Production Possibilities
Given the solid work ethic students have today, we can assume that all of you are accustomed to 70 hour work weeks. While in school you could use this time to study all the time, or ....
A person could use this time to play or party all the time. Or, a person could use their time to do both, but one at the expense of the other (opportunity cost).
Doing some of both is a good idea, but the proportion of each will be related to the final outcome. The “correct” proportions of each will lead to a “well rounded person.” What is the “correct” proportions? Well, that will very with each individual. Many people learn by trial and error. Some people just seem to have a plan worked out that is best for them. Some people never do learn the appropriate proportions of each, or learn them at a later stage in life. Anyway, I hope that you are understanding that there are “tradeoffs” that we must confront, and some of those are confronted on a daily basis.
We are going to assume that a hypothetical student is only taking two courses. This will keep us on the two-dimensional plane of the “blackboard” to graphically illustrate the tradeoffs that this student is confronted with. We will also assume that this student has a part-time job and is only allocating 10 hours a week allotted to study for both subjects outside of class.

B. Assume that you are only taking two courses: Livestock Management and Agricultural Economics.

1. Also assume that you have a part time job, and only have 10 hours a week allotted to study for both subjects outside of class.
Numerous studies have discovered that there is a positive correlation between the hours one studies in a subject and the grade that individual receives in that course. Typically, the more time you dedicate to studying, the higher the grade one receives.
3. Assume if you study:

0 hrs for economics: get F in econ., A in livestock

2.5 hrs for economics: get D in econ., B in livestock
The Study: Work Tradeoff

5.0 hrs for economics: get C in econ., C in livestock

7.5 hrs for economics: get B in econ., D in livestock

10.0 hrs for economics: get A in econ., F in livestock
The graph above illustrates the tradeoff our student faces by only allowing ten hours of study for both subjects combined. Our student needs to study ten hours a week in each subject in order to receive an “A” in each subject. But, remember that our student is only allocating ten hours a week to studying. Five hours in each subject would yield a “C” in each course.
Above is the data set used to construct the graph on the previous slide. Next to the hours of study is the associated grade.

<table>
<thead>
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<th>X</th>
<th>Y</th>
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<tbody>
<tr>
<td>(hrs on econ)</td>
<td>(hrs on lstk)</td>
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<tr>
<td>(F)</td>
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<td>(D)</td>
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<td>(C)</td>
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<td>(B)</td>
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Let us assume that our student is starting to learn that college courses take a bit more study time than what may have been required in high school. So, our student cuts back some on the part-time employment and allocates 20 hours per week to study for his/her courses. Our student is now adding some more “time resources” to the potential production of grades.
Here is another look at the graphical illustration when our student applies only 10 hours per week to study.
Allocating an additional ten hours per week for a total of 20 hours per week of studying, the linear production possibilities curve in this example shifts outward due to an increase in available resource allocated to producing grades. Now our student can apply 10 hours of study to each course per week. A potential grade of “A” in both courses.
THE PRODUCTION POSSIBILITIES CURVE:

Lets look at an economy and break down the commodities into two commodity groups.

1. Agricultural goods & services

2. Non-agricultural goods & services
All resources are utilized and fixed means that all land, capital, labor, and entrepreneurship are being utilized to produce goods and services; and what quantity of those resources we currently have are all we are going to get. We are also assuming that technology is “fixed.” We are going to assume for a short while that no new technology is coming down the pipeline. What technology we currently have is all we have to work with. We also are going to assume that resources are not perfectly mobile. This is a realistic assumption relative to the first two. In our previous student/studying example, we implied resources WHERE perfectly mobile. One hour of study in ag. econ. was just as productive as one hour of student in the livestock course. Most resources are not perfectly mobile. A resource used in agricultural production may not be as productive if used in non-agricultural production.
Above is a graphical illustration of a PPC relating the dollar value of agricultural goods and services produced per year to the dollar value of non-agricultural goods and services produced per year. Notice that the production possibilities curve is truly a curve, not a straight line. It is curved due to the fact that resources used in the production of agricultural or non agricultural production are not perfectly mobile between the two alternatives. The actual curve itself can be considered a boundary or frontier. All points on or within the PPC are considered to be “attainable combinations” of ag. and non-ag. goods and services. Points not on the production frontier that are outside (points above and to the right of the PPC) are considered to be “unattainable combinations” of ag. and non-ag. commodities. Points outside of the production frontier are considered unattainable because we do not currently have the resources or the technology to produce those combinations of ag. and non-ag. goods and services. If we had access to more resources, or new technology, then the production frontier would be shifted outward and would encompass some new points that were once unattainable.
The PPC Curve

- Vertical axis = $ value of agricultural goods & services produced per year.
- Horizontal axis = $ value of non-ag. goods & services produced per year.
The PPC Curve

- $ value = the sum of the price of each commodity produced times the quantity of each commodity produced.

- In our example, the $ value of ag. goods + $ value of non-ag goods equals gross domestic product (GDP).
The PPC Frontier

The PPC frontier shows all the combinations of the two commodities that can just be produced if all resources are fully employed with the technology currently available.
The PPC curve illustrates 3 concepts: (assuming resources are fully employed)

Scarcity: This is shown by the unattainable points.

Choice: Any of the attainable points are possible.
The PPC curve illustrates 3 concepts: (assuming resources are fully employed)

Opportunity cost:

This is due to the downward slope of the production possibilities curve. i.e. To get more non-agricultural goods, you must give up some agricultural goods.
An explanation of the negative slope of the PPC:

The PPC is bowed out, and slopes down because of the

**LAW OF INCREASING COSTS:** The more of one good the economy produces, the greater the amount of other goods that must be given up (opportunity cost increases at an increasing rate).
The graph above illustrates a production possibilities curve between the dollar value of agricultural goods and services on the y-axis, and the dollar value of non-agricultural goods and services on the x-axis. On the y-axis, you should see an equal, incremental increase of the dollar value of agricultural goods and services from 0 to 4 units. As the dollar value of agricultural goods and services is increased from 0 to 1 unit, you should notice that a very small amount of the dollar value of non-agricultural goods and services had to be given up (opportunity cost). If we increase the dollar value of agricultural goods and services from 1 to 2 units (an equal, incremental increase), you should notice that an increased amount of the dollar value of non-agricultural goods and services had to be sacrificed (increasing opportunity cost). To get the next unit of the dollar value of agricultural production, we have to give up more and more non-agricultural production.
The solid colored lines above indicate the dollar value of non-agricultural goods and services that had to be given up to acquire the next equal, incremental dollar value of agricultural goods and services. As you can see, the dollar value of non-agricultural goods and services that had to be sacrificed increased at an increasing rate (got bigger and bigger).
Why do costs increase as more and more of one commodity is produced?

- Resources are not easily adaptable to all types of production. (Not Perfectly mobile!!)

- It costs more and more to shift not so adaptable non-ag. resources into agricultural production, or visa-versa.
Over time, we would like to see the PPC shift outward.

When the PPC shifts outward, the economy has grown and our standard of living is often enhanced.

An outward shifting PPC over time illustrates the ECONOMIC GROWTH you hear about all the time on TV, and read about in the newspaper.
What can cause the PPC to shift?

- Remember the initial assumptions we made? They were somewhat constraining, let's begin to relax them.

- Remember we assumed that technology and the amount of available resources were fixed or held constant.
Whenever we can produce more goods and services with the same amount of resources, or less resources, physical efficiency has been enhanced.
As hybrid corn varieties became widespread after World War II, corn yields increased dramatically resulting in more corn being produced with less resources than ever before. This technology shifted the PPC outward a great deal in favor of the dollar value of agricultural goods and services. But, you should notice a small shift in the PPC on the dollar value of non-agricultural goods and services as well. Why? Resources were freed up from agricultural production due to hybrid corn technology. These freed resources from agricultural were now available for non-agricultural production. Therefore, advances in agricultural technology has allowed our society to dedicate more and more resources to non-agricultural uses and expand the production possibilities of our economy. The primary resources freed up by agricultural technology have been human resources: labor and entrepreneurial talent.

In 1997, there were 961,560 farm operators whose principal occupation was farming. An additional 950,299 persons were farm operators, but it was not their principal occupation. This totals 1,911,859 farm operators in 1997. The population of the U.S. in 1997 was 268,008,000. That means that .713% of the U.S. population were farm operators. That .713% of the population feeds the rest of us. In 1940, the farm population was described as farm operators doing 1 or more hours of farm work and members of their families working 15 hours or more during a week without cash wages. This 1940 population totaled 30,546,573 or 23.33% of the total U.S. population (130,962,661). As you can conclude, agricultural technology freed human resources to produce goods and services other than agricultural commodities.
I have illustrated the effect of microcomputers as being more equally dispersed throughout the economy. If one purchases a tractor today, they purchase micro-processors that control the engine and transmission functions. There are hook ups for a lap top computer, a global positioning system, and data ports for implements that would facilitate precision agriculture techniques. If you walk into a farm office today, I would hypothesize that the vast majority of these offices have a personal computer running on a desktop accessing weather and marketing information. They are also being used to keep production and financial records.
Advances in technology allow us to increase output with the same or a lessor amount of inputs.

What about increases in resources themselves?

If we are able to increase the quantity of resources such as land, capital, labor and managerial talent, then we could also increase economic growth.
The production possibilities curve shifts right.

For example:

Increased labor force due to population growth.
Increasing the size of the labor force will increase the amount of ag. and non-ag commodities that the economy can produce. At this point in our history, we are increasing the labor force by about 1 percentage point per year. Not a very sizeable increase in economic growth.
The Romans were after resources. Land, capital, and human resources. Many of the cultures they conquered were enslaved to produce the infrastructure of Rome. The Greek culture was absorbed into Roman culture. The Romans used Greek technology for their own ends. The Greeks served as teachers of Roman children and servants in Roman households. Other cultures were not so lucky.

The U.S. needed human resources to foster economic growth. Immigration was a source of these human resources. We needed people to expand our economy from the Atlantic coast to the Pacific coast. We conquered indigenous people to acquire land resources and advance the U.S. economy.
Hitler raced through Europe with the largest military apparatus the world had witnessed to that point to secure additional resources to grow his military machine ever larger. Military production is a form of economic production. Military production requires economic resources. The people of Europe were enslaved to produce war materials. Factories were converted to produce war materials. Hitler was after economic resources.

Sadam Hussein was after oil. A land resource to expand his economy.

If we look throughout history, most wars between people have had economic resource roots in one way, shape or another.
Capital is by definition the man-made aids to the production process. Our machinery, equipment, tools, buildings, factories, etc. We can build capital. We can build increasing amounts of capital by diverting resources from the production of consumer goods and services to the production of capital goods.
In the diagram above, you see the dollar value of consumer goods on the y-axis and the dollar value of capital goods on the x-axis. We create a new production possibilities curve illustrating the trade-off between consumer goods and capital goods. Point A on this PPC illustrates the production of a large quantity of consumer goods and a small quantity of capital goods. Point B illustrates just the opposite. Notice the “hash mark” on the x-axis. The “hash mark” represents the quantity of capital goods that need to be produced by the economy to maintain the economy at its current production level. We know that capital wears out and becomes obsolete so that it must eventually be replaced. To maintain the economy at its current production levels, we must produce enough capital to replace what capital wears out. Point A does not allow for the production of enough capital to maintain the economy. Point B produces enough capital to replace what capital wears out, and more to spare. Point B adds to our capital stock and increases the quantity of one of the factors of production, thus allowing the economy additional resources by which to grow.
Point A will make a lot of people happy in the short run. Consumer goods and services will be plentiful and relatively cheap. WalMart and Kmart shoppers are elated. But, down the road, the quantity of consumer goods and services will start to decrease and their price increase as the economy starts to contract as capital wears out and is not replaced.
Due to the economy not producing enough capital goods to replace those that wear out, the economy will contract. The PPC curve will shift inward toward the origin.
Point B: The economy has lots of capital goods and little consumer goods. The emphasis is on the long run and not on the short run. A large shift in the $Ag. vs. $Non-Ag. production possibilities is possible. In this case, the economy will have less present Consumer good consumption now than at point A but future Consumer good consumption will be more.

Point B will make a lot of people unhappy in the short run. Consumer goods and services will be less available and relatively expensive. WalMart and Kmart shelves may look like the day after a major snow storm or hurricane in the southeast. But, down the road, the quantity of consumer goods and services will increase and their price decrease as the economy starts to grow as new capital comes on line that will increase production possibilities.
Again you can see that Point B allows for the production of capital in excess of what is required to maintain the economy. This added capital stock can be used to produce additional consumer goods and services in the future.
As the capital in excess of what is needed to maintain the economy begins to produce additional ag. and non-ag commodities, the PPC curve for the dollar value of ag. and dollar value of non-ag. commodities shifts outward illustrating economic growth of the economy.
DETERMINANTS of the PPC.

1. Quantity of resources (FOP's) available for society to utilize.

   a. If resources increased ⇒ output is increased c.p.
2. Improvements in Physical efficiency (New Technology!, Enhanced Productivity!)

   a. increase (units of output / units of input)

   b. If resources are currently fixed, this is one way to shift the PPC outward to achieve economic growth.
3. The current mix of capital and consumer good production.

a. If we increase capital good production relative to consumer good production → this increases one of the FOP's (capital) → this increases potential future output.
b. This is the primary reason for investment tax credits and capital gains tax rates.
4. Mobility of resources:

a. If we increase (improve) the mobility of resources between the production of different commodities,
-- We decrease the opportunity cost of moving resources from the production of one commodity to the production of another. We take some of the “bow” out of the PPC curve.
b. By reducing the opportunity cost, the potential output of both commodities is increased.
c. Our economy is more resilient to changes in world economic conditions,

--resources are more quickly re-employed if displaced from the production of a particular commodity,
--temporarily unemployed resources are more efficient when re-employed in the production of alternative commodities.

--less training or modification is required, therefore their is a lower cost of re-allocating these resources.
d. Which of the four categories of the FOP's is our society most concerned with in the short-run?

-- LABOR
-- ENTREPRENEURSHIP OR MANAGEMENT
When these two human resources are unemployed, the social costs are enormous.

(Circular Flow → decreased disposable income → decreased demand)
e. HOW do we make these two FOP's more MOBILE?

--increase the educational and technical skills level of our society!!!
PRACTICAL AND PERSONAL APPLICATION OF THESE CONCEPTS:

There is a trade off between investment in education and current consumption. As you invest more in education, your current consumption decreases but your future consumption will likely increase. The relationship between your current investment in education and your future consumption can be shown with production possibilities curves.
The above PPC between hours of academics (studying) and hours of leisure (playing) illustrates the trade-off students have between the two alternatives. I have allowed 8 hours for sleeping, thus you have 16 hours to allocate between studying and playing. Point A represents a significant amount of time studying, but you should also notice there is time to play. Point B illustrates a significant time playing with much less time studying. What may be the possible outcome of these two choices, Point A or Point B.
Above you see another PPC, the trade-off between the dollar value of our basic wants in life and the dollar value of all the other wants we have in life. Illustrated in this slide is the hypothetical PPC curve of an individual with only a high school education.
What do I mean by basic wants? Well, we need some shelter. A cardboard box is all the shelter that some folks have, but here we will assume this to be a single wide mobile home. Transportation? Feet or a bicycle are pretty basic, but we will assume an old used motor vehicle. Food? Well filet mignon is not basic fare. We need some calories from carbohydrates and/or fat and some protein, some minerals and vitamins. Potatoes and macaroni cheese are pretty basic. We’ll throw in some Ramen noodles for a little pizzazz. Clothing? Good Will and the Salvation Army can provide some functional used clothing for us. Anything else for our basic survival?
Now, the things listed above are not basic. These represent a small fraction of all the other things we want. Many of the things listed we all take for granted as being available to many of us.
Well, here is our trade-off picture again. Which point have we chosen this semester? Which point will we choose in the future?
“Choosing Point B”

Point B represents lots of Leisure now and little investment in Academics (education) now.

In this case, the PPC for Basic Wants and Other Wants may not shift out very much (if any) relative to the PPC with a H.S. diploma!
Choosing Point B while here at N.C. State University may not allow you to progress much further than the PPC for a high school education. In other words, Point B does not afford you the educational resources necessary to shift the PPC curve out to the right very far.
Academics vs Leisure

Hrs. of Academics

16

Pt. A

Pt. B

16

Hrs. of Leisure
“Choosing Point A”

Point A represents lots of investment in Academics (education) now, and little consumption of Leisure now.
Choosing Point A however, certainly may provide sufficient resources to shift your personal PPC out to the right illustrating personal economic growth that may provide the lifestyle of your dreams. Take advantage of all the educational opportunities that this great university offers to you. Use your time here wisely. Use your time to learn all that you can possibly learn so that learning can be put to productive use to determine your future. The choice is yours.
The Choice is Yours!

The outcome of choosing Point A or Point B is based on the progress made in the same amount of time.
Its your free and independent choice of which point on the Academic vs. Leisure PPC to be on!

Which will you choose?