Production possibilities

In this column, **Peter Smith** introduces some key economic concepts that you will meet in the first weeks of your course

When you begin to study economics, one of the first things that will be said to you is that economics is about **scarcity**. It is about how we make choices between alternative possibilities. This, in turn, leads to the crucial notion of **opportunity cost**.

Scarcity is important because it is a universal feature of human life. All societies face scarcity for the simple reason that resources are limited relative to human wants. It is not possible to supply everything that everyone would like to have. As soon as we accept this fact, we realise that for every choice that is made, something is given up. If I choose to spend money on a DVD, that money is no longer available to be spent on something else. If I choose to spend my leisure time watching television, I cannot at the same time be out enjoying a good dinner at a restaurant.

Opportunity cost is, then, the value of the next-best forgone alternative that could have been chosen. The opportunity cost of a DVD might be the bottle of wine that I could have chosen to purchase instead. The opportunity cost of spending an evening watching television is that I did not get to go out to dinner.

In many situations, economists like to draw diagrams in order to illustrate their ideas and to help to analyse choices and situations. A diagram that can help us to interpret the notion of opportunity cost is the **production possibility frontier**, sometimes known as the **production possibility curve**. This simply shows the production opportunities open to an individual, a firm or a society.

Another method that seems to appeal to economists is the use of **models**. As the world is a complicated place, it is often helpful to make some simplifying assumptions in order to model a decision making process. Once having analysed things in a model, we can then extrapolate to a more general situation. So, we will analyse the notion of opportunity cost, and introduce the production possibility frontier (*PPF*) by making some assumptions, and setting up a simple world.

Desert island castaway

Suppose that Robyn Cruise has been cast away on a desert island. She finds that she has to spend time every day collecting food in order to survive. Food is available in the form of fish and fruit. We assume that Robyn spends a certain amount of time each day on food collection, needing to balance this with building a shelter, getting a beacon ready to attract the attention of passing ships and so on. If she spends all her time fishing, she can expect to catch six fish per day, whereas if she just focuses on finding fruit, she can collect 12 portions.

One way of looking at this is that the opportunity cost of six fish is 12 pieces of fruit, and the opportunity cost of 12 pieces of fruit is six fish. In other words, the opportunity cost of one of the items of food is defined in terms of what must be forgone. If Robyn can divide her time between the two types of food collection, then various combinations of the two items are possible. For example, if she spends half of her food time in collecting fruit, and the other half fishing, she will end up with six pieces of fruit and three fish. In this case, we see that if Robyn wants to spend time catching one extra fish, she forgoes two portions of fruit, so the opportunity cost of a fish is two pieces of fruit.

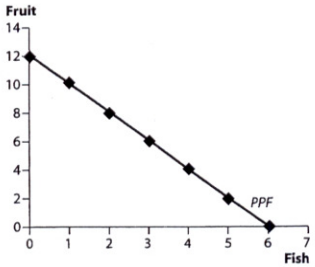


Figure 1 *Fruit and fish*

The range of possibilities can be shown on a diagram such as Figure 1, which shows the situation just described. The line on the diagram marked *PPF* shows the production possibilities faced by Robyn. It joins up all the possible points at which Robyn can choose to be. Of course, this simple example is a little unrealistic. Robyn can only be at the points marked with diamonds, as it is not possible for her to catch just half a fish. However, when we start to generalise our model and talk about a firm (or a society) choosing to produce combinations of two goods, there is more flexibility, so we can interpret the *PPF* as showing all the combinations of the two goods that can be produced.

Furthermore, we can interpret the *slope* of the *PPF* as telling us about the relative opportunity cost of the two items, as the steepness of the *PPF* tells us about the rate at which one item can be substituted for the other.

Diminishing returns

This very simple diagram can be generalised to illustrate some other important concepts. For example, we might argue that if Robyn spends all her time collecting fruit, and none fishing, she may find the last portions of fruit more difficult to obtain. In other words, beyond a certain point, her productivity in collecting fruit begins to fall, because she has to go further afield or climb to higher parts of trees in order to get more fruit. Similarly, it may be that, after a while, she gets bored with fishing or that she has exhausted the number of fish in her favourite fishing spot.

How will this affect the *PPF*? Think about it for a moment before reading on…

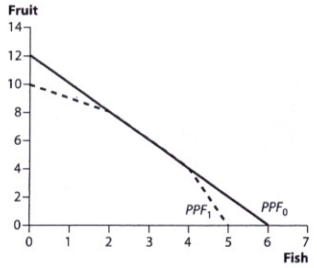


Figure 2 *Fruit and fish again*

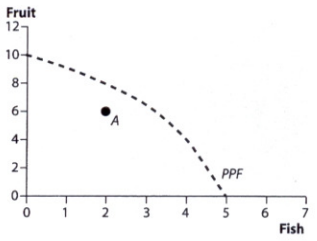


Figure 3 *Unemployment*

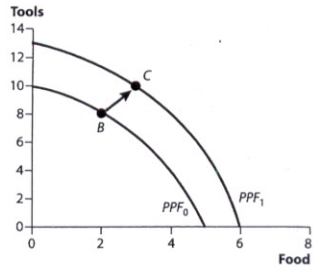


Figure 4 *Economic growth*

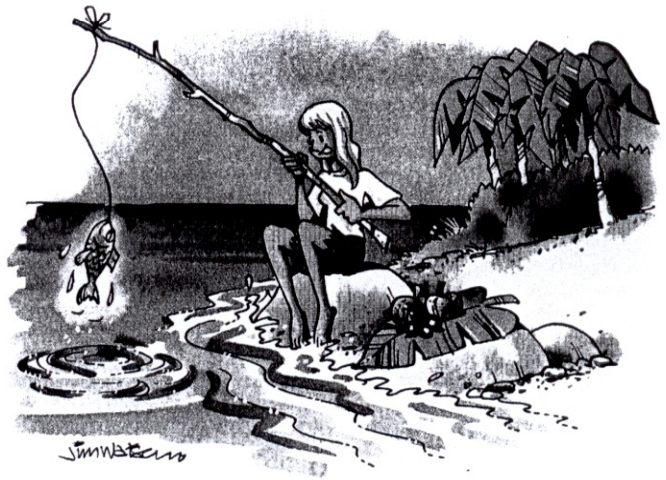
The change in Robyn's productivity affects the opportunity cost of one item in terms of the other. For example, suppose that once Robyn has caught four fish, the remaining time only produces one further fish. Similarly, suppose that the first eight portions of fruit are fine, but that beyond this Robyn slows down, and only collects two further fruit portions during the rest of her time. This can be seen as a change in the shape of the *PPF*, as shown in Figure 2. PPF_0 is the original *PPF*, and PPF_1 shows the effect of the productivity change, in that the curve bends at each end. This reflects the fact that the more time Robyn devotes to one activity, the lower the marginal return from that activity. You will meet this notion as the **law of diminishing returns**.

Unemployment

Now consider a situation in which Robyn spends some time catching fish (netting two fish), and some time gathering six portions of fruit, but then decides that, as she is feeling tired and not very hungry, she will take a break and go swimming. How would we interpret this in terms of our diagram?

Consider Figure 3. With two fish and six fruit, Robyn is now at point *A*, which is located *inside* the *PPF*. Robyn is not utilising her time to the full, so is not reaching the production frontier. This could also happen if Robyn uses her time poorly, wasting time in walking back and forth between her fishing place and the trees. This lack of efficiency in her use of time would also mean that she would not be producing as much as she could if she made full and efficient use of her time.

In the context of a real-world economy, we would interpret such a situation as unemployment. We would argue that the economy was not utilising its resources as efficiently as it could, leaving some of its resources unused.



Economic growth

Here is one final idea. Suppose now that Robyn divides her time between gathering food and making tools that will improve the process of food collection in the future. For example, consider Figure 4. PPF_0 represents the initial production possibility frontier. Robyn produces two units of food, but also eight units of tools. This then makes her more productive, so that in the following period, the *PPF* moves to PPF_1, and Robyn is able to expand her production of both food and tools, moving from A to B.

This expansion of productive capacity is known as economic growth. It is the process by which an economy adds to its stock of capital goods in order to be able to produce more in the future, so that its citizens can become better off.

An important point to notice is that in deciding to devote some of her time to producing tools, Robyn must forgo food in the present. Similarly, if a society wishes to expand its stock of capital goods to produce more in the future, it must sacrifice present consumption. This activity is known as **investment**. Investment entails the forgoing of consumption in the present in order to produce more in the future.

Summary

The production possibility frontier is a useful tool in economics. It highlights the nature of opportunity cost and emphasises the way in which individuals, firms and economies need to make decisions about how to allocate their resources wisely in order to reach the production possibility frontier, seeking to push it outwards over time in order to improve living standards. You will meet many other useful diagrams during your study of economics. This can be a powerful way of analysing important economic ideas.