Preliminaries

Economics, Market, Demand – Supply in general

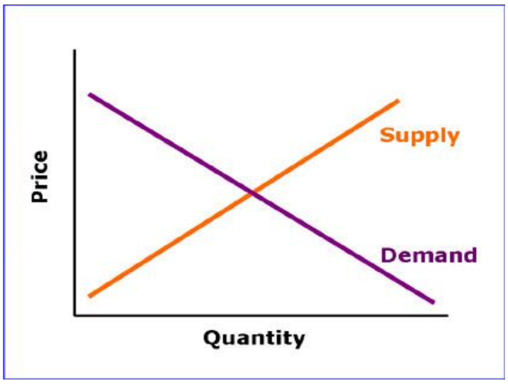
Trying to understand real-life economic situations using oversimplified models. Models use assumptions to avoid unnecessary work. In models, there are two types of variables; exogenous and endogenous.

Exogenous variable: variables determined by “out of model” factors
Endogenous variable: variables determined and discussed in the model

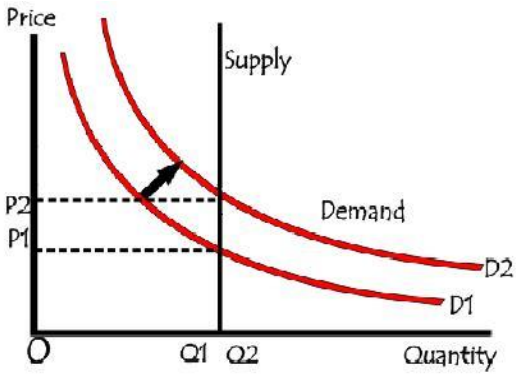
Human behavior in economy is investigated regarding two principles:

the optimization principle: people make the best consumption choices they can afford
the equilibrium principle: prices change until the amount demanded equals the amount supplied

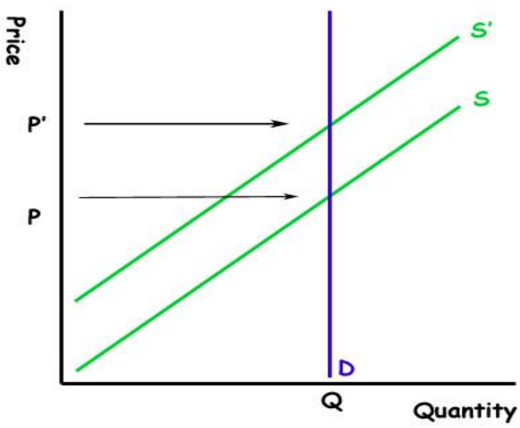
Supply And Demand Curves:



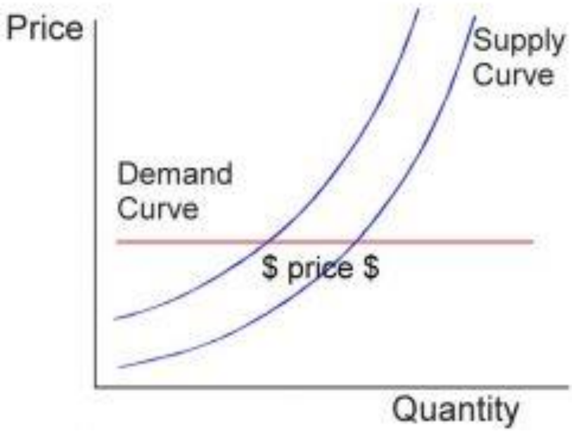
supply and demand



perfectly inelastic supply



perfectly inelastic demand



perfectly elastic demand

excess supply (surplus): if the current price is higher than the equilibrium price

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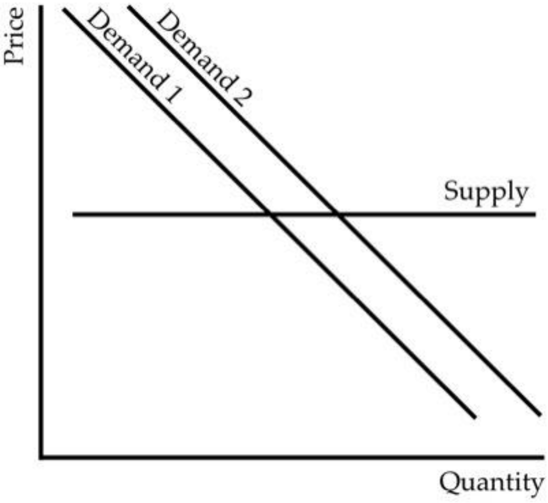
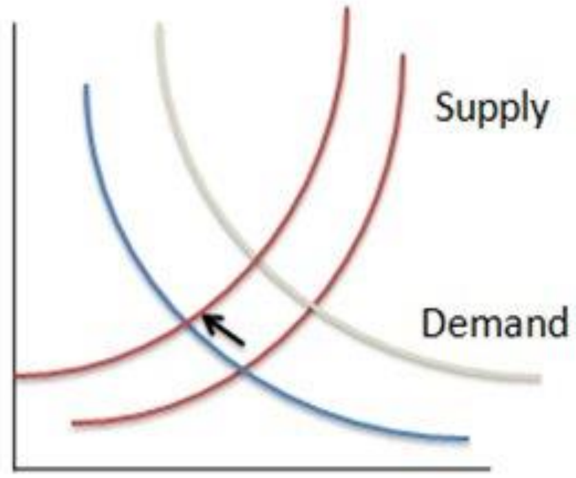
excess demand (shortage): if the current price is lower than the equilibrium price
perfectly inelastic supply: the producer will supply a certain amount, whatever the price is
perfectly inelastic demand: the buyer will demand a certain amount, whatever the price is
perfectly elastic supply: the producer will supply at a certain price and change the quantity supplied according to the quantity demanded at that price
perfectly elastic demand: the buyer will buy at a certain price and will consume the quantity supplied at that price



perfectly elastic supply



shifts in curves

given that supply is unchanged, an increase in demand will mean that the quantity demanded and the price will rise. a decrease in demand will mean that the price and the quantity will fall

given that demand is unchanged, an increase in supply will mean that the quantity demanded will rise and the price will fall. it is the opposite if the supply decreases

if both the supply and the demand in the market increases, the equilibrium quantity increases; if they both decrease, the equilibrium quantity will decrease. we can't say anything about the price in both situations

Pareto Efficiency: a situation in which, given the other members' states are constant, to make some people's as happy as possible. if there is a way to make some people better-off without making other worse-off, the situation we are in is “pareto inefficient”

Pareto Improvement: the way to make some people better-off without worsening-off the others

Long Run Equilibrium: the firms will adjust their ways to produce more, the consumers will adjust their ways to consume more and both the supply and the demand in the market will increase. so, the equilibrium quantity will increase. we can't say anything about the price without making the comparison between the changes in supply and demand.

Budget Constraint

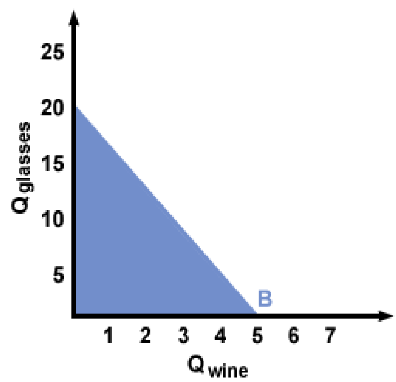
what people can afford given a certain amount of money, time, etc.

resources are scarce and we can't get whatever we want with them. there is a limit that restricts us from having whatever we want with the money we have and this limit is the budget constraint.

A typical budget constraint is represented by the formula: $p_1*x_1 + p_2*x_2 =< m$, where m is the income of the consumer and p's and x'es are the prices and the quantities of the goods respectively.

Opportunity sets: opportunity set of a consumer is the all combinations of the number of different goods he/she can afford.

Ex: if a consumer consumes only two goods (wine and glasses with prices, $p_w= 20$, $p_g= 5$) and has an income of 100 dollars, her budget constraint and opportunity set will be like in the graph. If she buys wine with all of her money, she will be able to buy 5 bottles of wine; if she buys glasses with all of her money, she will be able to buy 20 glasses; or make combinations of two good to be worth equal to 100 dollars. Of course, she does not have to spend all of her income. So, she can chose combinations in her opportunity set that are not on the budget constraint.

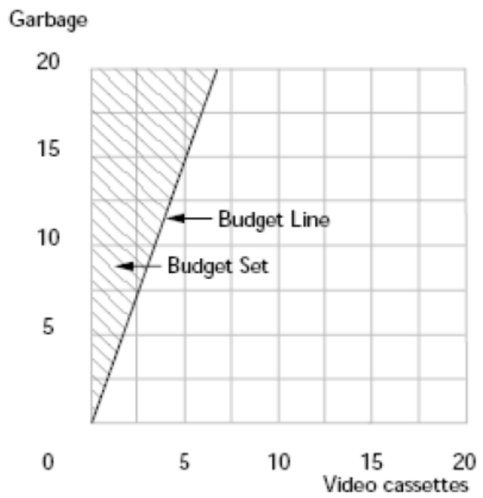


budget constraint

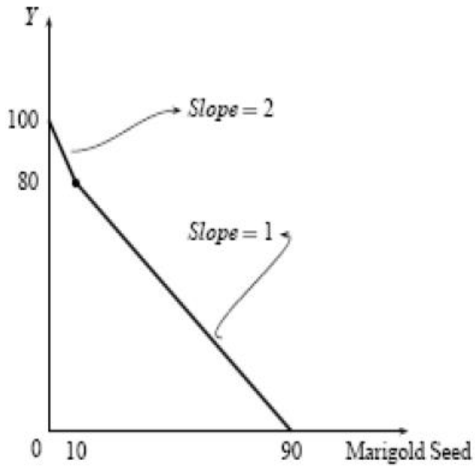
Remark: the points on budget constraints are included in opportunity sets.
If the limited resource is in terms of time, the line is called “time constraint” and tells us the amount of activities that an individual can do in a limited time.

The points that are in the op. set but are not on the budget (or time) constraint are considered inefficient. Because the consumer has some money (or time) left and can always increase her utility (happiness or use she gets from consuming the goods) by using the money (or time) left and buying some more goods (or doing some more activity).

Some examples of B. Constraints from the study questions:



one bad thing the consumer does to get money and one good he consumes(here, people give money for him to keep garbage)

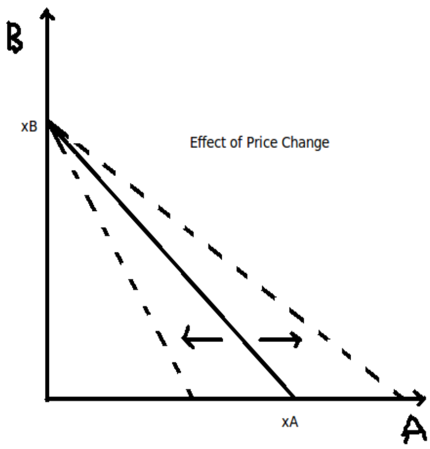


in this example, the price of M. seeds changes after consumer buys a certain amount, so the slope changes accordingly

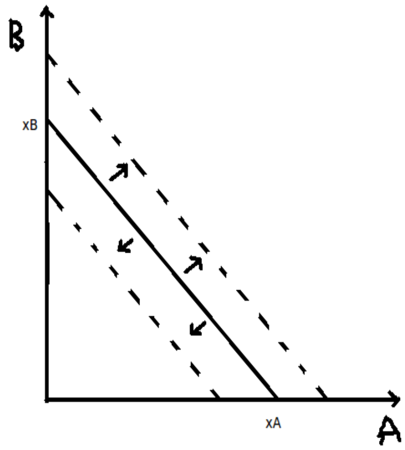
Budget Constraint: how it changes

Price change: If one of the goods' price increases, the consumer will buy less of that good and the budget line will move inwards from the axis representing that good. The intercept of the line on the other axis won't change. And if the price of one good decreases, the consumer will buy more of that good and that end of the budget line will move outwards similarly. On "the graph 1" below, we see the effect of a change of the price of good A.

Income Change: If the consumer's income increases, he will be able to buy more of both goods and the budget line will shift outwards. Similarly, if his income decreases, the line will shift inwards. On "the graph 2" below, we see the effect of an income change.



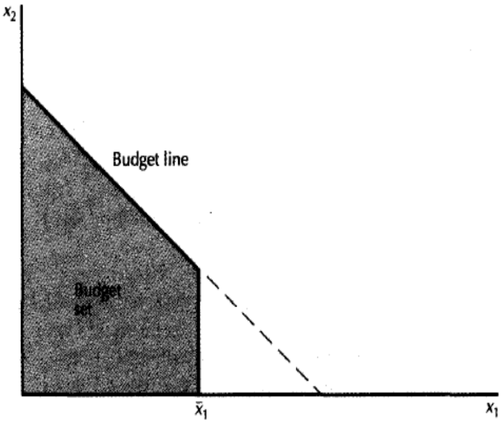
graph 1:effect of a price change



graph 2: effect of an income change

Tax – subsidy: if a quantity tax is applied on one of the goods, that good's price will increase by the amount of the tax per good consumed. So, the effect on the budget line is the same as an increase in price. In this case, the budget line gets steeper. Similarly, if a value tax (tax applied by some percentage of the good's price) is imposed on the good, again it will change the price from p, to (1+a/100)p, where a is the percentage of the tax. It will also act like a simple increase in price. Subsidy is an amount of money given to the consumer for every unit of good he consumes (quantity subsidy) or for a percentage of his consumption (value subsidy). Like taxes, subsidies are just changes on the price and will act accordingly; and the budget line will get flatter.

Rationing: governments can also put a limit to the consumption of some goods. This is called rationing and this limits the opportunity set with a line passing through the limited level of consumption of the rationed good and orthogonal to the axis that represents the rationed good. See the graph >>



effect of rationing on the opp. set

Numeraire price: in the budget line equation ($p_1*x_1 + p_2*x_2 = m$), if we set one of the prices equal to 1, that price is called the numeraire price. To set one price as a numeraire price, we should divide both sides of the equation with the actual price:

let us set the price of good 1 as the numeraire price, $(p_1*x_1 + p_2*x_2)/p_1 = m/p_1$ and,

$x_1 + x_2*(p_2/p_1) = m/p_1$

as we can see, when we set one of the prices to be 1, the other price will be the actual price of the other good divided by the actual price of the first good. Setting one price to be the numeraire price helps us know the price of the other good and the income of the consumer in terms of the selected good's actual price. The budget line doesn't change.

Preferences

Assumption: a consumer can rank two bundles of goods like (x_1,x_2) and (y_1,y_2) according to their desirability. And if the first bundle is "definitely" more desirable than the second for the customer, we call it (x_1,x_2) is strictly preferred to (y_1, y_2) and it is shown as: $(x_1, x_2) > (y_1, y_2)$. Preferences are about behavior. If the consumer always chooses the first bundle over the second, it is ok to say that she prefers it to the second one. But if she is just as satisfied with the other bundle. That means she is "indifferent" between those two bundles and it is shown like $(x_1,x_2) \sim (y_1,y_2)$. If the consumer prefers "OR" is indifferent, we say she weakly prefers bundle 1 to bundle 2 and show it like $(x_1,x_2) >= (y_1, y_2)$. If the consumer both weakly prefers bundle one to bundle two and bundle two to bundle one, then we can say that she is indifferent between them.
logically, [$(x_1,x_2) >= (y_1, y_2)$ and $(y_1,y_2) >= (x_1, x_2)$] implies, $(x_1,x_2) \sim (y_1, y_2)$

Assumptions about preferences: to understand consumer behavior, economists make some assumptions and they are called "axioms" of consumer theory. So, the preferences of a consumer are:

complete:

Bundles can be compared and they will either be like "the consumer weakly prefers b1 to b2 (or b2 to b1)" or like "the consumer is indifferent between the bundles" (remark: the notion "strictly prefers" is included in the notion "weakly prefers")

reflexive:

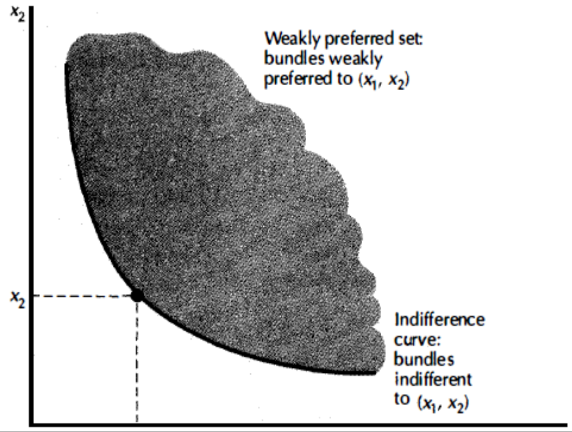
Any bundle is as good as itself. So, $(x_1,x_2) >= (x_1,x_2)$

transitive:

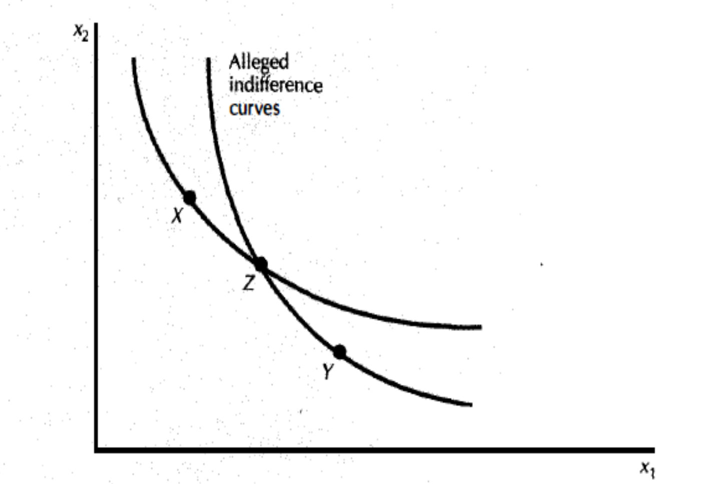
If $(x_1,x_2) >= (y_1,y_2)$ and $(y_1,y_2) >= (z_1,z_2)$, then $(x_1,x_2) >= (z_1,z_2)$

Indifference Curves

Graphical representation of preferences
If two bundles are on the same indifference curve, then the consumer is indifferent between them
If we shade in the area outwards the indifference curve, the say that the bundles in that area are weakly preferred to any bundle (x_1,x_2) on the indifference curve and the area where the weakly preferred bundles lie in is called "weakly preferred set". See the graph >>



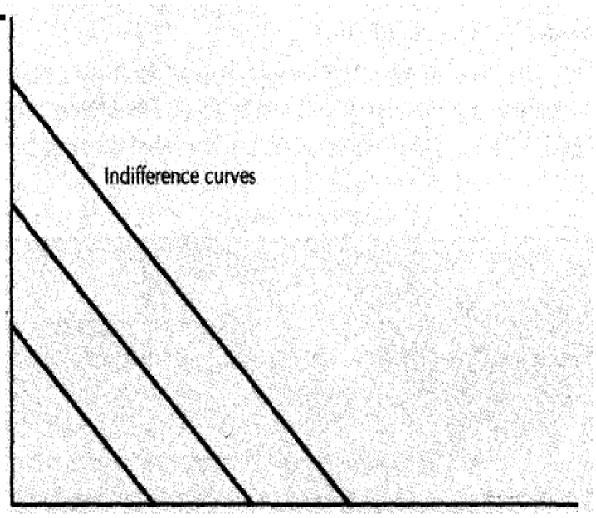
Indifference curves can change according to the goods consumed and the relations between two goods. We can determine how to draw indifference curves by changing the number of one of the goods consumed and trying to understand how the consumer will change the consumed number of the other good the be just as satisfied. Below are some significant examples of indifference curves for different relations of goods (between goods themselves and about how the consumer relates to them):



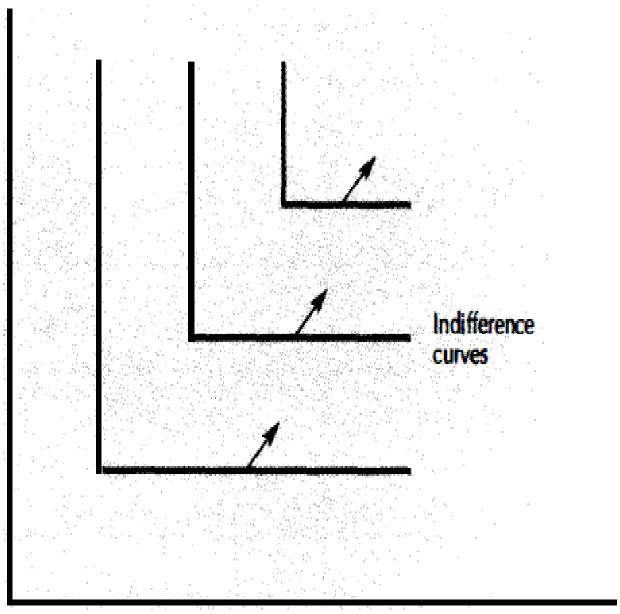
Indifference curves cannot cross. If they did, X, Y, and Z would all have to be indifferent to each other and thus could not lie on distinct indifference curves.

Perfect Substitutes:

In this example, one of the goods is a perfect substitute for the other. i.e. if the consumer consumes one less of the first good, she will be just as happy "with a constant amount" more of other good. For example, if the consumer just wants to consume a total of n units from the goods A and B, she will be indifferent between the bundles (n-a, a) and (n-b, b). She is just as happy as long as the total number of goods is 'n'. So, to



maintain the same level of satisfaction, if she increases good A's consumption by 1, she will decrease good B's by 1. So, the indifference curves will be straight lines with a slope of -1.

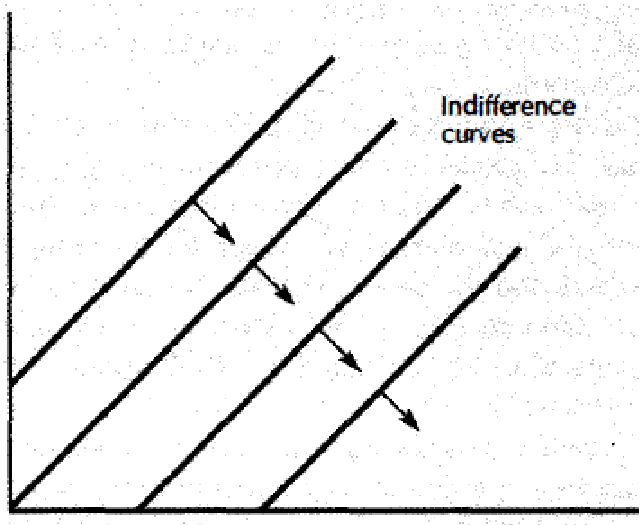


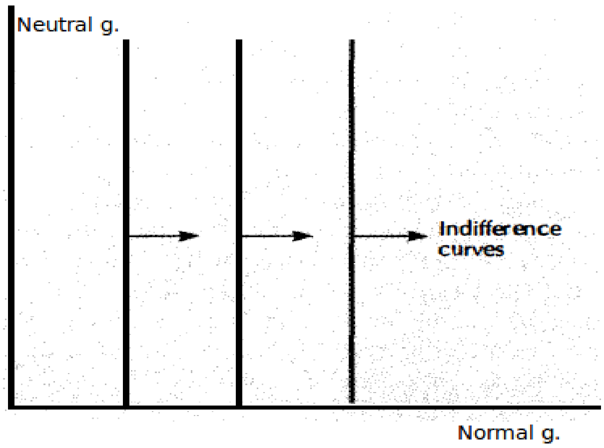
Perfect Complements:

Perfect complements are consumed together with fixed proportions. So, an increase in the consumption of one good will not change the satisfaction of the consumer as long as the consumption of the other good is unchanged. Ex: if the consumer is drinking tea, she will use a certain amount of sugar and more sugar will not make her happier as she will not get any use from additional sugar without additional tea. The indifference curve for perfect complements will have a corner point where both goods are used for consumer's satisfaction and any more of one of the goods won't make a difference. If we increase one of the goods from that corner point keeping the other good unchanged, satisfaction of the consumer won't change. So, the curves will be L shaped for perfect complements.

One Good, One Bad:

Bads are things that a consumer doesn't like. So, if she consumes more of a bad, her happiness will decrease. For a consumer who consumes one good and one bad, the good is kind of a compensation for the unhappiness that the bad brings him. Think of a guy who doesn't like french-fries. But he can eat them with ketchup (which he likes). If he eats more french-fries, he will have to consume more ketchup to maintain the same level of happiness. So, the indifference curves for these types of situations are upward sloping curves. (they don't have to be straight lines)



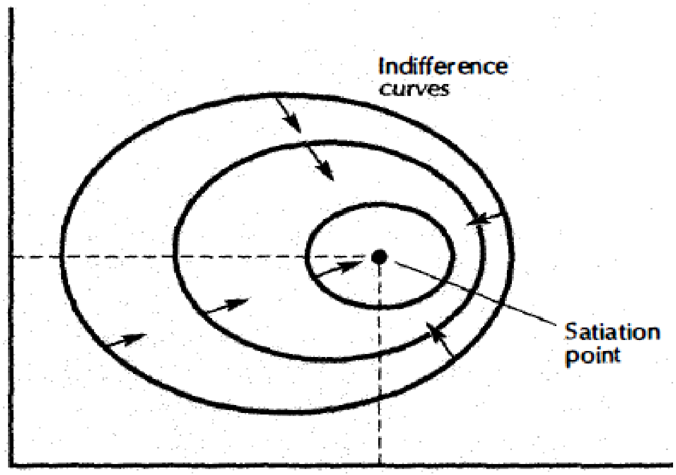


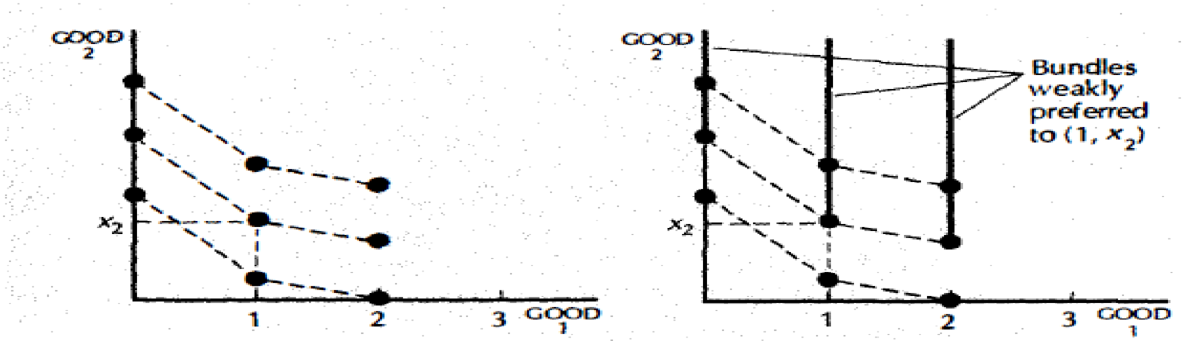
Neutral Goods:

They are goods that don't make any difference to consumer's satisfaction. If we think of a blind person who consumes flashlights and hamburgers, we can see that the only good that contributes to his satisfaction is hamburgers. It doesn't matter if he consumes more of flashlights as he doesn't get any use from them. So, the indifference curves for these kinds of situations are straight lines parallel to the axis representing the neutral good.

Satiation:

If there is a bundle (x_1,x_2) that makes the consumer most happy or satisfied, that bundle is called "the satiation point" or "the bliss point" and that bundle is preferred to any other bundle on the graph. Satiation is about goods that we like to consume at certain amounts to get the most satisfaction. Any more and any less of one of the goods breaks the satiation. Think of a girl who consumes water and salt and there is a certain amount that makes her satiated. If she drinks less, she gets thirsty; if she drinks more, she has to use the bathroom. Similarly if she consumes less salt, she doesn't get the nutrition she needs, but if she consumes more, it harms her kidneys.





A Indifference "curves" **B** Weakly preferrred set

A discrete good. Here good 1 is only available in integer amounts. In panel A the dashed lines connect together the bundles that are indifferent, and in panel B the vertical lines represent bundles that are at least as good as the indicated bundle.

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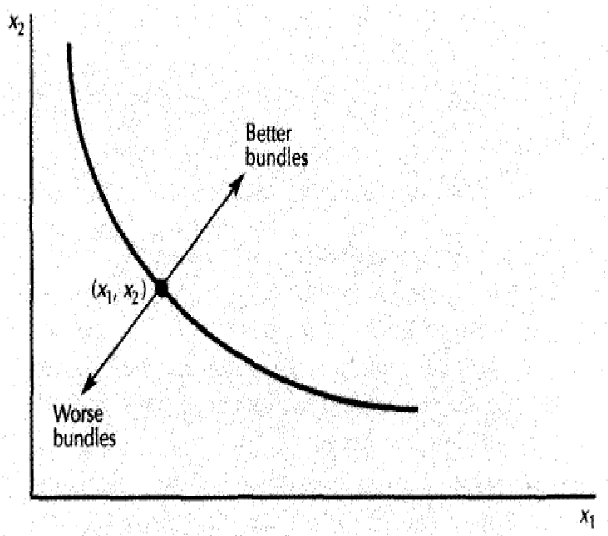
another example of ind. curves from the book: discrete goods

Discreet goods are goods that are consumed in integer units. Ex: we can consume 14.5 kilos of potatoes per month, but we can't consume 2.4789 cars. So, cars are considered discrete goods.

Well-behaved preferences

Assumptions to work on indifference curves;

More is better (monotonicity of preferences), we are dealing with goods, not bads. If the bundle (x_1,x_2) has at least as much goods as in (y_1,y_2) and one of one good, then (x_1,x_2) >



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(y_1,y_2)

as more is better, the indifference curves' slopes are negative

Averages are preferred to extremes;

we will assume, if there are two different bundles (x_1,x_2) and (y_1,y_2) on the same indifference curve, the bundle with the average amounts of good 1 and good 2 -according to the first two bundles- is at least as preferable as both of the first two bundles.

that is, if $(z_1,z_2) = ((x_1 + y_1)/2,(x_2 + y_2)/2)$, then $(z_1,z_2) >= (x_1,x_2)$ and $(z_1,z_2) >= (y_1,y_2)$

this means weakly preferred set to (x_1,x_2) is a convex set

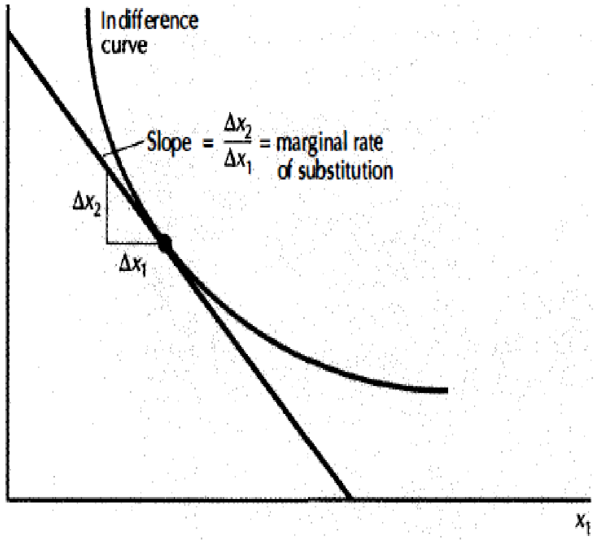
convex set: if you take any two points in the set, the line segment connecting those points will be in this set entirely

non-convex preferences: for goods that are not preferably consumed together. Like apples and salt

strictly convex preferences: consider a set of points where all the averages of any two points are strictly preferred to both of the points

Marginal Rate of Substitution

MRS is the slope of an indifference curve
the rate, at which the consumer is willing to substitute one good for the other
suppose the amount of good 1 is increased by a small amount Δx1, then we will have to decrease the amount of good 2 by a small amount Δx2 to stay on the same indifference curve.
MRS is Δx2/Δx1, namely the slope of the indifference curve



Exchange Rate

the rate that other good is exchanged while acquiring one
if the consumer gives up x1 units of good 1, she can get Ex1 units of good 2
if the consumer gives up x2 units of good 2, she can get x2/E units of good 1
consumer is given the opportunity to move along a line passing through the initial bundle with a slope of -E
the line is called the "exchange line"
exchange line should be tangent to the indifference curve on the point we choose. if it is not, then it means there are better points for us on the exchange line

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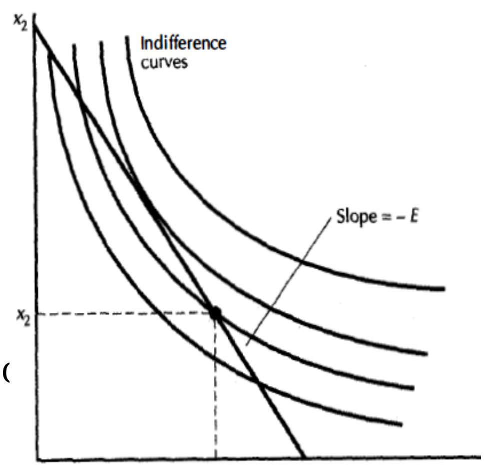


exchange line and indifference curves

Other Interpretations of MRS

MRS is also the rate that a consumer is willing to pay some of good 1 in exchange for good 2
so, MRS is also Marginal Willingness to Pay
when we contruct a 2 good model, we can also examine the situation in general by setting one of the goods

as "all other goods." If we think of all other goods as the money we pay for them, actually, we give up dollars we keep for other goods when we chose to consume extra amounts of good 1. That's why MRS is also called marginal willingness to pay
changes in amount must be considered in terms of "marginal"(small) and "willingness"(about preferences)

MRS Behavior

perfect substitutes: MRS is constant
perfect complements: MRS is either zero, or infinite
neutral goods: MRS is infinite (given that the amount of the neutral good is placed on the y-axis)
convex indifference curves: it decreases in absolute value as we increase x1 (it is called diminishing MRS)

Utility Function

assigns numbers to preferences to be able to rank them, doesn't have a real value
size of the difference between utilities is insignificant as utility is used only for ordering
as it is used for ordering (comparing) preferences, it is called "ordinal utility"
is not unique, we can find infinite ways of assigning utilities, only the ordering is important

monotonic transformation of a utility f'n:

transforming the utility f'n without changing the order of numbers
ex: making "u" 5u, u/4 or u+5
for monotonic transformation, if $f(u_1) – f(u_2)$ is positive, $u_1 – u_2$ must be positive
so, a monotonic f'n always has a positive slope
represent the same preferences of the utility f'n

cardinal utility theories:

claim there should be a significance about the magnitude of utilities and their differences
for a person, we can't know if he likes a bundle "exactly" twice as much as he likes another
a consumer would prefer a bundle with a larger utility, but the question "how much larger?" does not help with anything

constructing utility functions:

not all preferences can be represented by a utility f'n. Ex: intransitive preferences
utility function is a way to label monotonic indifference curves
utility is constant along the curves
every indifference curve represents a different utility
we draw indifference curves by making the utility f'n equal to a constant

some examples of utility f'ns:

perfect substitutes:

$u = a*x_1 + b*x_2$
or $u = x_1^2+2x_1x_2+x_2^2$ (sqr. of a first order sum)
or any monotonic transformation

perfect complements:

$u = \min\{ax_1,bx_2\}$
or any monotonic transformation

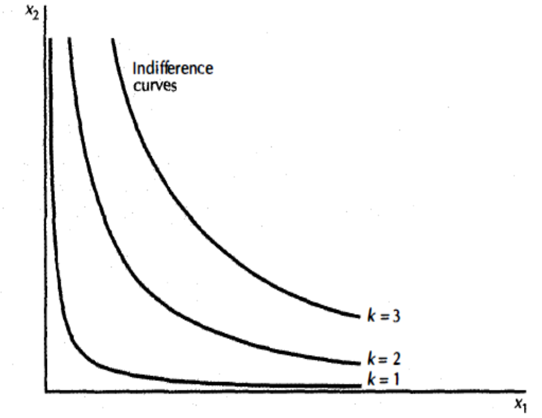
Quasilinear preferences:

each indifference curve is a vertically shifted version of a single indifference curve
usually in the form $x_2 = k – v(x_1)$
setting $k = u$, $u = v(x_1) + x_2$
the f'n is linear in x_2 but can be non-linear in x_1
quasilinear = partly linear
these f'ns are not realistic, but easy to work with

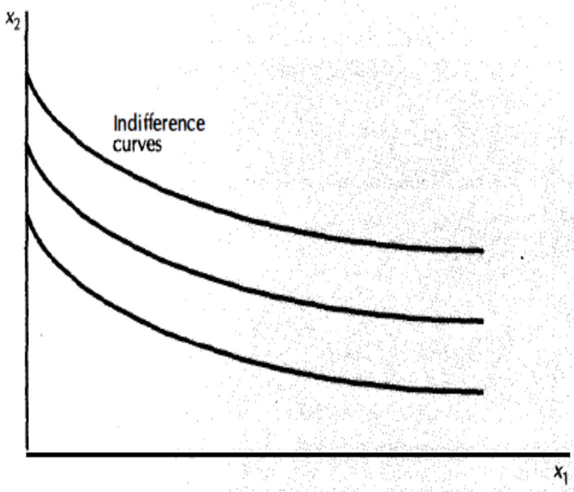
Cobb-Douglas:

of the form "$u(x_1,x_2) = x_1^a*x_2^b$"
or any monotonic transformation
standard examples of utility f'ns that look well behaved
raising the utility to 1/(a + b)th power and by taking $c = a/(a + b)$, we can find a monotonic transformation that equals the sum of the powers equal to 1,

$$u(x_1,x_2) = x_1^c*x_2^{1-c}$$



Indifference curves. The indifference curves $k = x_1x_2$ for different values of k.



Quasilinear preferences. Each indifference curve is a vertically shifted version of a single indifference curve.

Marginal Utility

the rate change in utility for a small amount of additional good

$$MU_1= [u(x_1+\Delta x_1,x_2)-(u(x_1,x_2)]/\Delta x1$$

change in utility = $\Delta U = MU_1*\Delta x_1$
magnitude of marginal utulity depends on the magnitude of utility (if utility is multiplied by n, MU will be also nMU)
marginal utility for a good, by itself, can't be used to interpret consumer behavior (as it depends on the utility f'n chosen)

MU and MRS

MRS is the slope of indifference curve at a given bundle
by using MU and MRS, we can find the bundle where the consumer is willing to sacrifice one good for the other
consider a small change in the given bundle that keeps the utility constant:

$$MU_1\Delta x_1 + MU_2\Delta x_2 = \Delta U = 0$$

solving the slope for the indifference curve, we have:

$$MRS = \Delta x_2/\Delta x_1 = - MU_1/MU_2$$

marginal utility changes according to the given utility function (remember, utility function is not unique) but ratio of marginal utilities give us a measurable value, "MRS"

Computing Utility with Commuting:

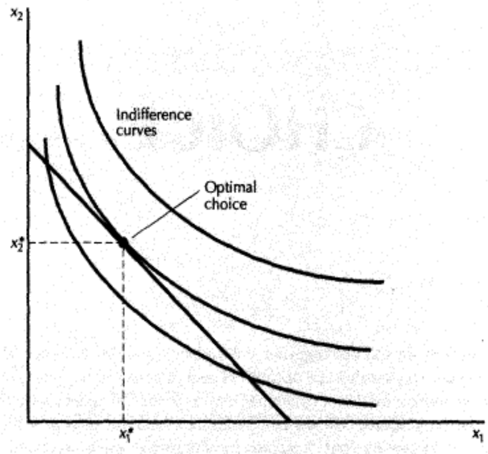
If there are more than one ways to consume something, we use commuting to compute utility.
Ex: if x1 = waiting time to get on a bus, x2 = travelling time on a bus, ... , and so on, we compute the utility like this:

$$U(x_1, x_2, x_3, \ldots \ldots) = b_1x_1 + b_2x_2 + b_3x_3 + \ldots\ldots + b_nx_n$$

Choice

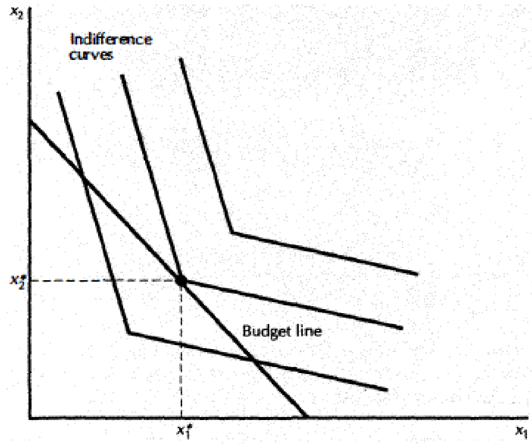
Optimal Choice:

If we have many bundles with the same utility, how do we choose? Basically, we chose the bundle which we can afford with minimum income. So, if we draw indifference curves and budget lines in the same graph, our choice will be the bundle on our indifference curve to which the budget line is tangent. See the graph >>



We can say that the optimal point is the point where MRS is equal to the slope of the budget line.

But we cannot always calculate the MRS for any indifference curve. MRS is numerically calculated by using differentiation, and not every function is differentiable. In the graph on the right, we can see that the indifference curves do not have tangents lines on the optimal points. So, to cover these exceptions, we will use the budget line that includes the corner (kink) of the indifference curve.

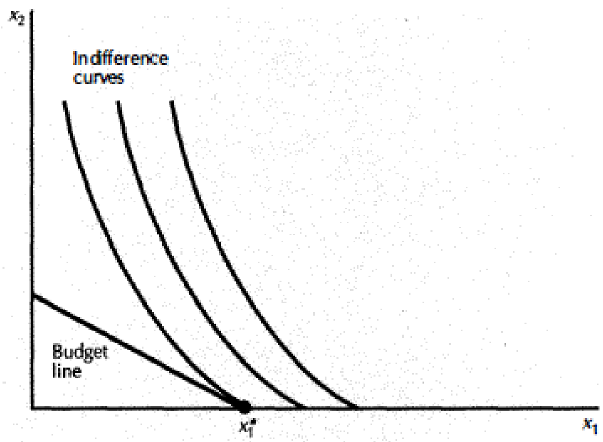


Kinky Curves

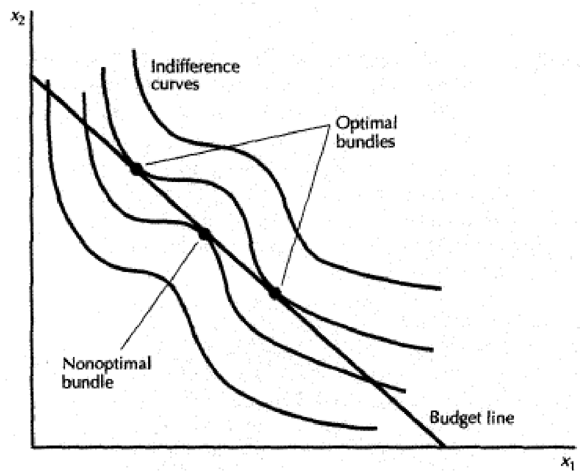
There are also other exceptions like more than one optimum bundles and boundary optimums.

Boundary optimum means, the optimum point is on one end of the indifference curve. That is because all the points on the curve does not have tangents and we must choose the closest budget line that includes points on the indifference curve.

Sometimes there can be more than one optimum bundle. That is, the budget line is tangent to more than one point on the indifference curve. If we have a budget line that is tangent to more than one indifferent curve, we must choose the indifference curve that is further to the origin.



boundary optimum



more than one optimums

For the convex preferences,

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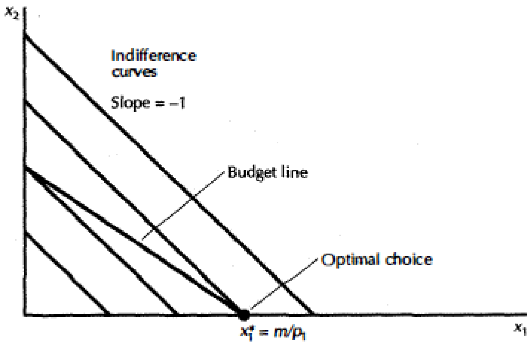
"tangent" property of MRS always works.

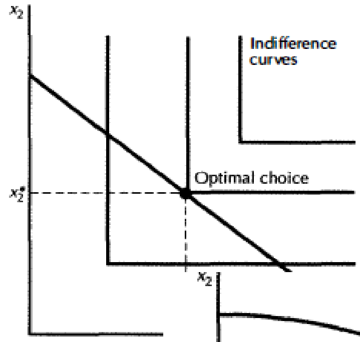
Rate of exchange interpretation: if the consumer is willing to stay put where she is, on the optimal bundle, she must have an MRS which is equal to $-p_1/p_2$, which is the exchange rate.

If the prices or the income changes, the consumer's demand for the goods and choices will also change. The **demand function** relates the prices, income and optimal choices.

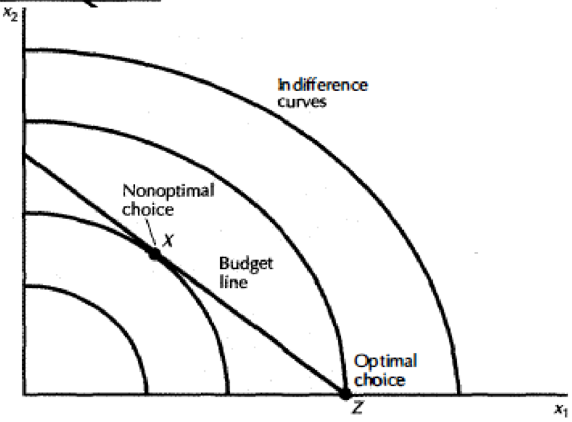
Examples of choices:



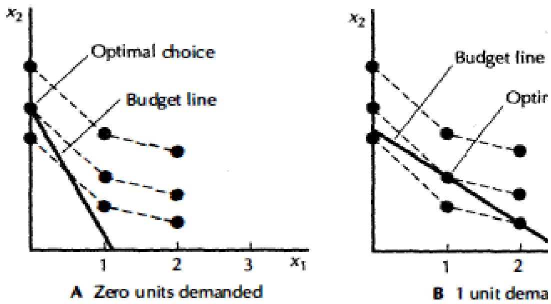
Optimal choice with perfect substitutes. If the goods are perfect substitutes, the optimal choice will usually be on the boundary.



Optimal choice w are perfect complem lie on the diagonal equals x_2.



Optimal choice with concave preferences. The optimal choice is the boundary point, Z, not the interior tangency point, X, because Z lies on a higher indifference curve.



Discrete goods. In panel A the demand for good 1 is zero, while in panel B one unit will be demanded.

Estimating the Utility Function:

We know that the budget line is: $p_1x_1 + p_2x_2 = m$

so, the shares of expenditures on goods are:

$s_1 = p_1x_1/m$ and $s_2 = p_2x_2/m$

Some data describing consumption behavior

Year	p_1	p_2	m	x_1	x_2	s_1	s_2	Utility
1	1	1	100	25	75	.25	.75	57.0
2	1	2	100	24	38	.24	.76	33.9
3	2	1	100	13	74	.26	.74	47.9
4	1	2	200	48	76	.24	.76	67.8
5	2	1	200	25	150	.25	.75	95.8
6	1	4	400	100	75	.25	.75	80.6
7	4	1	400	24	304	.24	.76	161.1

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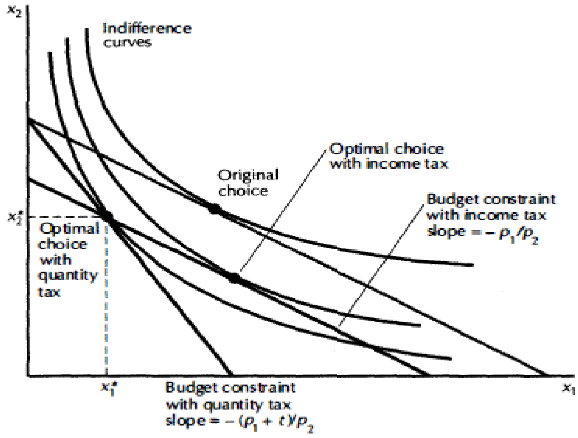
According to the consumption behavior table above, the average shares of expenditures of good1 and good2 are ¼ and ¾. So, we can say that the utility function will be like $u(x_1, x_2) = x_1^{1/4} x_2^{3/4}$.

Taxes:

If we apply a quantity tax on good1, the budget line will be like this: $(p_1 + t)\, x_1 + p_2 x_2 = m$

and the revenue raised by this tax will be $R^* = tx_1^*$

an income tax will just reduce the income.



Income tax versus a quantity tax. Here we consider a quantity tax that raises revenue R^* and an income tax that raises the same revenue. The consumer will be better off under the income tax, since he can choose a point on a higher indifference curve.

The Income Effect and the Substitution Effect

The first part-the change in demand due to the change in the rate of exchange between the two goods-is called the substitution effect.

The second effect-the change in demand due to having more purchasing power is called the income effect.

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General Equilibrium:

Edgeworth Box

Exchange of two goods between two people

Determine the endowments and preferences of two individuals in one diagram

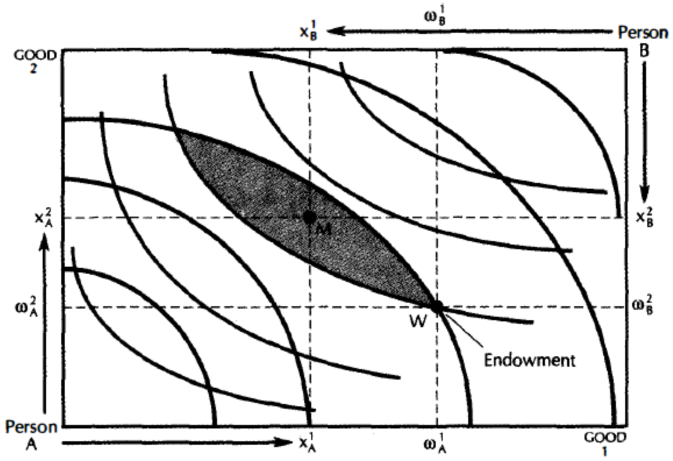
EX: two people A, B and two goods 1,2.

A's consumption bundle: $X_A=(x_A^1,x_A^2)$

B's consumption bundle: $X_B=(x_B^1,x_B^2)$

A pair of consumption bundles X_A and X_B is called an allocation

Allocation feasible if total of each good consumed equals total amount available



Equilibrium in the Edgeworth Box

For all goods, if the demand of one agent for one good equals the supply of the other agent for the same good, that means we are in the equilibrium point. (considering the prices p_1 and p_2)

Algebraically;

$$[x_A^1(p_1,p_2)-w_A^1] + [x_B^1(p_1,p_2)-w_B^1] = [x_A^2(p_1,p_2)-w_A^2]+ [x_B^2(p_1,p_2)-w_B^2] = 0$$

In other words, aggregate excess demands for both goods (z_1,z_2) must be zero.

$$z_1 = x_A^1(p_1,p_2) + x_B^1(p_1,p_2) - w_B^1 -w_A^1$$
$$z_2 = x_A^2(p_1,p_2) + x_B^2(p_1,p_2) - w_B^2 -w_A^2$$

Initial Endowment Point

We denote the initial endowments by $W_A=(w_A^1,w_A^2)$ and $W_B=(w_B^1,w_B^2)$

W is the initial endowment point and in the graph, any point in the shaded area will make both of the agent better off.

If we think of the allocation M as, $M=(X_A,X_B)$, to find a better allocation M, A should give up $|x_A^1-w_A^1|$ units of good 1, and acquire $|x_A^2-w_A^2|$ units of good 2. (it's similar for B)

Indifference Curves

Considering the indifference curves of A and B, the allocation M is on higher indifference curves for both A and B.

Pareto-efficient allocation

1. There is no way to make all the people involved better off
2. There is no way to make some individual better off without making the other worse off
3. All the gains from trade have been exhausted
4. There are no mutually advantageous trades to be made

Contract curve

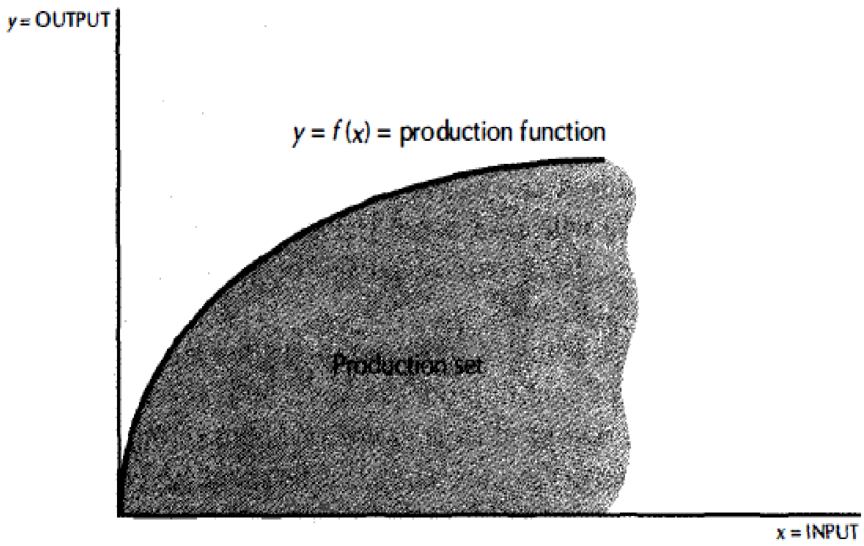
It is a curve that connects all the pareto-efficient points in the Edgeworth box

Chapter 18 Technology

Production function

Production function is a function that shows the amount of output produced according to the amount of inputs.

For one input, if a graph is showing how the output is formed, it is a production possibilities frontier. The production set is the set of all possible amounts of output for all possible amount of input in one interval.



Marginal product

Marginal product is the amount of output created by one extra input.

Law of diminishing

marginal product

Typically the marginal product declines as the amount of input increases.

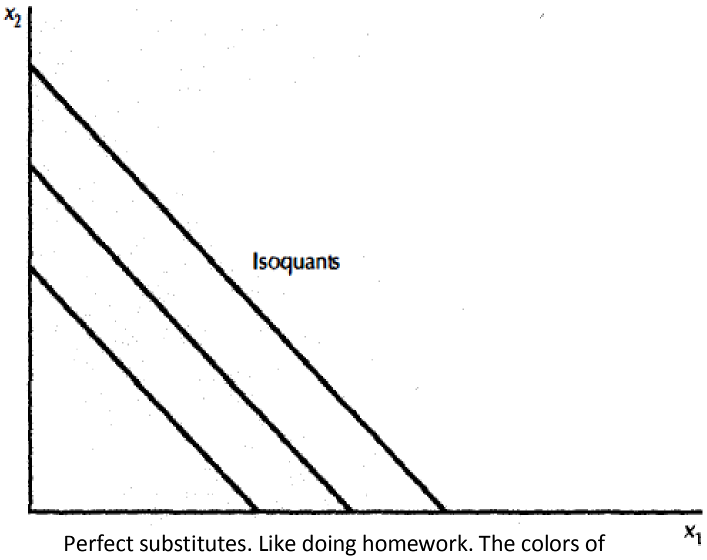
Ex: the amount of output each worker contributes to declines because of the limited amount of space, equipment, etc.

TRS

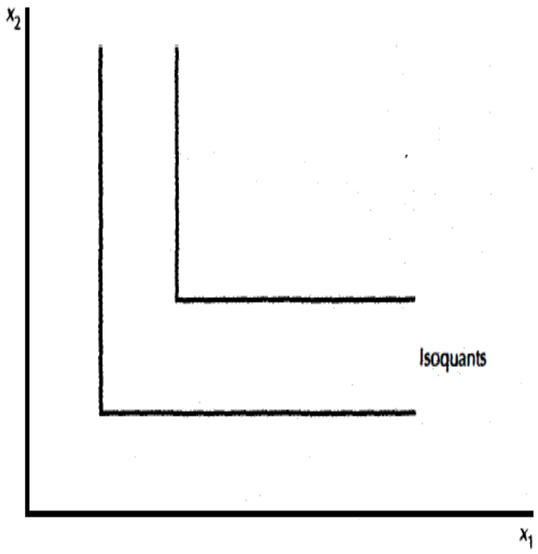
Suppose we are operating at some point (x_1, x_2). If we give up using a little bit of factor 1, to produce the same output, we should use a little more of factor 2. TRS, or technical rate of substitution shows us how much we should increase the use of factor 2 according to the decrease in the usage of factor 1. It is also the slope of the isoquant we are on.

Isoquants

An isoquant is a curve just like an indifference curve. It shows how a certain amount of output is produced with different combinations of two inputs. There are different examples of isoquants just like indifference curves.



Perfect substitutes. Like doing homework. The colors of the pencils are not important. Each pencil will produce a certain amount of output and we can use a pencil of another color to do the homework.



Fixed proportions of input. In other words; perfect complements. Consider digging an hole in the yard. You need one man and one shovel to dig a hole.

Above are two examples of isoquants, there are infinitely many examples of isoquants. One of them is Cobb-Douglas style isoquants. It is the same as in indifference curves but whether the sum of the indexes is one or not is important because the value of the production function matters.

The properties of well-behaved preferences also apply to the isoquants. They can be convex, monotonic, or not.

Returns to scale

The production function's returns to scale is important, and it is about the MP. If there is a diminishing marginal product, it is increasing returns to scale. If there is a constant MP, it is constant returns to scale, etc.

Chapter 19 Profit maximization

given prices of inputs and output: For one-input case compute the profit maximizing level of input, and output:

$\pi = py - wx$ where y is output, w is the wage of one input and x is the amount of input introduced.

In this case, we take the derivative of the profit function with respect to the amount of input and equal it to 0.

For two-inputs case compute the profit maximizing level of inputs, and output:

$\pi = py - w_1x_1 - w_2x_2$

Given that x_2 is constant, we do the same math with the one-input model.

Revealed Profitability

Consider a profit maximizing firm, making different choices in two different time periods t and s.

$p^ty^t - w_1^tx_1^t - w_2^tx_2^t \geq p^ty^s - w_1^tx_1^s - w_2^tx_2^s$

and

$p^sy^s - w_1^sx_1^s - w_2^sx_2^s \geq p^sy^t - w_1^sx_1^t - w_2^sx_2^t$

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these inequalities show that the choices of the firm were better at the time period it was in according to the other possible choices.

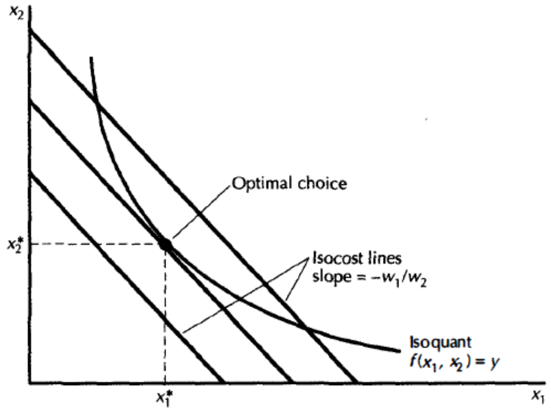
And they also mean that producing the certain amount of output with a certain amount of input in the period is more profitable than any different amount of input and output.

If any of these two inequalities is breached, the firm is not a profit maximizing firm.

Chapter 20 Cost minimization

Given a production function and input prices, be able to compute the cost minimizing level of inputs.

Know the definition of the cost function, how to find the cost function for different production functions (e.g. Cobb-Douglas, perfect substitutes, perfect complements).



Cost minimization. The choice of factors that minimize production costs can be determined by finding the point on the isoquant that has the lowest associated isocost curve.

Isocost lines are lines that represent the possible combinations of inputs that give the same value of cost.

So the equations of the isocost lines are like this:

$x_2 = C/w_2 - w_1x_1/w_2$

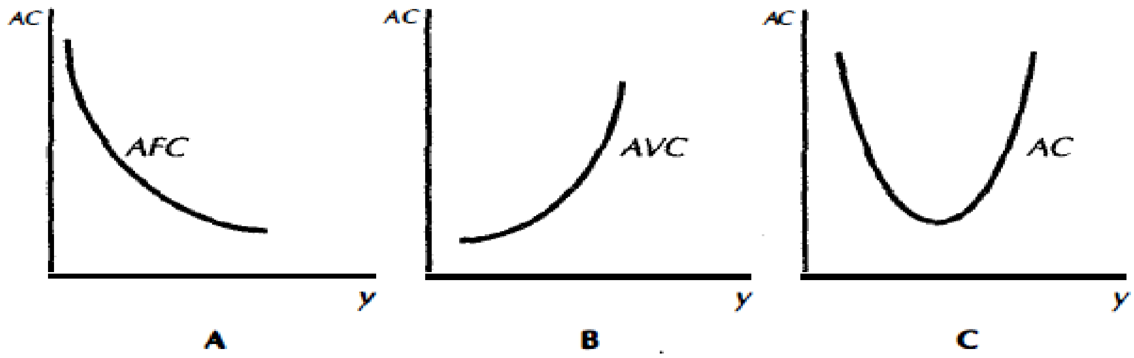
the cost minimizing combination is where the allocation on the isoquant corresponds to the lowest Isocost line.

And that is where the slope of the isoquant is equal to the slope of the isocost lines. In other words, that is where the TRS is equal to $-w_1/w_2$.

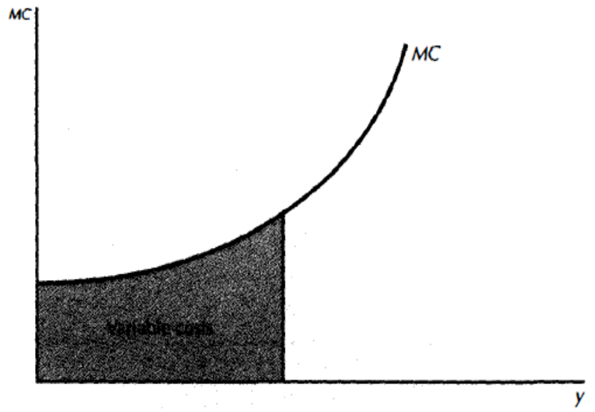
And TRS is the quotient that: $-MP_1/MP_2$

Chapter 21

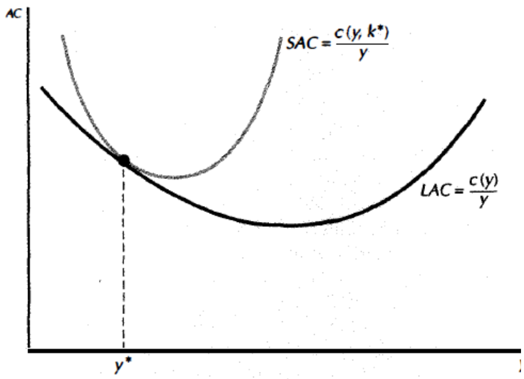
Cost curves



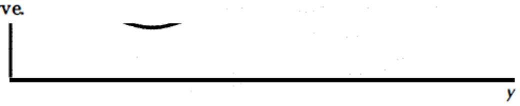
Construction of the average cost curve. (A) The average fixed costs decrease as output is increased. (B) The average variable costs eventually increase as output is increased. (C) The combination of these two effects produces a U-shaped average cost curve.



Marginal cost and variable costs. The area under the marginal cost curve gives the variable costs.



Short-run and long-run average costs. The short-run av erage cost curve must be tangent to the long-run average cos curve.

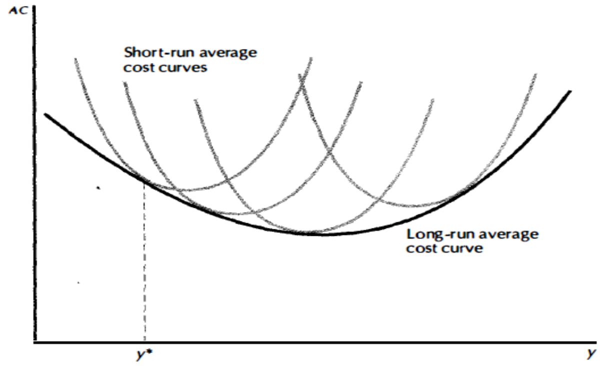


Cost curves. The average cost curve (AC), the average variable cost curve (AVC), and the marginal cost curve (MC).

Long run average cost curve vs. short run average cost curves

In the long run, the fixed costs will be variable costs

But for an amount of output y*, if the optimum amount of capital is k*, in the long run (whether it is a fixed or variable cost) it will still be the optimum input for y*. So, the short run average cost curve will be tangent to the long run average cost curve at y*. If we compute the optimum level of capital for many certain levels of input, we get different short run average cost curves. And the long run average cost curve is tangent to all of them at any given output level.



Short-run and long-run average costs. The long-run average cost curve is the envelope of the short-run average cost curves.

Perfect competition:

TR = pQ, MR = ΔTR/ΔQ, TC = FC + VC, MC = ΔTC/ΔQ, AC = AFC + AVC

firms produce where “MR = MC”, i.e. TR&TC graphs' slopes are equal and there is the maximum difference between TR&TC

MR = MC >> profits are maximum

competitive market: many buyers and sellers, information is as good as possible, firms can enter and exit

MR = p, firms are price takers; MC is the supply curve basically

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market supply = firm1's supply + firm2's supply + ... + firmN's supply

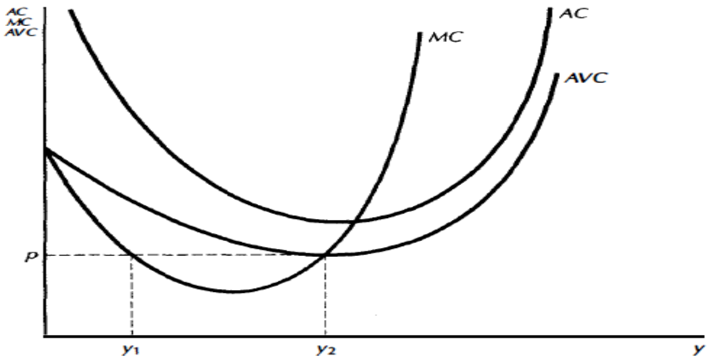
even without that many firms, competition may exist (fear of entry will keep the prices at some level)

why do firms produce if they will eventually get zero profits? Economic cost, opportunity cost issue

Chapters 22 and 23

How to find the profit maximizing output and the supply function for a perfectly competitive firm in the Short run.

max py – c(y)



Marginal cost and supply. Although there are two levels of output where price equals ma
quantity supplied can lie only
marginal cost curve.

marginal revenue is simply the price. To maximize profits, we must maximize p – Δc/Δy > 0.

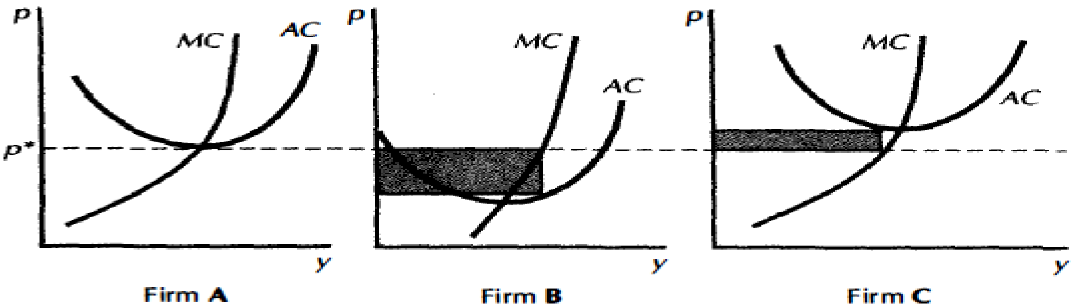
We know from the previous sections that, to maximize profits, the marginal cost and the price must be equal.

Equilibrium in the short run, shut-down condition.

Industry supply curve is the sum of the individual supply curves

To gain equilibrium, we must find the intersection point of the industry supply curve and the industry demand curve.

The implication of a price determined in the market equilibrium is given in the graph above.



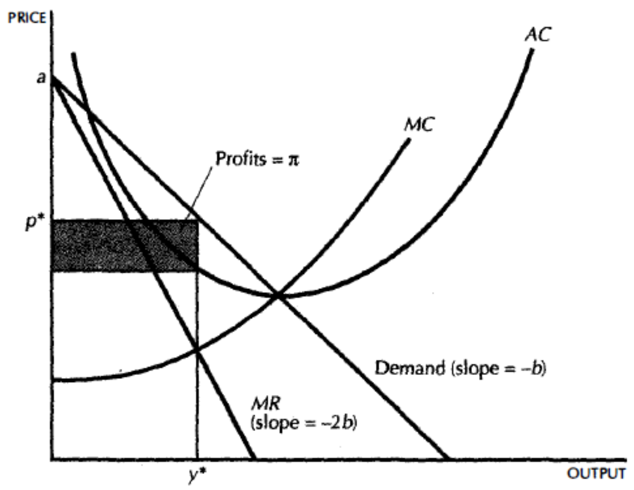
Short-run equilibrium. An example of a short-run equilibrium with three firms. Firm A is making zero profits, firm B is making positive profits, and firm C is making negative profits, that is, making a loss.

How to find the profit maximizing output in the long-run, finding the number of firms in the industry in the long run.

We can determine the profit maximizing output according to the price determined in the market. And the price in the market is dependent on the industry supply and the demand.

Industry supply is determined by the supplies of all the contributing firms. So, we use the firms' long run marginal cost curves (i.e. supply curves) to determine the industry supply.

There is another point to consider: exiting firms. If the firm gets losses instead of profits, it will exit in the long run. So, we only consider supply curves' parts that lie on or above the average cost curve.



Monopoly with a linear demand curve. The monopolist's profit-maximizing output occurs where marginal revenue equals marginal cost.

Chapter 24 Monopoly

Monopoly equilibrium

Assume that there is a linear demand curve

The formula for the curve is: p(y) = a – by

The revenue function is: r(y) = p(y)y = ay – by^2

The marginal revenue function is: MR(y) = a – 2by

Simply, the monopolist's profit maximizing output with a linear demand curve will be at a point where MR = MC

According to the elasticity formula for

demand curves that; e(y) = (Δy/y) / (Δp/p),

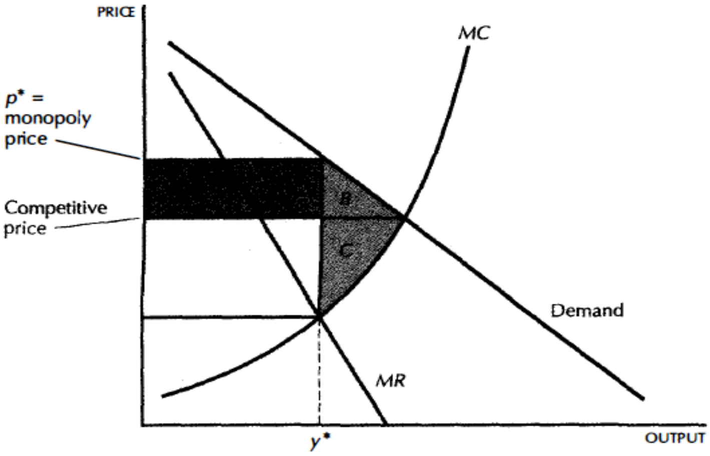
p(y) = MC(y*) / [1-(1/|e(y)|)] and it represents that the market price is a markup over marginal cost.

The markup is 1 / [1-(1/|e(y)|)], which means an elastic demand will help the monopoly to operate more profitably. So, a monopoly firm is expected to operate on the more elastic part of the demand curve.

p(y) = MC(y*) / [1-(1/|e(y)|)] is where the optimum level of output occurs.

Deadweight Loss of Monopoly

A monopoly is inefficient in terms of competition. And the inefficiency comes from the reduction of producers' and consumers' surpluses. The deadweight loss of monopoly is simply the sum of these two. And we use the difference between the competitive price and the monopoly price to see this.



Deadweight loss of monopoly. The deadweight loss due to the monopoly is given by the area $B + C$.

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