳ stable equilibrium <u>even if</u> $E_d < 0$ when $(P > P^*)$

(*) <u>SHOW</u> (V. Imp) the difference b/w Walrasian and Marshallian approaches to equilibrium determination. In the figure alongside, which of the 2 approaches, if either, leads to a <u>stable</u> equilibrium?



(*) <u>REVISE</u> COBWEB MODEL FROM BOOK:

- Main assumption: $S_t = P_{t-1}$; $D_t = P_t$
- With this, equilibrium is stable <u>if</u> |slope of supply curve| > |supply of demand curve| (⇒ supply curve is <u>steeper</u> than demand curve
- Examine the cases for 'dampened oscillations', 'perpetual oscillations', and 'explosive oscillations' (2 DIAGRAMS FOR <u>EACH</u> CASE).

- What is the policy significance of the entire analysis of stability of equilibrium under PC? (P. 702)

CHAPTER 31 INCOMPATIBILITY OF EQUILIBRIUM W/ PERFECT COMPETITION

Perfect competition theory assumes:

- Price of the product is given for the firm; the firms, individually, are "price takers"
- Prices of the factors (inputs) are given for the firm, and remain constant and unchanged when the firm expands its level of output

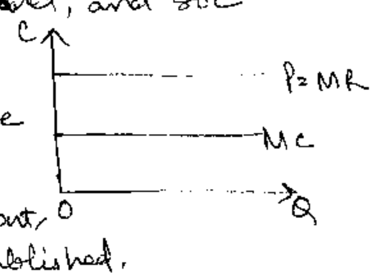
In the LONG RUN, in addition, it is assumed that all factors are freely flexible (unlimited supply). (I think this because perfect competition is also assumed to exist in factor markets). (In the SR, some factors are fixed & SMC can be rising and equilibrium is possible).

Thus, under all the above assumptions, for a given firm in the LONG RUN, ~~costs~~ unit (marginal) costs of production cannot rise.

This is KALDOR's analysis – given the assumptions of PC, in LR, there's no way MC curve could be rising. Thus, the SOC for PC equilibrium will never be satisfied & equilibrium doesn't exist under PC. (Note that eq. exists in Short Run, a/c to Kaldor).

Criticism of Kaldor's view: As output ↑, ~~production~~ managerial inefficiencies will ↑, supervision costs will ↑, and ∴ diseconomies of scale will set in, MC will ~~fall~~ start rising, & ∴ equilibrium will exist.

SRAFFA (argued along similar lines, saying that unit costs cannot be rising in LR equilibrium.) and said that under assumptions of PC, rising MC will not react, and SOC will never be satisfied. Under constant-cost conditions, P(= MR) will everywhere have to be (> MC), if the firm is to exist in the LR (think why). Thus, firm will keep expanding output, until PC breaks down and monopoly is established.



(*) <u>SEE</u> Ahuja's conspiracy theory on how decreasing long-run costs <u>ARE</u> compatible with PC equilibrium.

CHAPTER 32 : MONOPOLY

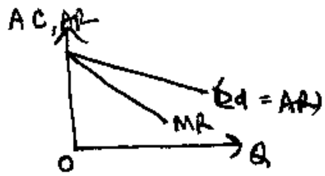
- 3 characteristics of monopolistic markets:
  - Single producer / seller
  - No close substitutes for the product (cross-elasticity is very small) (zero)
  - Strong barriers to entry of new firms

- Reasons for existence of monopolies:
  - Patents / copyrights
  - Control of essential raw materials
  - Advertising and brand loyalties
  - Economies of scale / Natural Monopoly: Exists when there are strong ↑ Returns to scale (⇒ ↓ avg. costs). In such cases, if more than one firm produces, each will produce at an inefficient scale, producing at a higher than min. per unit cost.

- In monopoly, demand curve for the monopolist-producer is downward sloping.

$$MR = P\left(1 - \frac{1}{|e|}\right)$$

$\because \left(1 - \frac{1}{|e|}\right) < 1 \;\forall e, \quad \therefore \boxed{MR < P}$



$\because$ in equilibrium, $MR = MC$, $\therefore$ for a monopolist, $\boxed{P > MC}$

(Corollaries: – Monopolist will never produce at a point of the demand curve where $|e| < 1$ (∴ lower half of linear dd curve)
– In case $MC = 0$ (no cost of production), then monopoly equilibrium is established at a level where $\boxed{|e| = 1}$

LONG-RUN EQUILIBRIUM UNDER MONOPOLY: As discussed in costs chapter, in the long run, plant size can be modified. A/cdingly, an 'LMC' curve can be derived from SMCs associated w/ successive plant sizes (remember, every point on the LMC is a point on some SMC). The LR eq. will be when:

(i) MR = LMC (= SMC for LR plant)

(ii) SAC = LAC (Remember, LAC is just hypothetical. This condition means that production will be at the level when SAC corresponds to plant being used then = lowest possible LAC).

(iii) P $\geq$ LAC (can't make losses in the Long Run).

COMPARISON OF MONOPOLY w/ P.C.:

P.C.	MONOPOLY
(i) P = MC	(i) P > MC
(ii) Equilibrium can **only** occur when MC is ↑ (constant costs or ↑ returns to scale ⇒ SOC not satisfied)	(ii) Equilibrium can occur when MC is ↑, ↓, or constant (in monopoly, **no** need of SOC!)
(iii) LR equilibrium occurs at the minimum point of the LAC curve	(iii) Equilibrium (LR) occurs at a point where AC is still falling & hasn't reached min. level (generally true)
(iv) Zero a/c profits in LR	(iv) LR supernormal profits are possible
(v) No price discrimination possible	(v) Price discrimination possible
(vi) (See >>)	(vi) Equilibrium price is higher, & output lower than under PC, (assuming **same** demand & cost conditions) (**SHOW**) P. 738