Production Possibilities Curve (a.k.a. Production Possibilities Frontier)

Let's use the **Production Possibilities Curve** (PPC) to examine opportunity cost.

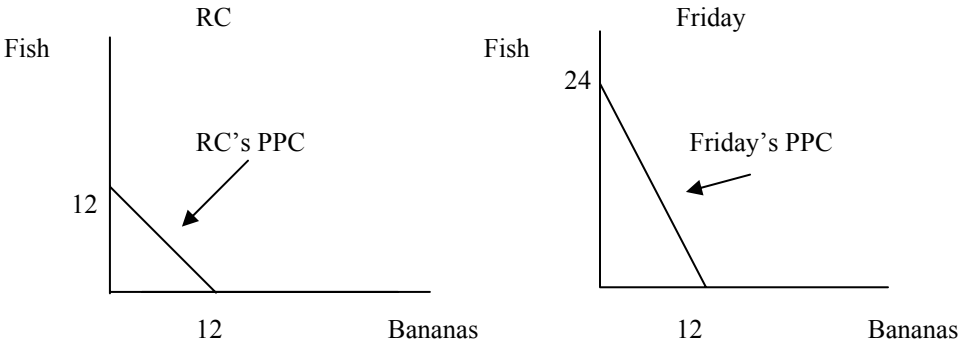
PPC - shows the maximum amount of goods and services that can be produced, for a given level of technology and resources.

Suppose we are on a deserted tropical island, with Robinson Crusoe (RC) and Friday. There are only two activities to spend time on, banana gathering and fishing. Each person has specific productive abilities.

PPC can be represented numerically and graphically (and algebraically if you want). We'll suppose the following figures represent the possible production, say from a day's work, that RC and Friday can achieve.

RC			Friday		
	Fish	Bananas		Fish	Bananas
	12	0		24	0
or	11	1	or	22	1
or	10	2	or	20	2
	.	.	.	.	
or	1	11	or	2	11
or	0.5	11.5	or	1	11.5
or	0	12	or	0	12

We will assume that all other linear combinations of production can occur. That is, we will connect the dots. Thus, we are assuming that half or even a 10^{th} of a banana can be produced. Don't worry about this.



Those points on or inside the PPC are feasible (possible). Points outside the PPC are unattainable (not possible). Points inside the PPC are inefficient, as society is not producing as much output as is possible with the given resources and technology. In other words, resources are being wasted. We could do better. Points actually on the PPC are efficient (society can do not better with the resources and technology). For an example of inefficient use of resources, consider Mark McGwire cooking meals for people, and Julia Child hitting clean up for the Cardinals. Do you think we could arrange resources differently and get more recipes and homeruns?

Notice that that the PPC holds technology and the amount of productive resources constant. If we add resources or improve technology, this will shift the PPC outward (to the right). This is economic growth. Likewise, if we have fewer productive resources or degrade technology, this will shift the PPC inward. This is economic contraction. We won't worry much about this, but in Econ 212 you will maybe?

Notice how scarcity is depicted. If RC wants more fish, he must produce fewer bananas. If he wants additional bananas, he must give up fish. (The PPC slopes downward)

Also, we have drawn a linear PPC. That is, the opportunity cost of producing a banana remains constant as we produce more and more bananas. This keeps the math simple, and we'll do this unless mentioned otherwise. **Read the book about why the PPC really is not straight.**

Absolute Advantage

People often get **absolute advantage** confused with **comparative advantage**. To determine who has the **absolute advantage** in an activity, we have both people completely specialize in that activity. Whoever is capable of producing the most of the good has the absolute advantage.

Specialization – producing a bundle different than the bundle you consume
Complete specialization – spending all time producing only one good

Note: we will not see complete specialization in consumption. This would require someone to consume only one good. This is very unlikely to occur, as we all consume a multitude of goods (clothes, ice cream, chick peas, liver). Imagine eating only SPAM, or wearing only wool clothing.

Thus, Friday has the absolute advantage in fish production, as when he completely specializes in fish production (produces only fish), he produces 24 F, where as if RC completely specializes in fish production, he is only able to produce 12 F.

Neither has an absolute advantage in banana production, as they both produce 12 bananas if completely specializing in banana production.

That being said about absolute advantage, it will be the comparative advantage that determines who produces what, as we shall see later. It seems like absolute advantage is the way to go, but it isn't always the case at all. Read on...

Opportunity Costs / Comparative Advantage

Recall that opportunity cost is the highest valued foregone alternative. In this example, deciding what is the highest foregone alternative is easy, as there are only two activities, fishing and banana gathering. If you produce more bananas, you are producing fewer fish.

Bananas
What does RC give up when he desires to produce one additional banana? One fish. RC's opportunity cost of producing a banana is 1 fish. (See RC's PPC)

What must Friday give up if he produces an additional banana? 2 fish. Friday's opportunity cost of producing a banana is 2 fish. (See Friday's PPC)

Fish
What is RC's opportunity cost of producing a fish? 1 banana.

What is Friday's opportunity cost of producing a fish? ½ banana.

Back to bananas. Consider who we should have producing bananas. If RC produces a banana, he must give up 1 fish. However if Friday produces a banana, he must give up 2 fish. RC is a relatively better banana gatherer, as he must give up only 1 fish to produce a banana, while it costs Friday 2 fish to produce a banana. We say RC is the low cost producer of bananas, as he has the lowest opportunity cost of producing bananas. It is smart, then, to have RC gather bananas.

We say that RC has a **comparative advantage** in production of bananas, because he is the low (opportunity) cost producer of bananas.

People (or nations) should **specialize in production of the good in which they have a comparative advantage**. As we shall see below in the example, if people or nations specialize in production of the good in which they have a comparative advantage in, and then trade, society as a whole will be made better off. There will be extra output that is created from rearranging production from the low-cost producer to the high-cost producer. We call this extra output the **gains from trade**. More on this later...

Now the fish. Friday has a lower opportunity cost of producing a fish than RC does (1/2 B vs. 1 B). We thus say that Friday is the low cost producer of fish. Thus, Friday has a comparative advantage in fish production. To produce an additional fish, he must give up only ½ B while RC must give up 1 B to produce an additional fish.

Note: it will always be the case that if person A has the comparative advantage in one good, person B has the comparative advantage in the other good. (In the unlikely case where both have the same opportunity costs, neither will have a comparative advantage in either activity).

Even in the case where person A has an absolute advantage in both goods (person A is absolutely better at producing both goods), person B will still have a comparative advantage in one of the goods, and thus A and B will benefit from trading. Or in other words, just because the US may be able to produce beer and marijuana better than Mexico, that does not mean we should isolate ourselves from trading with Mexico. In fact, Mexico likely has a comparative advantage in marijuana, and hence we should trade for Mexican marijuana. Mexico is bad in both activities, but they will specialize in the activity in which they are relatively less bad.

Specialization and Exchange in Action – this should convince you that comp. advantage isn't silly

Autarky

Autarky is just another term for self-sufficiency. Here RC and Friday consume (eat) the same bundle of goods that they produce (gather and catch). That is, no specialization, no exchange.

For a starting point (although arbitrary) we will begin with each person spending half of his time on each activity. We will compare this outcome to the specialization and exchange outcome.

	Production = Consumption	
	Fish	Bananas
Friday	12	6
Crusoe	6	6
Total	18	12

Specialization and Exchange

Friday, having taken Econ 211 and having learned about comparative advantage, has an idea. He realizes that Friday has the comparative advantage in fishing (is a relatively better fisherman than Crusoe), and realizes that Crusoe is the relatively better banana producer. Friday says to Crusoe, "I am a good fisherman, and you're a good banana gather. Why don't you stop fishing, and spend all your time gathering bananas. I spend lots of time fishing, and then I'll trade you fish for bananas."

	Production		Exchange		Consumption	
	Fish	Bananas	Fish	Bananas	Fish	Bananas
Friday	20	2	-7	+5	13	7
Crusoe	0	12	+7	-5	7	7
Total	20	14	0	0	20	14

They agree to produce the above combinations, which of course are points on their individual PPCs, and then agree to trade, as outlined above.

Compare to autarky. There are an extra 2F and 2B produced. Each of RC and Friday gets to consume an extra banana and an extra fish. Neither is working any more or working any harder. No new resources have been discovered. Is it that trade that is productive? Yep. We call the extra stuff produced the "**gains from trade**". The gains from trade are literally the extra two bananas and fish produced (and consumed).

Where do the extras come from? Why do we say trade is productive?

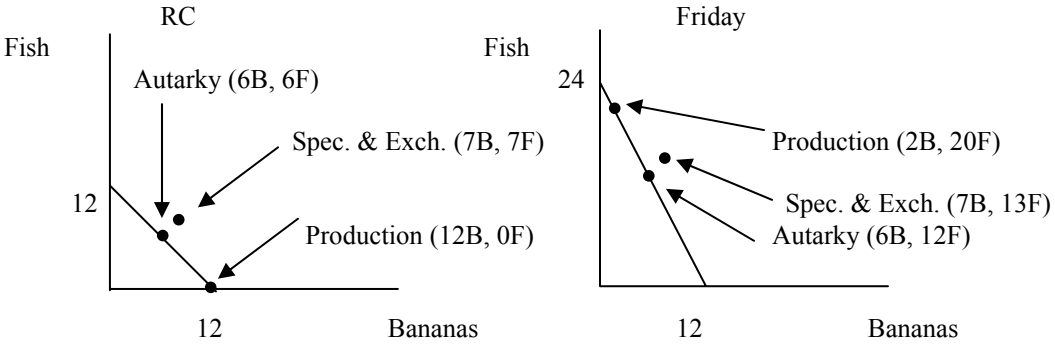
Specialization enables Crusoe to cut back on his high cost activity (fishing) and expand time spent on his low cost activity (banana gathering.) Likewise, specialization allows Friday to spend extra time on his low cost activity (fishing) and cut back on his high cost activity (gathering bananas). Each spends more time on the activity that they are "relatively good" at. By specializing, and producing the good in which they have a comparative advantage, each gains. **However, it is trade that allows them to specialize. You can't have specialization without exchange**. RC will never agree to spend all his time producing bananas unless he can trade with Friday (he doesn't want to eat all bananas). It is the act of exchange (trade) that allows the specialization to occur, which allows the extra output to be produced. We say trade is productive.

More details, at the risk of confusing you a bit?

Consider switching production of one fish from RC to Friday. That is, RC produces one less fish, leaving him time to produce one more banana (slides along his PPC). However, Friday produces an extra fish, but most only give up ½ banana (also sliding along his PPC). Thus, society gains 0.5 bananas from this switch. This 0.5 banana is the gains from trade.

	Fish	Bananas
Friday	+1	-0.5
RC	- 1	+1
Total	0	0.5

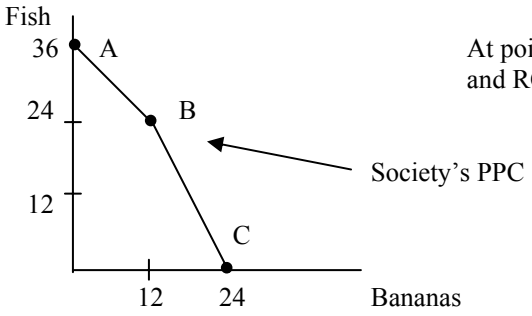
Another look at the PPC



Trade allows both people to consume at a point that was outside their PPC; that is, they get to consume at a point that was previously unattainable (opportunities have been expanded). Neato! Trade is good!

Society's PPC

There are three important points on society's PPC. First, have both people completely specialize in banana production (C). Then, both people completely specialize in fish production (A). Finally, have each person completely specialize in the activity in which they have the comparative advantage (B). Connect the dots, but notice there is a kink at point B. You're curve should bow outwards.



At point B, we have Friday producing 24 Fish and RC producing 12 Bananas.

Suppose society decides that it wants 30 fish and as many bananas as possible. How should it arrange production? First, it makes sense to have Friday produce as many fish as possible, as he is the low-cost producer of fish. He will spend all of his time producing fish, and then, since society wants even more fish (Friday can only produce 24), only then will RC begin to produce fish (he is the high-cost producer of fish). Thus, we want to exhaust the production of the low-cost producer before we have the high cost producer. Thus, for points on the upper section of the PPC (if society wants lots of fish), Friday will always be producing 24 fish.

If society wanted lots of bananas, the logic is just the same. First, exhaust the low-cost producer, and then bring in the high-cost producer. If society wanted 18 bananas and as many fish as possible, first have RC (low-cost) produce as many as he can, then have Friday (high-cost) begin producing bananas. Thus, on the lower section of the PPC, RC is always producing 12 bananas. See Lecture 2B for more details.

What if we want 12 fish and as many bananas as possible?
What if we want 8 bananas and as many fish as possible?

If you have each person specialize in the wrong activity, you will get a kink, but this will make your PPC bowed inward. You will end up at an inefficient point. Don't do this, it is communist.

How would we draw the PPC for society if there were three people?

How do I know what point along the PPC that society will choose?

Answer: Beats me, take Econ 314. It depends on how society puts relative values on fish and bananas. If they likes fish a great deal compared to bananas, we'd expect something on the upper half, and vice-versa.

Draw your self the following PPC. Put tanks (GI Joe type tanks) on the vertical axis, and cars on the horizontal axis. Now choose a point that society might choose for the year 1939. Any old point will do.

Do you think that US society would choose a different point in 1944 than they did in 1939? Does this have something to do with a different relative value of tanks versus cars in 1939 versus 1944? Why might the relative value have changed? Why 1944?

Other tips / reminders

- The opportunity cost of one activity is always measured in terms of the other good. That is, if you want to know the opportunity cost of producing a banana, it is always measured in terms of fish.

- If one person has a comparative advantage in one activity, the other person must have the comparative advantage in the other activity. (Even if one person has an absolute advantage in both goods).

- If you calculate a person opportunity cost of one activity, that person's opportunity cost of the other activity is the reciprocal of the first. For example,

Friday's opportunity cost of producing a B = 2F
Friday's opportunity cost of producing a F = ½ B

- There is a short cut method to determine the opportunity cost of each activity without writing out the whole production possibilities chart. So long as we have linear PPCs (and we will), use the endpoints to determine the opportunity costs.

  For Friday, the endpoints are (0B, 24 F), and (12B, 0F). Suppose initially, Friday is producing 0 fish. Now, he decides to produce 24 bananas. What has he given up to produce the 24 bananas?

  It follows that Friday's opportunity cost of producing 24 F must be 12 B. Divide each by 24. Thus, his opportunity cost of producing 1 F = 12 B / 24 = ½ B.

  Likewise, the opportunity cost of 12 B is 24 F. Thus, the opportunity cost of 1B = 24 F / 12 = 2 F.
  (The mathematically inclined will realize that I am looking at the absolute value of the slope of the PPC. The rest of you needn't worry.)

<u>On the "trade price" – How did I know 7 F for 5 B would work?</u>

In our example, the RC and Friday found it mutually beneficial to trade 7 F for 5 B, or 1.4 F for each banana. They agreed to this trade because both stood to benefit from the trade. Both ended up with an extra banana and an extra fish. How did I know that this would work? What is the range of possible "prices" for a banana where the trade is mutually beneficial?

Answer: it depends on the range of opportunity costs that the people have of producing a banana.

In our example, RC's opportunity cost of producing a banana is 1 F.
Friday's opportunity cost of producing a banana is 2 F.

It turns out that any "price" of a banana between 1 F and 2 F (in our example it was 1.4 F) will be mutually beneficial. Or in other words,

Low cost producers opp. cost of 1B < "trade price" of 1B < high cost producer's opportunity cost of 1B

In our example, 1F < 1.4 F < 2 F. Thus, in our case, 7 F for 5 B (1.4 F per banana) satisfies the criteria. So does 9 F for 5B. So does 1.9756 F for 1 B.

If the "trade price" does not lie within the range above, one of the parties will not find the exchange beneficial, and the exchange will not occur. See homework.

<u>What should I read?</u>

See the last lecture's reading list. This is in there somewhere in the first three chapters.