Week 1 practice problems solution

Elements of Microeconomics (discussion section 4)

John Green

Question 1: Cost

You are trying to decide whether to go on a beach trip during spring break. What costs would you need to consider in making this decision?

Answer:

- Direct cost of the vacation: transportation, food, renting a house ...
- Money you could make if you worked your part-time job instead
- Studying you could get done: preparation for finals, work on semester projects, etc.

There are many things you could include here, but a good answer will specifically mention the phrase *opportunity cost*: you need to consider not just the direct costs of going on the vacation, but what you could have done with that time and money otherwise. The second two items are examples of this, but there are others.

Question 2: PPF of a firm

Let's start an Italian restaurant that makes pizzas and sandwiches.

1. What will our production possibility frontier look like?
2. Why will it take the shape that it has?
3. How can we read the opportunity cost? Does it matter which part of the PPF we look at?
4. Why might the shape change over time?

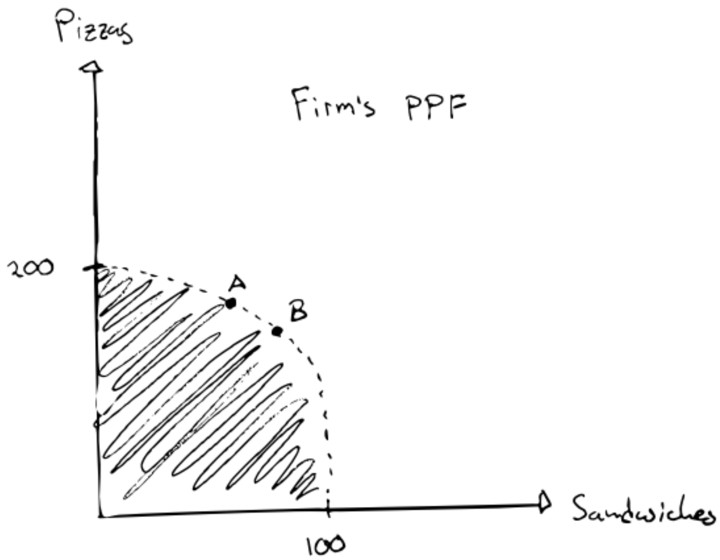

Figure 1: Production possibility frontier of the Italian restaurant

Answer:

1. I did not give you enough information to draw a function with specific values, but the important thing is that it should be concave (rounded) and look something like figure 1. I provide some example intercepts which I will use in part 4, but these could be any numbers.

2. It takes this shape because of technology constraints: we face diminishing returns for switching production from one technology to another. Let's drill down with our example.

Say we have a deli counter to make sandwiches, and a kitchen in the back to make pizzas. In addition we have a team of expert sandwich makers and a team of expert pizza chefs. Suppose we are using all of our resources (our space, our equipment, and our labor) to make only sandwiches. This means our ovens are being wasted, and our pizza artists are taking forever to produce one sandwich. When we start switching some of the pizza-making equipment over to doing what it is meant to do (making pizzas), we at first see really big benefits: sacrificing one sandwich in output, we might be able to make several pizzas.

This will quickly start to even out, as we get to the point where most of the sandwich workers/equipment are being used for sandwiches and most of the pizza workers/equipment are being used to make pizzas. If we continue switching our resources over to pizzas, we start to face the opposite problem: our sandwich experts are being made to make pizzas, and they're not doing a very good job. So the slope of the PPF grows very flat, since we can only get a small amount of pizzas for the amount of sandwiches we give up.

3. Take any two points A and B and make up some numbers: suppose at A we produce 50 sandwiches and 180 pizzas, and at point B we produce 70 sandwiches and 150 pizzas. When we move from A to B, we are producing more sandwiches than before, and so we want to express the oppportunity cost of that increased production in terms of pizzas we are no longer making:

$$\text{opportunity cost } = 180 - 150 = 30 \text{ pizzas}$$

We also might be interested in looking at the opportunity cost per sandwich. We can do this by adding the change in sandwiches produced into the denominator:

$$\text{opportunity cost } = \frac{180 - 150 = 30 \text{ pizzas}}{70 - 50 = 20 \text{ sandwiches}} = 1.5 \text{ pizzas per sandwich}$$

However, it is clear from the shape of the graph that it matters where we are on the PPF because the slope is not constant. To see this, check what the opportunity cost (on a per-unit basis) would be if we moved from producing *only* pizzas to producing *only* sandwiches.

4. Things that might change the shape of the PPF over time will be related to the production process: a new type of pizza oven that is more efficient, a change in the cost of labor, or a new technique for making 10 sandwiches at one time. Let's think about a specific example, and use it to distinguish a change in the *shape* of the PPF due to a change in technology from an overall shift in the entire PPF due to a change in resources.

Suppose a new pizza oven makes us able to produce 50% more pizzas than we were before, holding the input (workers, ingredients, etc.) fixed[1]. Instead of producing 200 pizzas when we are devoting all of our resources to pizzas, we can produce 300. However, nothing has changed for our ability

[1]This is a pretty magical pizza oven since we can make more pizza without using more ingredients.

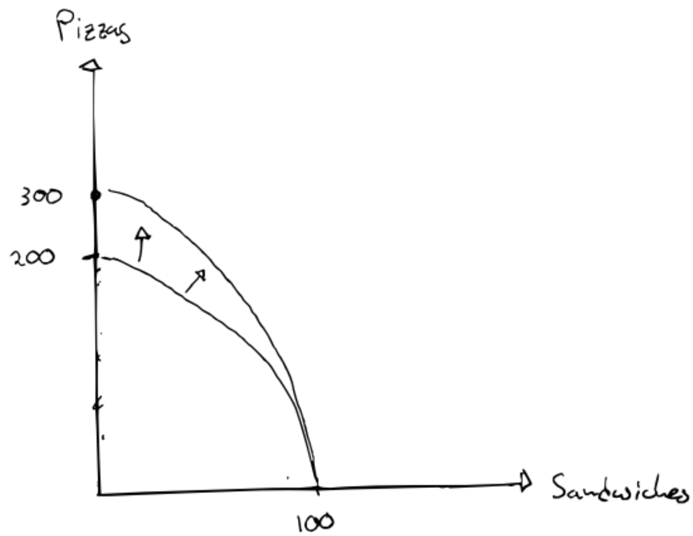

Figure 2: A change in the shape of the PPF

to produce sandwiches, so we can still only produce 100 when we devote all of our resources to sandwiches. So the shape of our PPF has changed, illustrated in figure 2.

Now suppose that we have a new investor, and he has given us double the resources (staff, space, equipment, ingredients, etc.). Also assume that we have "constant returns to scale" for each product — this just means that twice the workers with twice the equipment can produce twice the pizzas. Now we haven't changed anything about the technology itself, so the tradeoff between making pizzas and making sandwiches is the same as before, we can just now make twice as many of them. This means that the *shape* of our PPF is the same, it's just moved further out in a uniform way, as shown in figure 3.

Question 3: CPF of a consumer

Now suppose we are *going* to the Italian restaurant with a group of friends, and we want to decide what to order. Pizzas are \$10, sandwiches are \$5, and we have \$100 to spend.

1. What will our consumption possibility frontier look like?

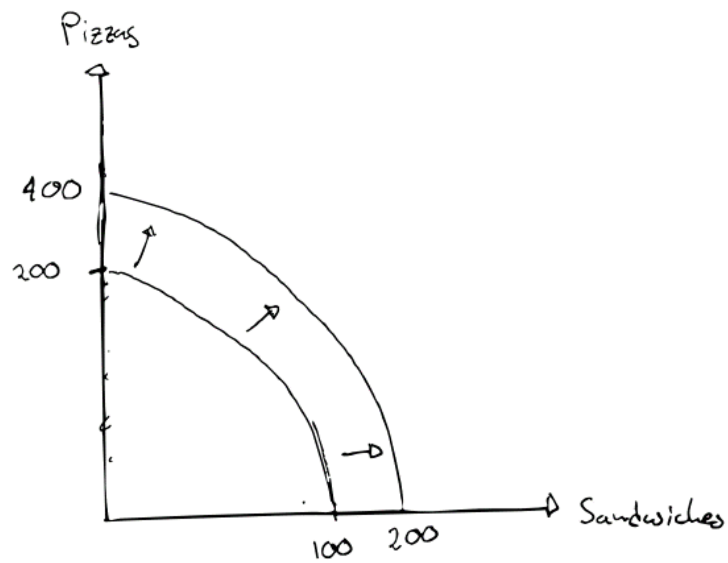

Figure 3: A shift in the PPF

2. What is the opportunity cost of a pizza? Does it matter where on the CPF we are?

3. What will happen to the CPF if we have \$200 to spend?

4. What will happen to the CPF if the price of sandwiches increases to \$10?

Answer:

1. In this case, our CPF is just a straight line. Unlike with the PPF, there are no decreasing returns as we buy more sandwiches and fewer pizzas. The consumption set and consumption possibility frontier are shown in figure 4.

2. Since I provided specific numbers, we can actually draw the CPF (also called a budget line) and do some calculations. We have \$100 and pizzas cost \$10, so if we only buy pizzas, we can buy 10. Thus we put one point at 10 pizzas and 0 sandwiches. Alternatively, we can buy only sandwiches: since they are \$5, we can buy 20 of them if we buy no pizzas.

We know from algebra that two points on a straight line are all that we need to calculate its slope:

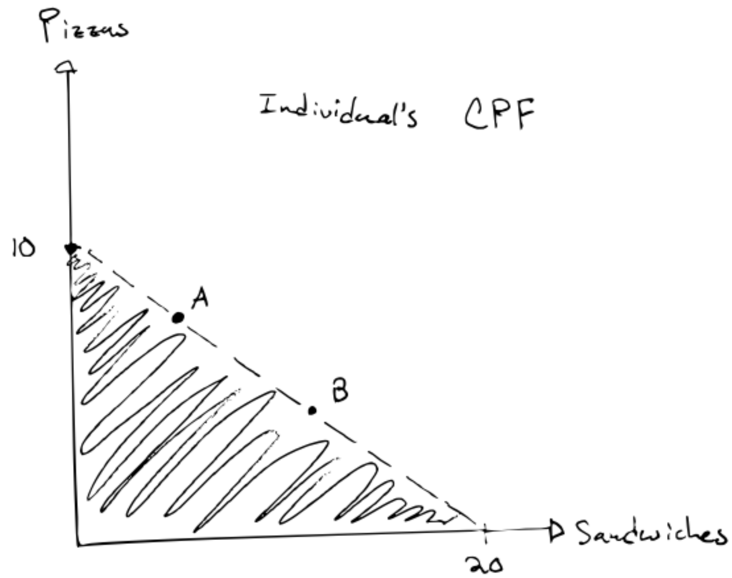

Figure 4: Consumption possibility frontier for Italian food

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)} = \frac{0 - 10}{20 - 0} = -\frac{1}{2}$$

We can also see that the line intersects the y (pizza) axis at 10. Recalling the formula for a line $y = mx+b$, where m is the slope and b is the y-intercept, we can describe the CPF with the equation:

$$y = -\frac{1}{2}x + 10$$

or alternatively

$$\text{pizzas } = -\frac{1}{2} \text{ sandwiches } + 10$$

To see this is true, just throw in one of our points and double-check that both sides agree.

So, what is the opportunity cost of pizza? Since the slope is constant, it doesn't matter which points we use to test this out, and we may as well use the end points of the line. If we start off with 0 sandwiches and 10 pizzas, and move to 20 sandwiches and 0 pizzas, our opportunity cost is $\frac{10 \text{ pizzas}}{20 \text{ sandwiches}} = \frac{1}{2}$ pizzas per sandwich.

3. With \$200 instead of \$100, we can now afford 20 pizzas and 0 sandwiches on the one end, or 40 sandwiches and 0 pizzas on the other. In other words, we have moved out our CPF and expanded the size of our possible consumption set. This is a shift in our CPF, but it does not change the shape of it (note that the slope is the same — check this!).

4. Return to only having \$100 to spend. While we can still afford 10 pizzas and 0 sandwiches, with sandwiches costing \$10 we now can only afford 10 sandwiches and 0 pizzas. This causes a pivot to the left of the x-axis intercept, and our entire consumption set has shrunk. This actually changes the *shape* of the CPF, as opposed to the example in question 3.

Question 4: Italian restaurant economy

Suppose the entire economy consists of Italian restaurants: during half of the week we work in one, and during the other half we buy food from them.

1. What does the circular-flow diagram look like?
2. What is missing from our model?

Answer:
Your circular-flow diagram might look something like figure 5.

Of course this is an extremely simplified ("stylized" in economics-talk) model of the economy, and there are plenty of things you could mention that are left out. One obvious example would be a public sector; perhaps workers and firms pay taxes to a government, which in turn provides services to them. Another example would be household savings and a financial sector.

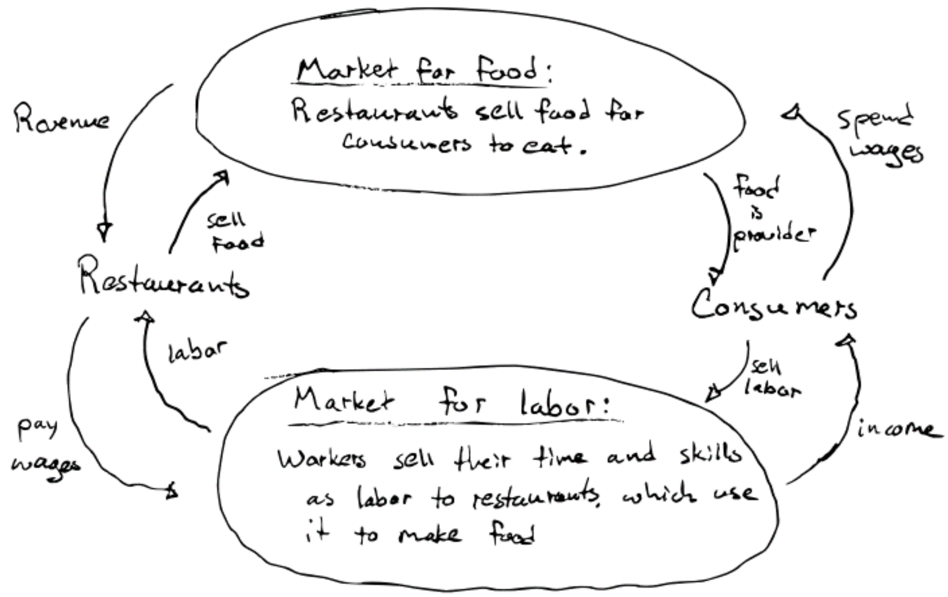

Figure 5: Circular-flow diagram of the Italian restaurant Economy