Efficiency, equity and the competitive markets' ability to achieve efficiency

erm, Nov. 17, 2011, rough and tough notes

These notes correspond to Chapter 13, "Efficiency and Equity" in the **first** edition of KW; that chapter is **not in the second edition.** Chapter 13 from the first edition is on my course web page, and includes comments by me. Read it.

Have you been reading my comments on each chapter? My web page for the course has a section with each chapter of the book with comments inserted by me. The Aplia site also has the chapters, but, for better or worse, without my comments attached.

The bottom line is that a competitive market system is, to a large extent, a wondrous thing

What does that mean?

If certain conditions are met, the allocation of resources and distribution of goods in a competitive market economy, in equilibrium, will be efficient.

This is called the "first theorem of welfare economics." The theorem was first proposed by Adam Smith in his famous book, *The Wealth of Nations*. (Note that A. Smith lived with his mother.)

The theorem basically says that, **under certain conditions**, in a competitive market economy with everyone selfishly pursuing their own interests, overall efficiency will be achieved. WOW. It is as if there is an invisible hand coordinating all activity (Adam Smith's "invisible hand").

1 Before, proceeding let's remind ourselves what it means for the allocation of resources and distribution of goods to be efficient.

Overall efficiency is defined in the context of society. Before we can decide whether an allocation is or is not efficient, we have to decide who is, and who is not a member of society.

- all people?
- all people who live in Boulder?
- do we include future people?
- the bears in the woods?
- terrorists?
- foreigners?

As we discussed in an earlier lecture, whether an allocation is efficient or inefficient oftens depends on who is, and who is not, a member of society.

Overall efficiency is also defined in the context of society's limited supply of resources and the state of technical knowledge for using those resources to produce goods. At a given point in time, society has some fixed amount of resources, R, and a given state of knowledge, and efficiency is defined taking both the amount of resources and the amount of knowledge as constraints.

- a society learning new stuff (expanding the state of technical knowledge), while typically a good thing, is not, in itself, an efficiency increase.[1]
- discovering, for example, oil shale in Western Colorado, while probably a good thing, does not make the allocation of resources more efficient; it simply increases the stock of resources. The allocation of resources before the discovery might or might not have been efficient, and after the discovery might or might not be efficient.

[1] The guy on the street would probably describe a technological advance as an efficiency increase, but an economist would not. In general, the guy-on-the-street definition of efficiency is a vague and broad concept.

- These said, more knowledge and more resources increases the options for making at least one member better off without making any other member worse off. So, more resources or more knowledge are generally thought of as good things, and one can ask about the efficient amount of research (searching for new knowledge) and exploration (looking for additional resources).

1.1 So what is an efficient allocation of resources and what is an inefficient allocation of resources.

Society's allocation of resources is efficient if the **only way** to make one or more members of society better off, **requires that** other members of society be made worse off.

Notice the term **requires that**. And, don't underestimate the importance of "only way. "

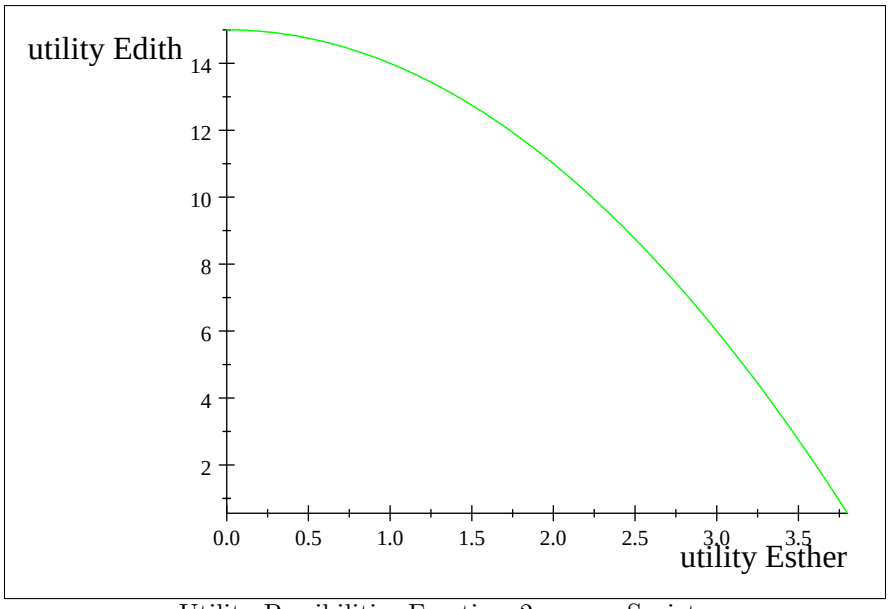
When is the allocation of resources **in**efficient?

When it is possible to reallocate and make some members of society better off without making any other members worse off. If that is possible, then the current allocation of resources is inefficient. Making some better off, and none worse off, is efficiency increasing. So, before the re-allocation occurs, the allocation is inefficient. Efficiency results only after all such reallocations have occurred.

Note the distinction between achieving efficiency and efficiency increasing. For example, changing things so Joe is better off and no one is worse off is efficiency increasing, but this change does not guarentee that efficiency has been achieved: there still might be more such changes possible.

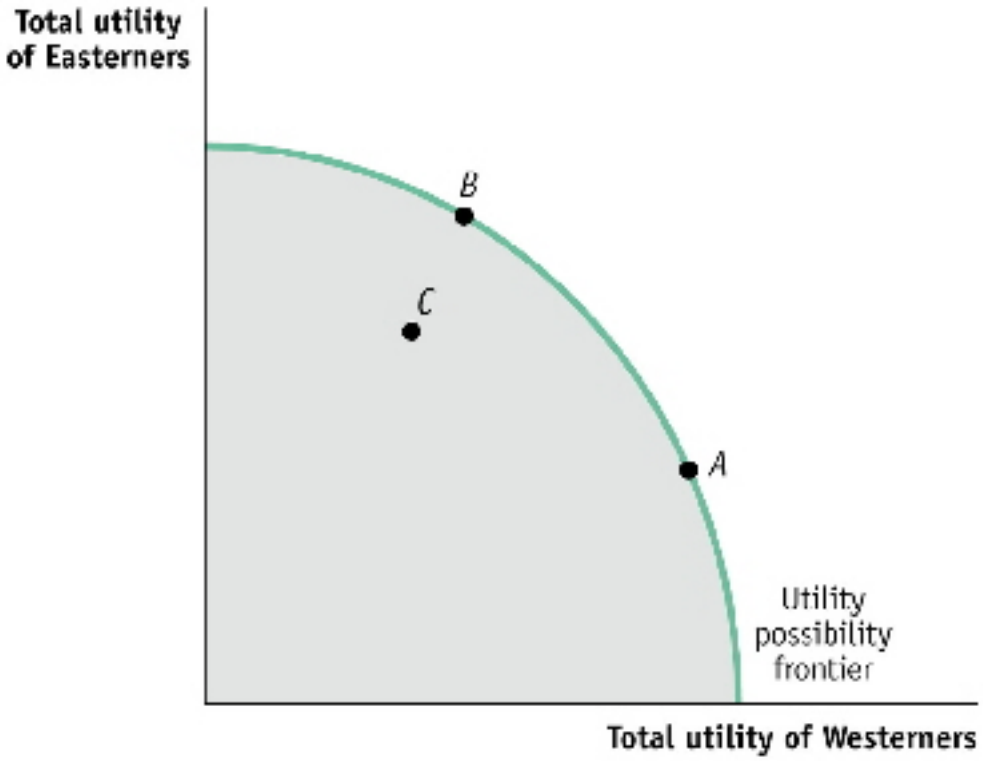
1.2 One can visualize efficiency and inefficiency in a two-person society (Edith and Esther) with a graph called a *utility-possibilities frontier*.

For example, it might look like



Utility Possibilities Frontier: 2-person Society

Here is the one in Chapter 13 (first edition of KW):



For this small society (Esther and Edith), society can allocate utility between its two members such that society ends up on any point on the green line, or at an allocation of utility in the shaded area (to the left of the green line).

To the right of the green UPFrontier, the resource and knowledge constraints of the society are violated, so these utility levels are impossible to achieve.

Alternatively, one could, for example, waste all of society's resources and knowledge and end up at with both Esther and Edith getting zero utility - a stupid, but feasble, outcome.

Every point in shaded area is feasible.

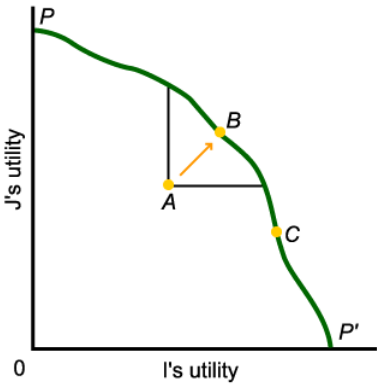
Notice that if society is inside the curve it is **possible** to make both Esther and Edith better off without making the other worse off. So, points inside the curve/frontier are inefficient.

A trivial example. Esther has all the cigars produced and Edith has all the wine produced; Esther prefers wine and Edith prefers cigars. This allocation is inefficient: they both can be made better off by trading.

(KW describe inefficiency as un-consumated trades, but I find this statement, while technically correct, misleading. It make it sound like voluntary trades always increase efficiency, which is not **always** the case.)

Here are a couple more UPFrontiers that I pulled off the internet. (as an aside, if you don't understand an economic phrase or concept, Googling it will bring up lots of stuff.

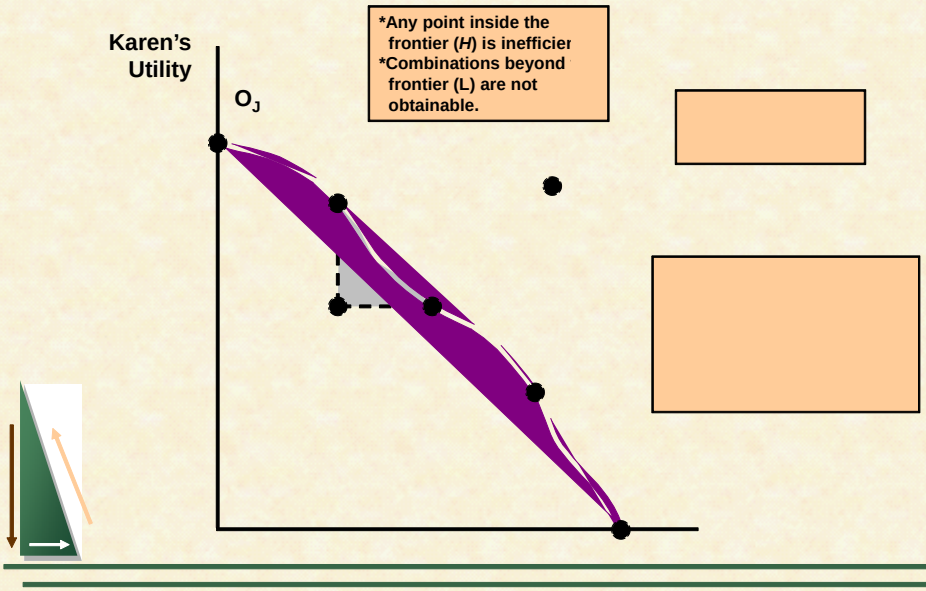
The Utility Possibilities Frontier



- Any point inside the *utility possibilities frontier* is inefficient. At point A, both I and J could be better off.
- Point B is preferable to point A.
- Both B and C are efficient, but may not be equally desirable.

 Principles of Economics, 6/e Karl Case, Ray Fair

Utility Possibilities



Note that every allocation on the frontier is efficient.

as we discussed early in the term

2 Economists put forward two goals for an economic system: efficiency and equity.

The bottom line is economists define good acts as those that increase the welfare of society, and bad acts as those that decrease the welfare of society. Welfare economics (how to decide what is good and what is bad) is a branch of moral philosophy. (Another terms for moral philosophy is ethics.)

Economists, but not everyone, would say that a policy/action that makes one or more members of society better off and no members worse off is a **good** policy, a moral policy.

Bet you did not know you were studying philosophy. Welfare economics originated with the famous philosophers John Stuart Mill and Jeremy Bentham

2.1

2.2 What does equity mean?

Equity and fairness are synonyms.

What is, and is not, fair is a matter of personal opinion: my opinion is my opinion, yours is yours.

We can all agree that certain outcomes are not fair but for most outcomes there will disagreement on whether the result is or is not fair.

- Most agree that the winner of the tennis match should get the trophy, rather than the loser
- Agree that it is unjust to torture innocent babies for fun and entertainment - well most of us would.

Consider some other outcomes and policies where there would be disagreement on whether the outcome/allocation is fair

- Smoking is banned

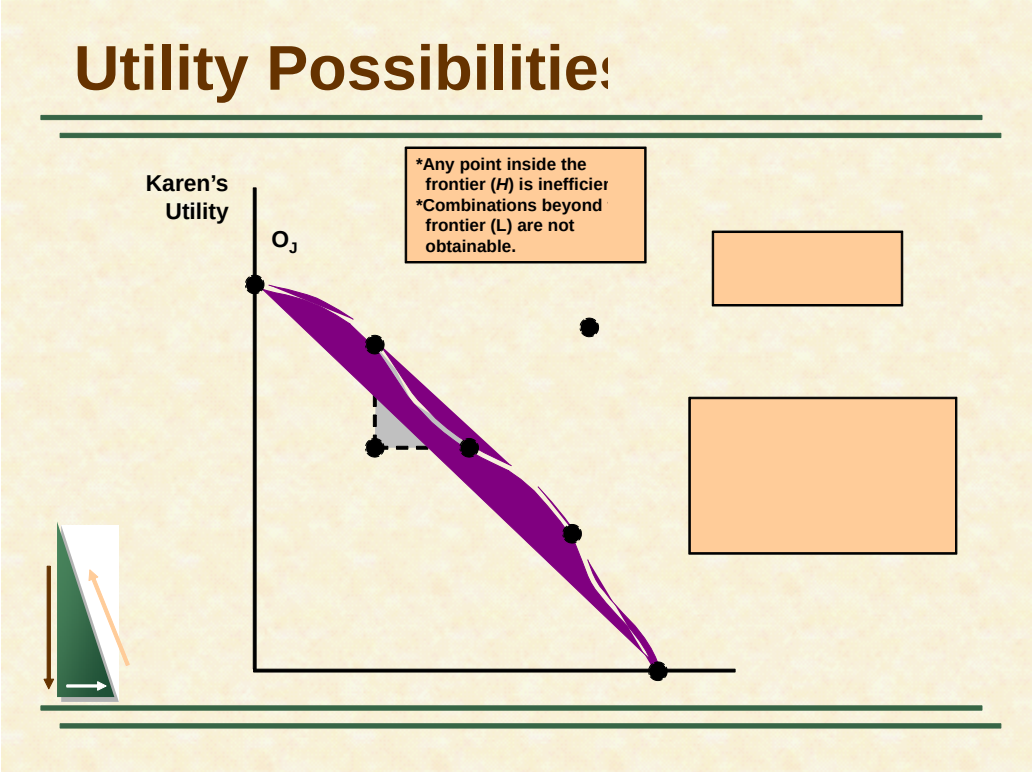
- Food stamps for poor people. Maybe you believe that poor people are poor because they are lazy, and the food stamps just encourage more laziness so giving stuff to lazy people is not fair to hard-working Americans.
- Everything you "earn" you earned; it is yours, and you should not have to give any of it in taxes so the government can use it to help poor people, or pay for public goods.
- highly progressive income tax rates where the tax revenues are used to create a social security net (like in Sweden and Norway) are fair because they help distribute wealth from the rich to the poor, making sure everyone experiences some minimum standard of living.
- We are not morally obligated to help poor people because poor people choose to be poor. In America, we all can achieve prosperity; all we need to do is work hard enough.

Not that equitable does not necessarily mean "equal." You might think that the fairest distribution of wealth is an equal distribution (everyone gets the same). I might disagree and say the fair thing is to give all to Donald Trump because he works harder than us, and, besides, needs more money so he can get a decent haircut–it is not fair to have to live with hair like that.

Economists have no more expertise than others in deciding what is and is not fair, so spend more time talking about efficiency than about equity. That said, economists have expertise in determining how different people (or different types of people) will be affected by a policy. Religious people would typically say that what is, and is not fair, is determined by religious doctrine.

2.2.1 We can use the UPF to discuss fairness.

Consider again James and Karen



Which allocation is most fair?

- Is it always on the frontier?
- If society could choose any allocation of utility between James and Karen, would they always choose one on the frontier?
- If they had to choose between some specific efficient allocation and some specific inefficient allocation, would society always choose the efficient allocation? For example, in the above graph would a society necessarily choose the distribution O_j over the distribution H?

3 Summarizing, and according to economics:

- The best allocation is efficient: efficiency is a necessary condition for bestness (welfare maximizing)[2]
- But, more efficient is not necessarily better than less efficient
- Sometimes we are forced to trade off efficiency and equity.

For example, a government mandated minimum wage is likely an inefficient way to help poor people. But, that said, if it was the **only** politically feasible way of helping poor people, I would choose it over not helping poor people, even though it causes inefficiency. In this case I am saying that if I **had to choose** between what I would view as an efficient but highly unfair allocation and a slightly inefficient but much fairer allocation, I would likely choose the inefficient allocation. Note that I am making this choice as Edward the person.

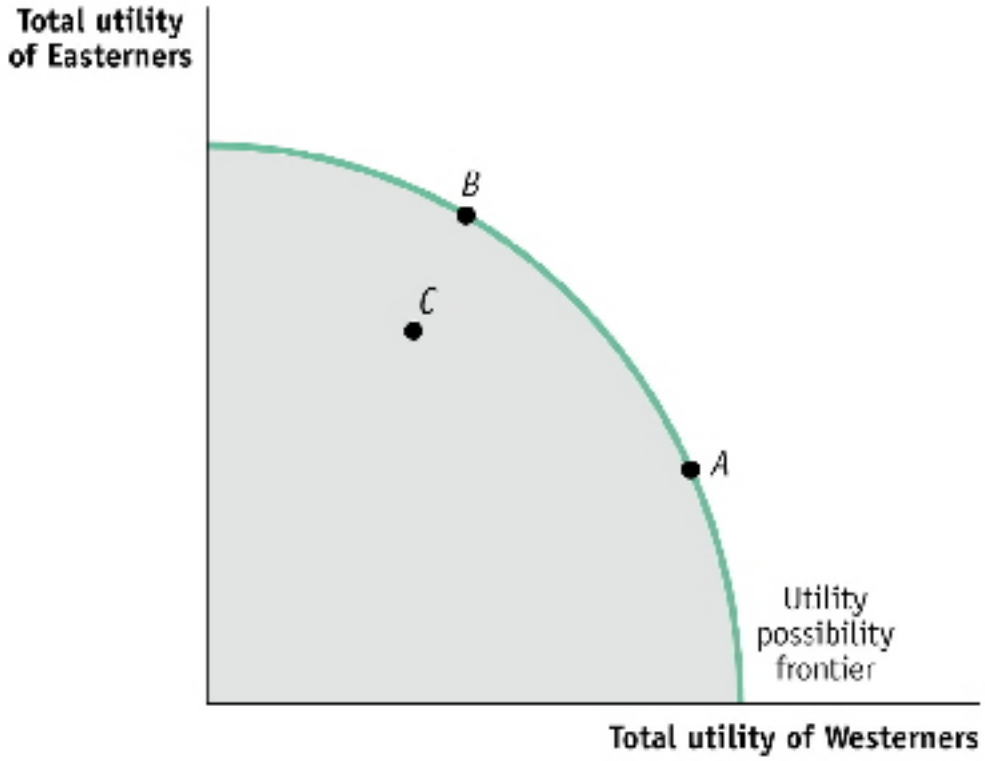
[2] Note efficiency is necessary, but not sufficient for welfare maximization.

4 Let's back up and look at the UPF more closely

4.1 start simple: a manna from heaven model

What is going on when society moves from allocation B to allocation A?

this graph is from chapter 13 In KW (first edition)



To keep things simple, assume there are only two people: the Westerner, Colin the cowboy, and Sophia, the New York affectionato of opera. Further assume only two goods: BBQ steak and CDs of Maria Callas singing different operas.[3] Assume there is only one copy (CD) of each opera.

So
$U_c = U_c(B_c, O_c)$ and $U_s = U_s(B_s, O_s)$ where U_c is Colin's utility, B_s is the pounds or BBQ consumed by Sophia, and O_c is the number of opera performances owned by Colin.

[3] Maria is a dead foreigner, so not a member of society.

They both like BBQ and opera (both are goods for both individuals) but not to the same degree. Colin and Sofia do not like each other so would not consider listening to each other's opera CDs.

To make things even simpler, assume that there are a fixed number of opera CDs and a fixed amount of BBQ(10 operas recorded and 10 pounds of BBQ). The BBQ and opera are provided in these fixed amounts by a generous, but not too generous, god.

The constraints, in general terms, are $B_s + B_c \leq B$ and $0_s + 0_c \leq 0$ - Colin and Sofia cannot consume more than god endowed, and they cannot each consume the same unit of a good.

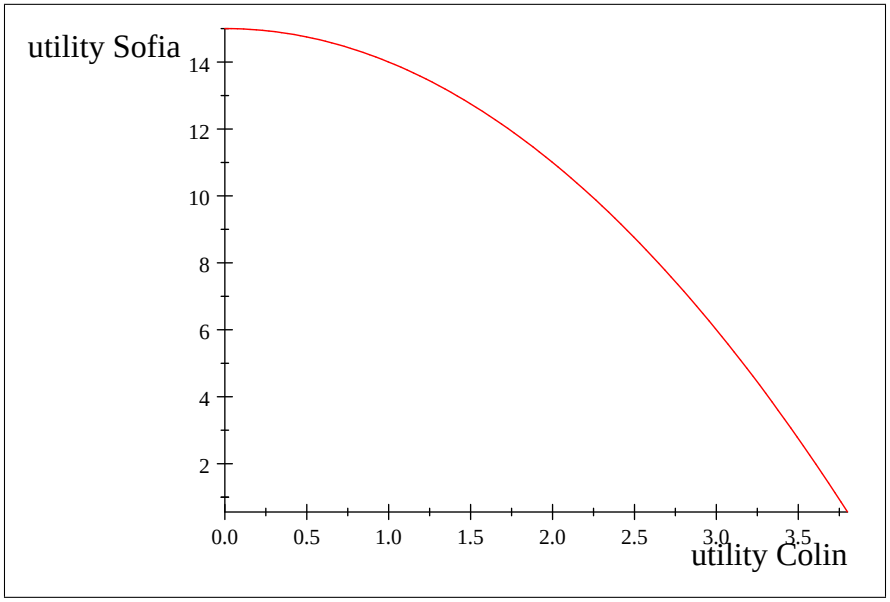
This sort of model is called a *manna from heaven model.*[4]

Since there is no production in this model, overall efficiency and efficiency in consumption are one and the same.

Overall efficiency (and efficiency in consumption) is achieved when society is operating on their utility frontier.

In this world, as one moves between points A, B (both on the frontier), and C (inside the frontier), the fixed quantities of BBQ and opera are being redistributed between Sophia and Colin. At, for example, C, some is not consumed.

[4]It has this name because there is no production in the model; stuff simply appears–falls from the sky. Manna (Hebrew: ■ ■) or Moun Salwa (Arabic, Persian, Urdu), sometimes or archaically spelled mana, is the name of a food which, according to the Bible, was eaten by the Israelites during their travels in the desert. It was said to be sweet to the taste.



Utility Possibilities Frontier: 2-person Society

4.2 But, we do not live in a manna from heaven world, society must use its scare resources to produce BBQ and opera

Society does not only allocate fixed amounts of BBQ and opera. It first must decide how to allocate its scare resources between producing BBQ and opera.

In addition to
$U_c = U_c(B_c, O_c)$
and $U_s = U_s(B_s, O_s)$

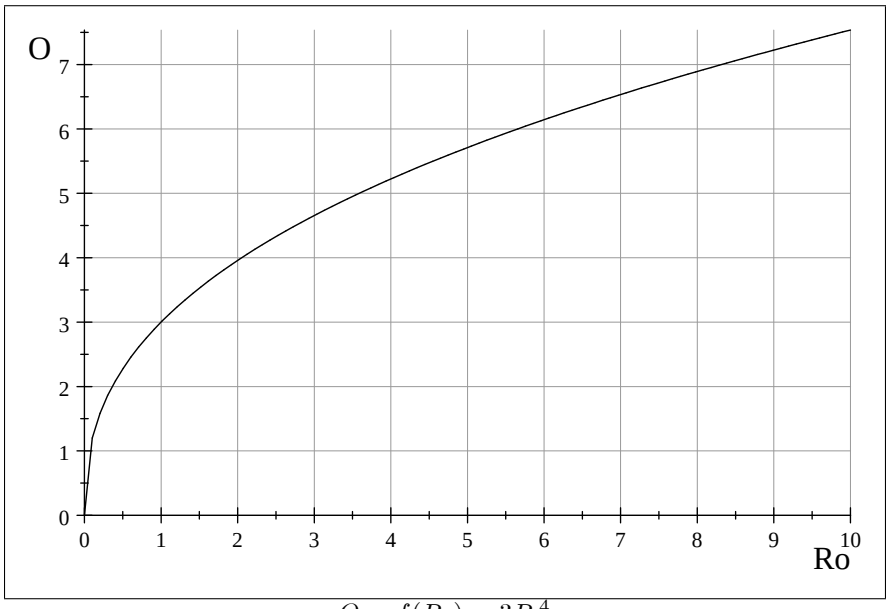
We also need to worry about production
$O = f(R_O)$ where R is the amount of resources available–fixed, and R_o is the amount used to produce Opera
$B = g(R_B)$
These are the respective production functions for opera and BBQ.

The production functions are the reflections of the state of knowledge for producing opera and BBQ (there are only so many ways to produce Texas BBQ).

$R_o + R_B \leq R$ - society cannot use more resources in production than they have.

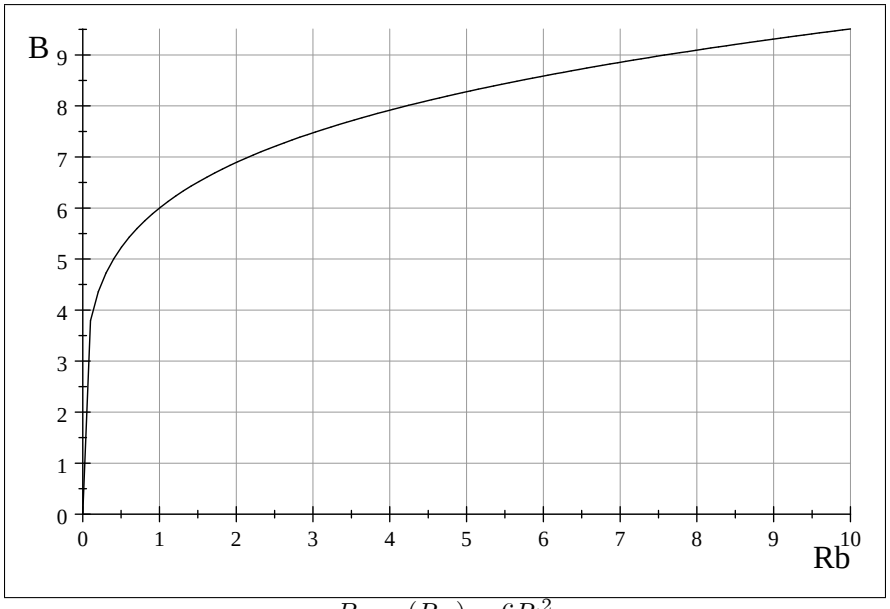
Maybe the two production functions look like

$O = f(R_O) = 3R^{.4}$



$O = f(R_o) = 3R_o^{.4}$

and $B = g(R_B)$



$B = g(R_B) = 6R_B^{.2}$

Efficiency still requires that we end up on UPF given the amount of opera and BBQ produced. But, in addition that we produce the BBQ and opera effecienty and the efficient amouts of them.

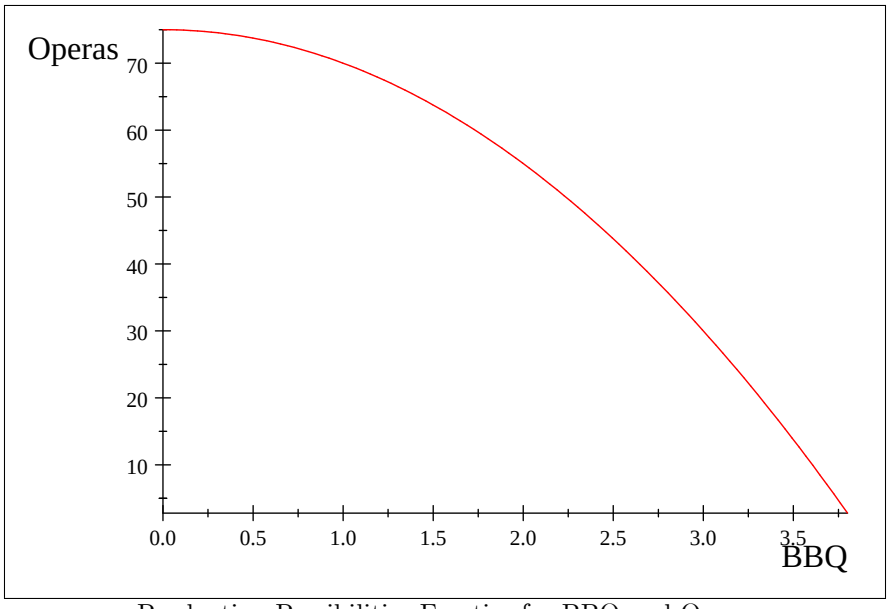
4.2.1 Efficiency in production

Given R and the state of technical knowledge, production is efficient if the only way to increase the production of one good requires that less of other goods be produced.

So, **in**efficiency in production means that it is, still, possible, by rearranging production, to increase the production of one good without decreasing the production of other goods.

Efficiency in production can be visualized in terms of a graph we have seen before the production-possibilities frontier, PPF.[5]

Draw a graph: BBQ on the horizontal, opera recordings on the vertical.



Production Possibilities Frontier for BBQ and Opera

[5] If you know the production functions for operas and BBQ can you determine the PPF for operas and BBQ? Yes. Make sure you understand how one would do derive the PPF.

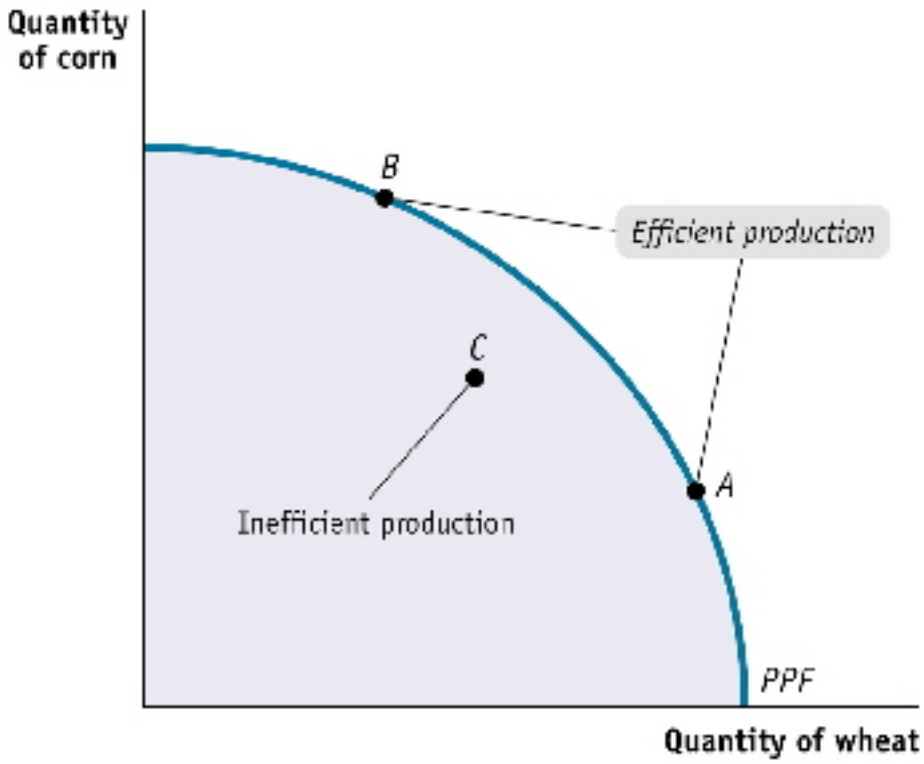
Points inside are inefficient, points outside impossible, points on the frontier are efficient in production.

How would you interpret the slope of this PPF? It is the rate society can substitute, in production, BBQ for Operas, given its resource constaint and the state of technical knowledge. To produce one more pound of BBQ society must give up x operas.

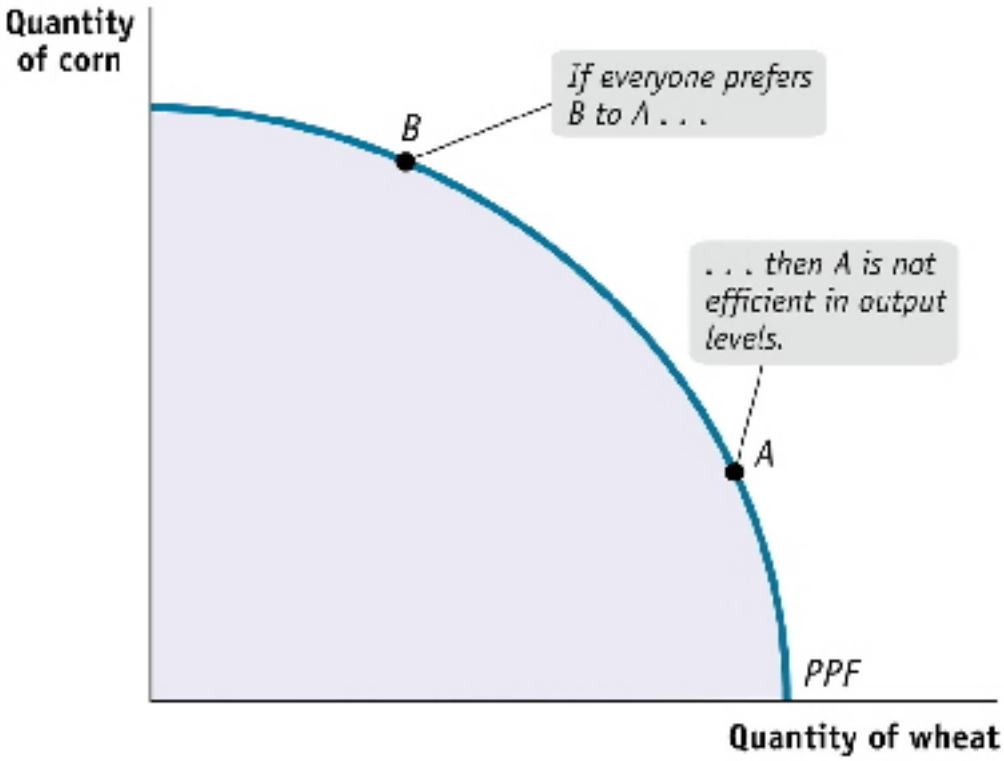
Specifically, the slope is $\frac{\triangle O}{\triangle B}|_{\triangle R=0}$, it is how much O has to change if we increase B by one unit holding constant society's resource constraint ($\triangle R = 0$). This slope is called the marginal rate of transformation of B for O (the rate at which society can transform one good into another).[6]. That is, $MRT_{BO} = \frac{\triangle O}{\triangle B}|_{\triangle R=0}$. It is a identifies the opportunity cost to society of producing more BBQ in terms of sacrificed operas.

[6] Sometime I get mixed up and incorrectly call it the marginal rate of technical substitution, which is the name for the slope of the isoquant.

The PPF from chapter 13 (first edition) in KW



The next graph from KW demonstrates that one can have efficiency in production while not having overall efficiency. Both B and A are efficient in production, but B is more efficient overall.


Quantity of corn
If everyone prefers B to A . . .
B
. . . then A is not efficient in output levels.
A
PPF
Quantity of wheat

4.2.2 In a world with both production and consumption, overall consumption requires efficiency in production, efficiency in consumption and efficiency in the interface between consumption and production.

Over all efficiency requires

- Society is operating on its UPF

A necessary condition, but not sufficient condition for this, is efficiency in production (society operating on its PPF).

5 The point of chapter 13 is to show that under certain conditions the equilibrium allocation of resources and distribution of goods in a perfectly-competitive market economy will be overall efficient

Competitive prices are the signals that make this possible: they send signals/information to all of the players.

Remember that in a competitive market economy the price of good or input x, p_x is the same for everyone. This is important.

The competitive firm takes the price it can sell its product, exogenous from it perspective, as information. The price signals to them how much to produce.

The consumer takes prices, relative prices, exogenous from her perspective, as information: the opportunity cost of buying x in terms of y. The prices are the information/signals she needs to figure out the bundle to buy to maximize her utility.

In a competitive industry,the industry suppy curve is determined by the horizontal summation of the the marginal cost curves for all of the firms in the industry.

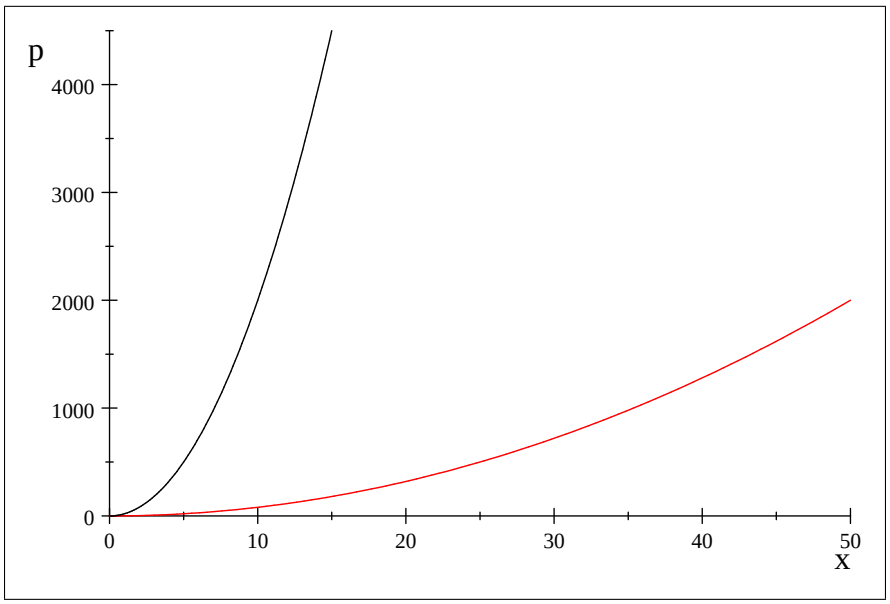
In my example there are 5 indentical competitive firms each with the black marginal cost curve.[7] Note that the competitive firm's marginal cost curve is its supply curve, how much it will supply at each price to maximize its profit.[8]

The red line is the horizontal summation of the the five black lines and the supply curve for the industry[9] For example, in this example at $p = 500$, each firm will want to produce 5 units to maximize its profits, and the five-firm industry will supply 25 units.

[7] In real competitive industries there are many firms, more than five.

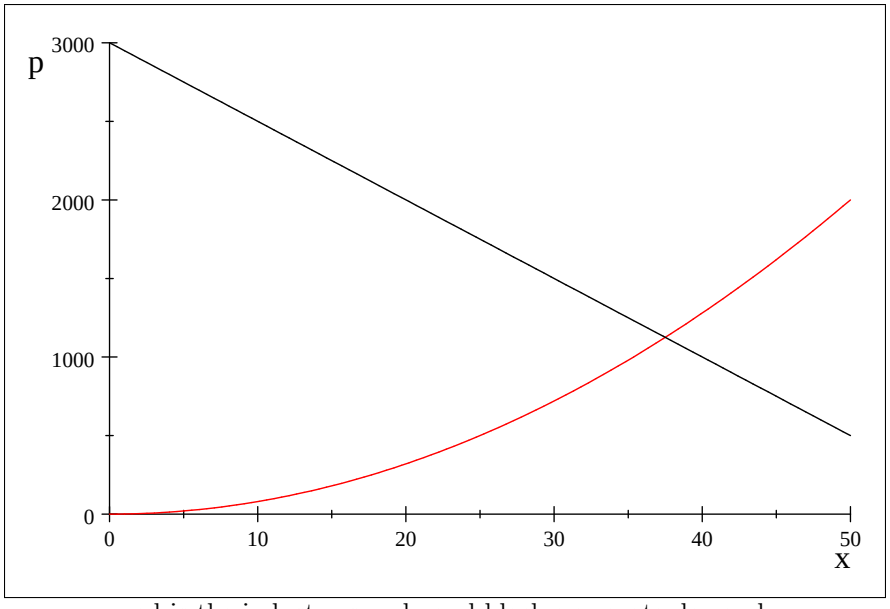
[8] I lie. Actually, the competitive firm's supply curve is its marginal cost cost curve above its average fixed-cost curve.

[9] In this example, I assumed $mc = 20x^2$. In which case the supply curve for three firms, each with this supply curve, is $p = 20(x/5)^2$. Note how x is replaced by $x/5$ where 5 is the number of firms in the industry.



black is mc for a representative firm, red is industry suppy

Putting industry supply and demand together



red is the industry supply and black aggregate demand

In a competitive market prices will adjust until supply equals demand. (in this example, the equilibrium price is approx.$1125 and the equilibrium quanity

is 37.5. At the equilibrium price everyone is buying their utility-maximizing amount at this price, and every firm is supplying their profit-maximizing amount at this price.

In competitive equilibrium for product x everyone who is buying x has a willingness-to-pay for each unit they purchase that is greater than or equal to the competitive price. And everyone who choose to buy no x a a wtp for x that is less than the market price.

This implies that one cannot increase efficiency by reallocating x among societies members: if the competitive market for beer is in equilibrium the individuals with highest wtp for beer are drinking the beer.

This is happening, simaltaneoulsy, in the markets for all consumer goods.

For fun, assume two goods: x_1 and x_2 , both produced competitively. Write down the budget equation for two consumers, Bill and George. Graph each of budget line. How are they different? How are they the same?

What do we know about the slopes of their budget lines?

In competitive equilibirum, where they are both maximizing their respective utilities, what does this imply about $MRS^G_{x_1x_2}$ and $MRS^B_{x_1x_2}$?

Will they neccesarily each be consuming the same amounts of x_1 and x_2? Why or why not? Make up some questions about this.

In competitive equilibrium
$MRS^A_{x_ix_j} = MRS^B_{x_ix_j}$ for all individuals and all goods.

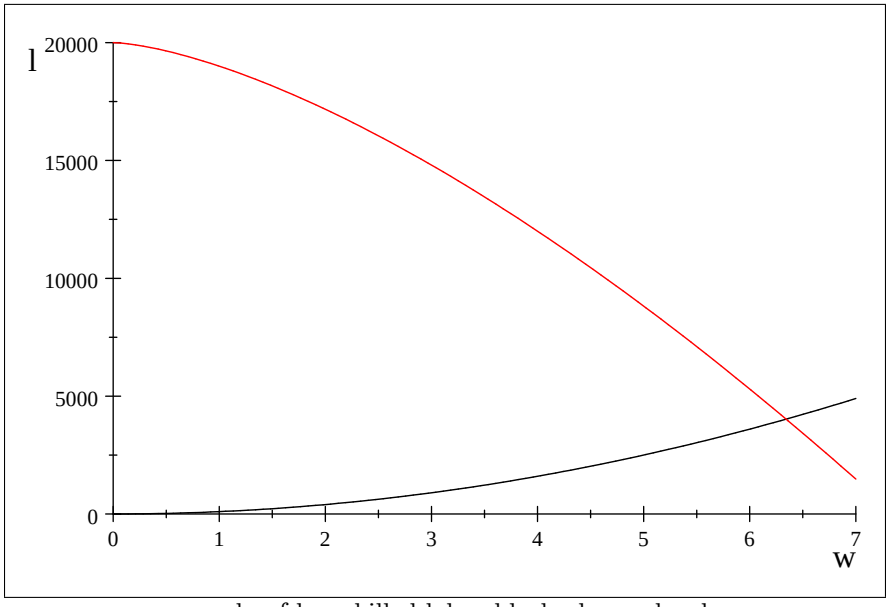
That is, in competitive equilibrium, for every pair of goods in the world, the rate at which individual A is willing to substitute good i for good j is the rate individual B is willing to substitute good A for good B. And this is true for all individuals and all goods. WOW.

This result is what causes the competitive equilibirum to be efficient in consumption, assuming there are no external benefits or costs associated with consumption.

If the competitive market for low-skilled workers is in equilibrium everyone who is low skilled and want to work at the equilibrium wage is working and all the low skilled who do not want to work at the equilibrium wage are unemployed, as they want to be.

Each competitive firm is purchasing just the number of low-skilled workers that they want at the equilibrium wage–they are hiring the profit maximizing amount.

For example, in Boulder the demand and suppy curves for low-skilled workers might look like



supply of low-skilled labor black, demand red

where w is the wage rate for low-skilled workers. In drew the curves so that the demand for low-skilled workers (demanded by firms) decines at an increasing rate as the wage rate increases, and I drew the supply curve such that the low-skilled want to work more as the wage rate increases the supply response is fairly inelastic in the wage-rate range shown.

In my example, the equilibrium wage for low-skilled workers is around $\$6.50/hr$ and around 4000 will work.

In competitive equilibrium for the whole economy, simaltaneously supply equals demand in all input markets (the market for low-skilled workers, high-skilled workers, oil, steel, land, etc.)

Note that since input markets are competitive all firms face the same prices for inputs. So the slope of the isocost line is the same for every firm.

That is[10], assuming two products, x_1 and x_2 and two inputs, l and k. Let x_1^f be the amount of x_1 produced by one of the competitive firm's producing x_1 and let $l_{x_1^f}$ be the amount of labor that firm hires to produce that amount of x_1

The isocost curve for a firm producing x_1 is

$m^f_{x_1} = wl_{x_1^f} + p_k k_{x_1^f}$ where $m^f_{x_1}$is the amount of money spent by a firm producing x_1

The isocost curve for a firm producing x_2 is

$m^f_{x_2} = wl_{x_2^f} + p_k k_{x_2^f}$ where $m^f_{x_2}$is the amount of money spent by a firm producing x_1

Graph each of the isocost lines with l on the horizontal axis and k on the vertical axis. For example, for a firm producing x_1,

$k_{x_1^f} = \frac{m^f_{x_1}}{p_k} - (\frac{w}{p_k})l_{x_1^f}$ identifies the different combination of x_1 and x_2 the firm can buy for $m^f_{x_1}$ dollars

The slope of the isocost line is $-(\frac{w}{p_k})$

It will be the same for firms that produce x_2

Put simply, every firm faces the same relative prices for inputs, so the slopes of the isocost lines are the same for all firms.

Each firm will use these same relative input prices to decide how what input combination to use to proudce their output at minimum cost.

Earlier in the notes we learned that a firm will minimize the cost of producing their chosen level of output by choosing the input combination where the relative price of the two inputs (the same for every firm) equals the rate at which the two inputs substitute for one another in the production of that firm's product. That is, for labor and capital, where $\frac{w}{p_k} = -\frac{\triangle k}{\triangle l} \mid_{\triangle x=0} = MRTS^x_{lk}$

[10] These details are for the mathematically inclined.

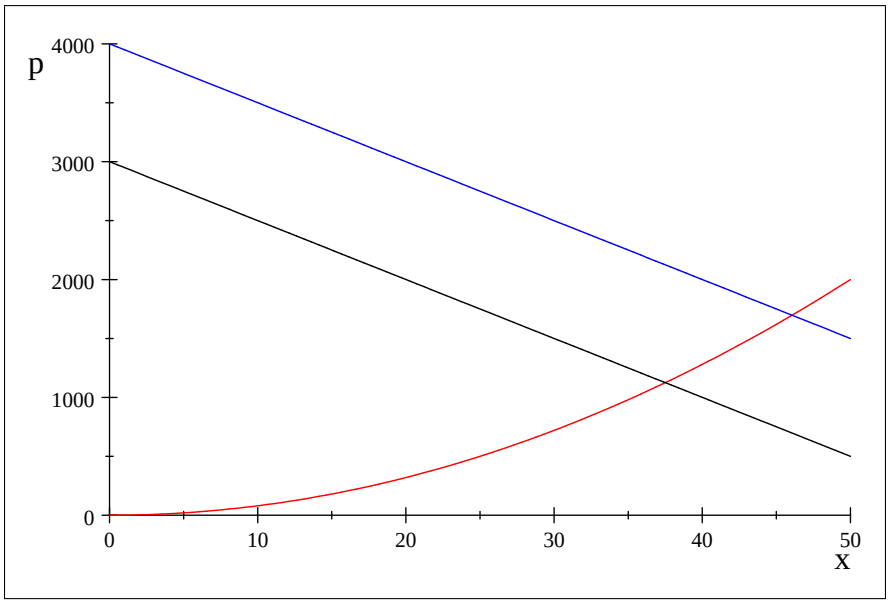
Draw an isocost line and an isoquant line for a firm minimizing its chosen level of production using two inputs, labor and capital

So for this firm the rate at which the firm is trading off labor for capital is equal to the price ratio of labor to capital

$$\frac{w}{p_k} = -\frac{\triangle k}{\triangle l} \mid_{\triangle x=0} = MRTS^x_{lk}$$

But since all firms face the same input prices, in competitive equilibirum every firm will be substituting labor for capital at the same rate. This will minimize the total cost of all that is produced, assuming input prices reflect all the costs of their use (no negative or positive external effects associated with the use of inputs).

If demand for a product increases (demand curve shifts right), efficiency dictates that more be produced. This is signaled to the producers by a price increase. The firms respond to this by producing more. Why? because it will increase their profits.



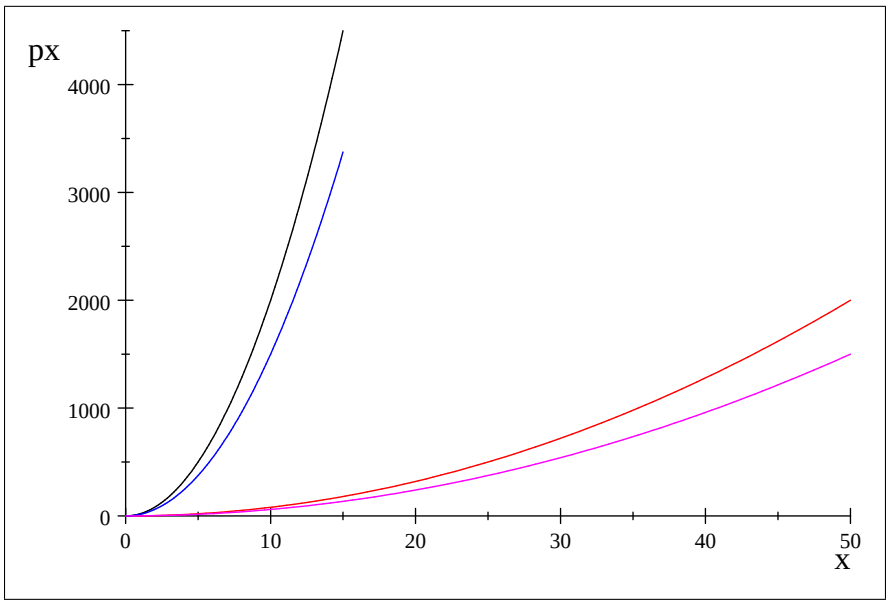
black is the initial demand curve and blue is ...

So, firms find out that demand for their product has increased (society wants more of it) when they see the price rising.

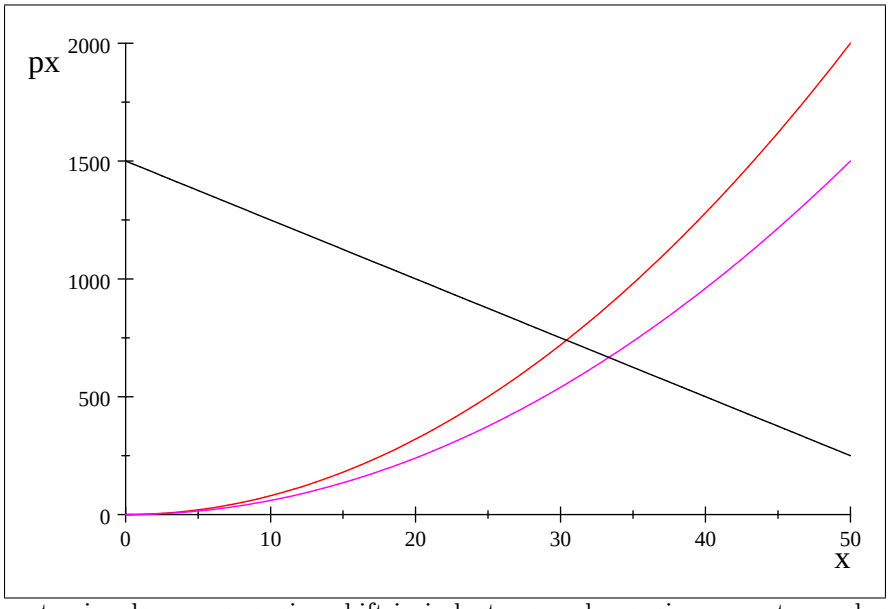
Graph a situation where the price of an input (labor) used to produce X decreases

Point is to show that if firms observe the price of the input decreases. The causes them to want to produce (supply) more at every p_x.

This causes p_x to start declining what causes consumer to buy more X.



input price decreases causing shift in mc and industry supply



input price decreases causing shift in industry supply causing more to produce and lower price

If oil becomes scarcer in the U.S. (maybe because Chinese demand for oil has increased) this is signalled to us in terms of a higher price for oil . Firms respond to the higher price of oil by some combination of shifting to less oil-intensive production methods and decreasing the production and consumption of goods whose production is oil intensive.

This makes us, the consumers, appropriately buy fewer oil-intensive goods - our utility-maximizing bundle has changed. We drive less, buy fewer blueberries from New Zealand, etc.

Critical components of this story are that that we all (consumers and firms) face the same prices and that prices adjust until supply equals demand.

6 An important term is under certain conditions

If these unmentioned conditions are not met, the competitive market fails and efficiency is not achieved.

The market will fail when prices do not fully reflect the social costs and benefits of the goods.

Put simply, this will happen when there is

- excess market power: monopoly and oligopoly power, rather than purely competitive markets
- poorly defined property rights
- externalities
- public goods (what is a public good??? see chapter ??)

Market failures will be discussed in chapters 17 and 18 (second edition), where we are going next to finish the course.

7 But, before we go there, two questions

Currently in the U.S. efficiency has been achieved, and this was achieved by an unregulated market system. True or false?

Another questions for you

Will a competitive market system achieve fairness/equity?

Let's put a question on the final about how markets are not designed to be fair.