

## Production Possibilities Curve

The concept of **opportunity cost** and associated **tradeoffs** may be illustrated with a picture.

**Production Possibilities Curve** – a graph that shows alternative ways to use an economy's resources – does not show consumer satisfaction. It is a **model** of a macro economy used to analyze the production decisions in the economy and the **problem of scarcity**.

**Production Possibilities Frontier** – the line on a production possibilities graph that shows the maximum possible output

**Efficiency** – using resources in such a way as to maximize the production of goods and services

**Underutilization** – using fewer resources than an economy is capable of using

**Cost** – to an economist, the alternative that is given up because of a decision – the opportunity cost

**Sunk Cost** – a cost that cannot be avoided because they have already been incurred

**Growth** – an economy wants to move the production possibilities curve to the right. It can do so only with growth.

### **Reasons for Growth**

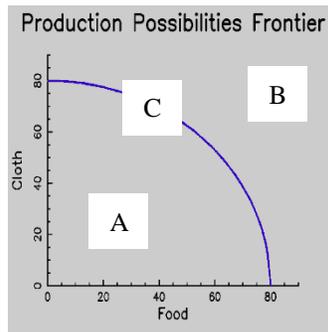
1. Accumulation of capital
2. Technological advances
3. Increase in population – immigrants, birth rates increase
4. Available land or improvements to land

### **Reasons for Decline**

1. Decrease in population – disease, catastrophe, war, birth rates decline
2. Loss of land – war or natural disaster
3. Decrease in production due to aging population, more uneducated population, less healthy population

## Four Assumptions

1. **Two Goods:** Resources are used to produce one or both of only two goods. This is a simplifying assumption that makes it easy to display production alternatives using graphs. More than two goods could be analyzed using advanced mathematics.
2. **Fixed Resources:** The quantities of land, labor, capital, and entrepreneurship resources do not change. This is a reasonable assumption, but it can be relaxed to analyze the consequences of changes in these resources.
3. **Fixed Technology:** The information and knowledge that society has about the production of goods and services is fixed. This is another reasonable assumption that can be relaxed to analyze the effects of technology changes.
4. **Technical Efficiency:** Resources are used in a technically efficient way. That is, the maximum possible production is obtained from the resource inputs.



- **Points on the PPC** (Point C) show efficient use of resources – maximum output. **Full employment**
- **Points beyond the PPC** (Point B) are not attainable given the resource constraint – only after **economic growth**
- **Points below the PPF** (Point A) are feasible, but inefficient.  
**Unemployment**

. **Slope of the line:** Opportunity cost is indicated by the negative slope of the production possibilities curve (or frontier). As more of one good is produced, less of the other goods is produced. This production reduction is opportunity cost.

**Curve of the line:** The curve indicates that goods do not change in equal proportions. As the production of one good goes up, the rate of the other decreases by an increasing rate. This is the **Law of Increasing Costs**. Rarely there might be a **straight line**. This means that production changes in equal proportions. As production for one product increases, the other decreases at the same rate. The rate of change is constant. Examples: black shoes vs. red shoes; sausage pizza vs. hamburger pizza; hours of study vs. hours of work. Law of Increasing Costs does not apply to straight lines.

**Reading:**

**Just some interesting facts regarding why the curve could shift left:**

FACTBOX-Five most expensive natural disasters  
Wed May 3, 2006 8:00 AM ET

May 3, (Reuters) - The following are the world's five biggest natural disasters in terms of insured losses, calculated in 2005 dollars.

August 2005 -- **Hurricane Katrina** hit Florida and then slammed into the Gulf Coast, flooding New Orleans and sending a 28-foot-high (8.5-metre-high) storm surge into Mississippi and Alabama. \$45 billion.

August 1992 -- **Hurricane Andrew** battered Florida and the Bahamas. \$22.3 billion.

January 1994 -- **The Northridge, California earthquake**, measuring 6.7 on the Richter scale, toppled buildings in southern California. \$18.5 billion.

September 2004 -- **Hurricane Ivan** rips through the Caribbean, battering oil rigs in the Gulf of Mexico and then hitting Florida, one of four hurricanes to crash into the state that year. \$11.7 billion.

September 2005 -- Following on the heels of Katrina, **Hurricane Rita** hits the Texas coast near Beaumont. \$10 billion. It is followed in October by Hurricane Wilma, another \$10 billion storm that cuts across southern Florida, including Miami, Fort Lauderdale and West Palm Beach.

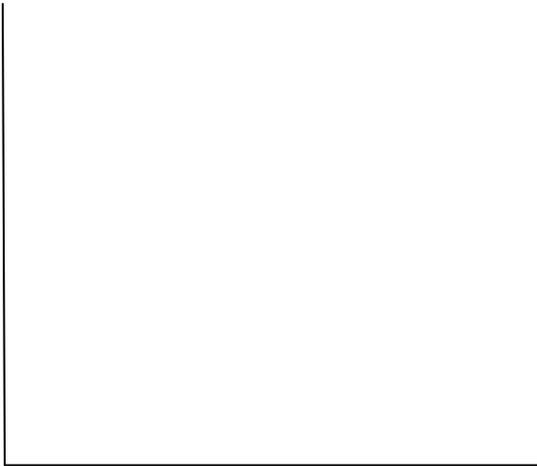
Eight of the 11 most expensive disasters in history, at least in terms of insured losses, have occurred along the U.S. Gulf Coast in the past four years.

## PPC Practice

1. Jackie land is known for the production of Cupcakes and Robots. The following is a PPT for Jackie land:

	A	B	C	D	E	F	G	H	I	J
<b>Cupcakes:</b>	<b>0</b>	<b>2</b>	<b>6</b>	<b>10</b>	<b>14</b>	<b>18</b>	<b>22</b>	<b>26</b>	<b>28</b>	<b>30</b>
<b>Robots:</b>	<b>30</b>	<b>28</b>	<b>26</b>	<b>22</b>	<b>18</b>	<b>14</b>	<b>10</b>	<b>6</b>	<b>2</b>	<b>0</b>

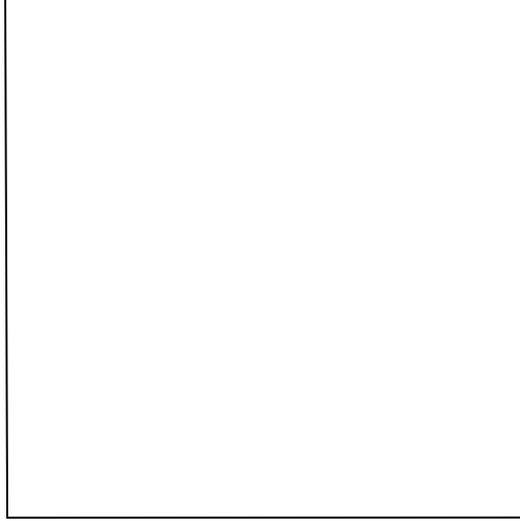
- a) Draw and label (each axis and each point). Put cupcakes on the Y  
b) Indicate on the graph with Point K where **inefficient** is.  
c) Indicate on graph with Point L where unattainable is  
Note that points A – J indicate **efficient** uses of resources.



2. Draw a second Production Possibilities Graph with two frontiers.  
a. Draw arrows to show growth  
b. List reasons for growth:



3. Draw a third Production Possibilities Graph with two frontiers.
- a. Draw arrows to show decline
  - b. List reasons for decline:



4. A zoo cannot have everything it wants. It has to make choices. The zoo committee has decided that it can have several concession stands. It has to decide how many popcorn stands and how many cotton candy stands to have scattered around the zoo. The committee made up a table of the different combinations depending upon what the committee has determined to be the cost of each stand. Now the committee has to decide what combination is right.

- a. Use the table below and graph a Production Possibilities curve on the graph below:

Popcorn or Cotton Candy

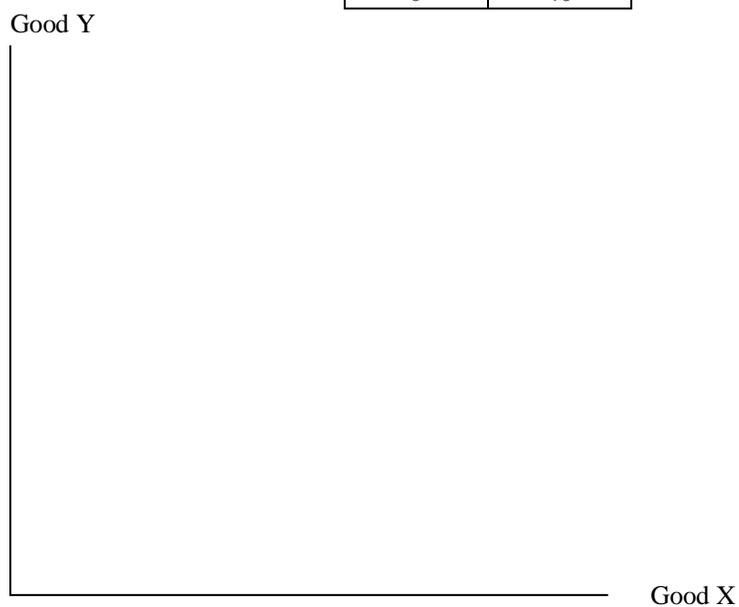
Popcorn	Cotton Candy
0	10
1	9
2	7
3	4
4	0



- b. Next, label a point of underutilization (inefficiency). Call it Point A. Next, label a point of efficiency. Call it Point B. Last, label a point that is now unattainable. Call it Point C.
- c. Look at the table: To get one popcorn stand, how many cotton candy stands have to be given up (marginal cost)?  $10 - 9 = ?$
- d. What is the marginal cost of 3 popcorn stands?
- e. What is the marginal cost of 4 popcorn stands?

5. Plot the following combinations of good X and good Y on the graph below. Plot all points and connect them with a smooth curve.

Good X	Good Y
37	0
34	10
30	17
28	20
20	29
10	36
0	40

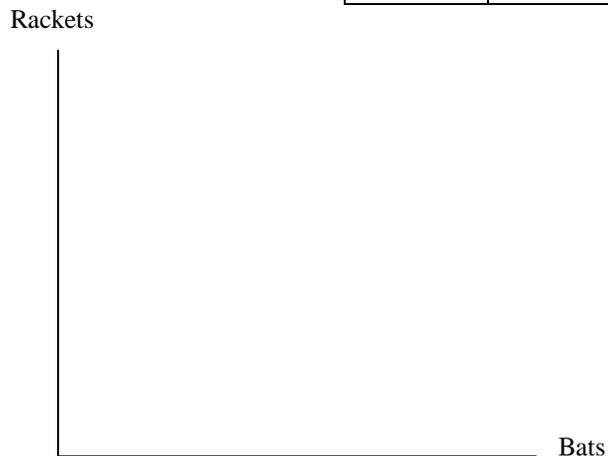


Answer the following questions:

- a. Calculate the cost of increasing production of good X from 0 to 10 units, as measured in the amount of good Y that would need to be sacrificed.
- b. Calculate the cost of increasing production of good X from 10 to 20 units, as measured in the amount of good Y that would need to be sacrificed.
- c. Calculate the cost of increasing production of good X from 20 to 30 units, as measured in the amount of good Y that would need to be sacrificed.
- d. What happens to the opportunity cost as the production of good X increases?

6. Plot the following combinations of bats and rackets produced by the Athletic Country on the graph below. Plot all points and connect them with a smooth curve.

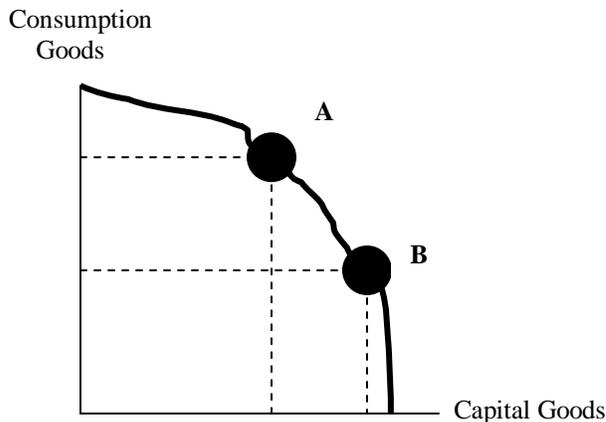
Bats	Rackets
0	420
100	400
200	360
300	300
400	200
500	0



Answer the following questions:

- a. If Athletic Country currently produces 100 bats and 400 rackets, what is the opportunity cost of an additional 100 bats?
- b. If Athletic Country currently produces 300 bats and 300 rackets, what is the opportunity cost of an additional 100 bats?
- c. Why does the additional production of 100 bats in number 2 above cause a greater tradeoff than the additional production of 100 bats in number 1 above?
- d. Suppose the Athletic Country is producing 200 bats and 200 rackets. How many additional bats could they produce without giving up any rackets? How many additional rackets could they produce without giving up any bats?
- e. Is the production of 200 bats and 200 rackets efficient? Explain.

### Shift in Production Possibilities Curve



7. The above production possibilities frontier shows the available tradeoffs between consumption goods and capital goods. Suppose two countries face this identical production possibilities frontier.

- **Investment:** This is indicated by a tradeoff between the production of consumer goods and capital goods. Investment results if society moves along the production possibilities curve, producing more capital goods and fewer consumption goods.

Answer the following questions.

- a. Suppose Party Country chooses to produce at point A while Sleepy Country chooses to produce at Point B. Which country will experience more growth in the future? Why?
- b. In this model, what is the opportunity of future growth?
- c. Demonstrate on the graph below the impact of growth on a production possibilities frontier such as the one shown above. Would the frontier for Sleepy Country shift more or less than that for Party Country? Why?



- d. On the graph below, show the shift in the production possibilities frontier if there was an increase in technology that only affected the production of capital goods.

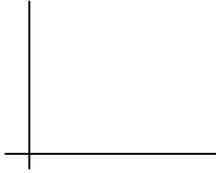


- e. Does the shift above imply that all production must be in the form of capital goods?

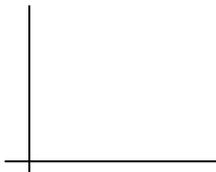
8. Directions: Circle Micro or Macro. For Macroeconomic situations, label the two axes as "Capital" and "Consumer" goods and services. For Microeconomic situations, use the two trade-offs.

1. Before
2. After the change

a. Following a period of high unemployment, the U. S. enters the fighting of World War II.  
(Micro or Macro?)

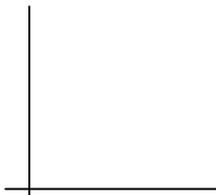


b. Following a period of full-employment, the U. S. accelerated the war in Vietnam and the War on Poverty.  
(Micro or Macro?)



1. Before
2. After the change

c. Following a period of discrimination against women and minorities, the U.S. legally ended such discrimination in the work place. (Micro or Macro?)



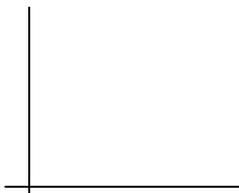
1. Before
2. After the change

d. Following a period that allowed lumber companies to log in publicly-owned land, a law was passed to protect the spotted owl's habitat that ended logging in the area.  
(Micro or Macro?)



1. Before
2. After the change

e. Before the Gulf War, Iraq was a full-employment of their resources, but during the war many of their facilities were bombed and people were killed.  
(Micro or Macro?)



1. Before
2. After the change

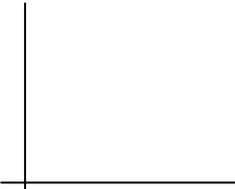
f. Although Americans have been at full-employment for almost a decade, our savings rate has dropped from 6% to 0%.  
(Micro or Macro?)



1. Before  
2. After the change

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g. Following a period of full-employment of their resources, Ethiopia experienced drought and over farming of the land.  
(Micro or Macro?)



1. Before  
2. After the change

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h. Following a period of mild recession, new developments in computer technology caused many businesses to invest in new computer systems. (Micro or Macro?)



1. Before  
2. After the change

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i. Following a period of full-employment, credit card companies like MasterCard extended lots of easy credit to American buyers.  
(Micro or Macro?)



1. Before  
2. After the change

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j. Following a deep recession, the U.S. government began an expansion of the interstate highway system.  
(Micro or Macro?)



1. Before  
2. After the change

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k. The Big Blue Computer Co. is able to produce either main-frame or personal computers. A new technique allows them to produce personal computers more efficiently.  
(Micro or Macro?)



1. Before  
2. After the change

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1. Exxon USA in Baytown can produce gasoline or heating oil. As a result of a very cold winter, Exxon increases its production of heating oil. They were operating at full capacity. (Micro or Macro?)

	1. Before 2. After the change
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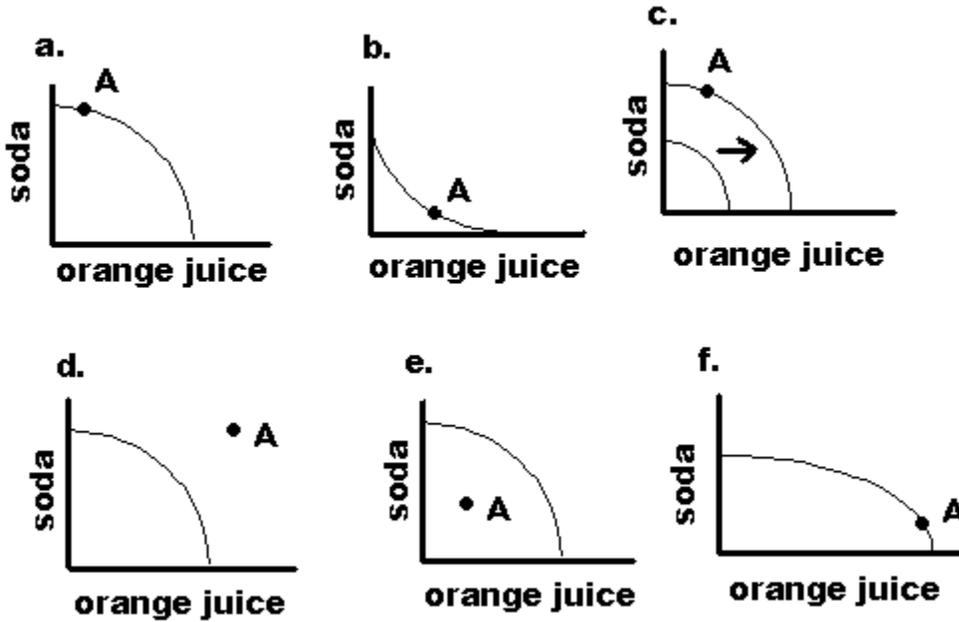
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m. You can use your time after graduation to either work or go to college. You need a new car so you decide to work more and take just a class or two this next year. You will fully use your time. (Micro or Macro?)

	1. Before 2. After the change
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**Match each diagram with its description.** Each can be used more than once and each description has more than one answer. Assume that the economy is attempting to produce at point A and that members of the society are trying to get healthy and prefer orange juice over soda.



- \_\_\_\_\_ 1. Inefficient production
- \_\_\_\_\_ 2. Productive efficiency
- \_\_\_\_\_ 3. An inefficient mix of output
- \_\_\_\_\_ 4. Technological advances in the production of both
- \_\_\_\_\_ 5. The law of increasing opportunity cost
- \_\_\_\_\_ 6. An impossible production mix

**Divide the class into groups and assign each group one of these scenarios. Then have them read their scenario, draw answers on the board, and explain it for review.**

**Version A**

Using economic analysis and the Production Possibilities Curve, explain what happened to the production of consumer goods and capital goods in 1968 when the U.S. increased involvement in Vietnam. At the time of the escalation of the war, we were at full employment and full production.

**Version B**

Using economic analysis and the Production Possibilities Curve, explain what happened to the production of consumer goods and capital goods in 1929 when the U.S. fell deeply into the Great Depression. Prior to that time we had been at full employment and full production. .

**Version C**

Using economic analysis and the Production Possibilities Curve, explain what happened to the production of consumer goods and capital goods in 1941 when the U.S. entered World War II. Prior to that time we had large amounts of unemployed resources. .

**Version D**

Using economic analysis and the Production Possibilities Curve, explain what happened to the production of consumer goods and capital goods in Somalia when that country became involved in a destructive Civil War. Prior to that time they had been fully utilizing their resources.

**Version E**

Using economic analysis and the Production Possibilities Curve, explain what happened to the production of consumer goods and capital goods in Mexico two years ago when economic chaos occurred and many workers lost their jobs and factories were closed. Prior to that time they already had 10% unemployment. Explain the short run and long run consequences.

**Version F**

Using economic analysis and the Production Possibilities Curve, explain what happened to the production of consumer goods and capital goods in Baytown in about 1984 after U.S. Steel closed its Baytown plant and also many oil-related businesses went broke. Prior to that time, we had been at full-employment, full production.

**Version G**

Using economic analysis and the Production Possibilities Curve, explain what happened to the production of consumer goods and capital goods in the U.S. when new computer technology caused productivity growth to increase significantly. Prior to that time the U.S. had been in a recession and had been suffering from unemployment.