

1 | PRODUCTION POSSIBILITIES CURVES

Purpose: To use the production possibilities curve (PPC) model to understand scarcity and constrained choice. To emphasize the distinction between movements along a PPC and shifts the PPC. To show the concept of opportunity cost using the PPC model.

Computer file: **ppc98.xls**

Instructions and background information:

Open the Excel file **ppc98.xls**, and choose whether you want to do the problems as practice, or whether you want to do the problems to hand in for credit.

A production possibilities curve (PPC) shows the maximum amount of one good that can be produced given a production level for some other good, and given the total amounts of inputs available for production of both goods, and given the technology of production. The PPC shows the limits on outputs of goods because society does not have unlimited resources. And it shows the trade-off society must bear if more of a good is to be produced.

Attainable levels of output are those that can be produced with the current resources (inputs) and technology. *Unattainable* levels of output cannot be produced with current resources and technological know-how. *Efficient* levels of output occur when the maximum output of one good is being produced, given the output level of the other. Efficient output levels must lie on the production possibilities curve. Output levels are *inefficient* if it's possible to produce more of everything using only your current resources and know-how.

The production possibilities curve for these problems shows the quantities of pizza and pasta that can be produced given the amount of labor input available for production, and given the current technology for producing the goods. (There may be other inputs than labor, such as wheat or tomatoes, but they are being held constant for the problems you will have to work out here.)

Examine carefully the parts of the screen that show data. There are baseline and current values for all of the variables: labor, pizza and pasta output, and technical efficiency. You will be able to change the current values (within limits), and the graph will show the results of your choices.

You can change the amounts of pizza and pasta produced by choosing different amounts of pizza. The spreadsheet will automatically compute the corresponding maximum amount of pasta. Labor is the amount of labor available for the production of *both* of the goods. Labor will be allocated to pasta and pizza depending on how much of each of the goods you want to produce.

Near the bottom of the spreadsheet you will see some baseline and current values for “efficiency”. These values are indices that measure how productive labor is in producing each of the goods. For example, the baseline value for labor efficiency in producing pizza is .50. This means that, for pizza, an increase in labor of 1 percent will increase the output of pizza by .50 percent. Correspondingly, an increase in labor by 10 percent would increase pizza production by 5 percent. Increasing an efficiency value makes labor more efficient in the production of a good; it is just like having a technological improvement.

Experiment with the worksheet by changing the current values of labor, pizza, and the technology of production and seeing the effects on the production possibilities curve. Be sure you have a good enough grasp of what happens so that you can predict the general consequences for the position of the production possibilities curve of each kind of change.

The (marginal) opportunity cost of a good is the value of what must be given up to get one more unit of the good. For example, in a world that has only pizza and pasta, the marginal opportunity cost of pizza is the amount of *pasta* that must be given up to get one more unit of pizza. For example, if pizza output is 10, the opportunity cost of one more pizza is the amount of pasta you must give up in order to produce 11 units of pizza.

For the PPC you’ll work with the cost of an extra pizza is higher the more pizza you produce. Marginal opportunity cost of pizza is the numerical value of the slope of the PPC. It is the “bowing out” of the curve from the origin that shows the property of increasing opportunity cost.

Some of the questions ask you to find the amount of labor it would take to produce a particular level of output. The worksheet contains a special version of Goal Seek to help you solve this problem. But remember, you can always find the answer using trial and error -- it just takes a little longer.

Suppose the problem is to figure out how much labor you would need to get pasta production of 115.00 units, given your output level for pizza.

To solve this problem using Goal Seek proceed this way:

- (i) Click on the button that says “Click here to use Goal Seek”.
- (ii) A dialog box appears asking you what value of pasta you need to produce. Enter the number 115 (the target value of pasta) in the text area and click on OK, or hit Return.
- (iii) Another dialog box appears asking you for the cell address of the variable you want to change to make pasta equal to 115. Since you want to change labor, you must enter the cell address of the labor *value* . That value is in cell I20 of the worksheet. Enter I20 in the text area of the dialog box and click on OK or hit Return.

If you chose OK, and everything worked as planned, the new value for labor is displayed, and the graph is updated. If in entering information you get an error box or message, simply choose OK in the error box and continue entering information.

Here are some things to watch for and learn as you do the problems:

- 1) Changing the value of pizza moves you along the production possibilities curve.
- 2) Changing the labor or the input efficiencies makes the production possibilities curve shift.
- 3) Provided you are on the PPC (not inside it), getting more of one good is costly. There is no free pizza!
- 4) The only way to get more of everything is to increase your inputs or improve your technology.

Here are some hints to help you get the answers quicker:

- 1) Always be sure to set variables to their baseline values when asked to do so in the questions.
- 2) If the answer is a word instead of a number, always use lower case letters. Check the Answer Bin for alternatives, and Copy items from the Bin and Paste them on the Answer Sheet if you want.

MATH MAVEN'S CORNER: The equation for the PPC in this problem set is given by $Y = A(L - (X / B)^{1/E_x})^{E_y}$, where Y is the quantity of pasta, X is the quantity of pizza, L is total labor, and E_x and E_y are the efficiency indexes for pizza and pasta, respectively. The values of A and B are randomly assigned when you open the workbook. You can use this function to answer all the questions above instead of using the worksheet. One thing that is easy to do with this function is to compute the end points of the PPC, which will tell you the maximum amount of either good that can be produced.

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Questions

Set all variables to their baseline values. Set pizza production to 30.

- 1) What's the most pasta that can be produced?

Set all variables to their baseline values and set pizza production to 35. Enter values for pasta that satisfy each of the following conditions:

- 2) Attainable and inefficient.
- 3) Attainable and efficient.
- 4) Unattainable.

Set all variables to their baseline values and set pizza production to 20. Enter values for pasta that satisfy each of the following conditions:

- 5) Attainable and inefficient.
- 6) Attainable and efficient.
- 7) Unattainable.

Set all variables to their baseline values. Set Pizza production to 30.

- 8) Are 100 units of pasta attainable or unattainable?
- 9) Are 115 units of pasta attainable or unattainable?

Set all variables to their baseline values, and set pizza production to 40.

- 10) Enter a value of pasta that is unattainable.

Set all variables to their baseline values and set pizza production to 35.

- 11) What would total labor input have to be to have maximum pasta production of 105?

Set all variables to their baseline values and set pizza production to 35.

- 12) What's the cost (in pasta) of one more unit of pizza?

Set all variables to their baseline values. What's the (marginal) opportunity cost of pizza

- 13) when pizza is 10?
- 14) when pizza is 30?
- 15) when pizza is 40?

- 16) Based on your answers to questions 13) to 15), when more pizza is produced, does the cost of one more pizza increase or decrease?

Set all variables to their baseline values, and set pizza production to 40. The government must admit (or deport) enough workers to get 140 units of pasta.

- 17) What's the size of the new workforce?