Raw Class Notes for 3012- Spring 2022

These notes are unedited versions of the notes we typed in class. For more polished notes, please see "Class Notes" on my webpage.

Contents

1 Class 1- 1/19/2022

X is the **feasible set**.

This a set of bundles. x.

We want the feasible set to be all the relevant bundles for a model.

For example, if we are modeling the choice of ice cream bowls. The bowl: "one scoop of vanilla and one of chocolate" is a single bundles in the set of feasible bundles.

A bundle will normally (in this class) consist of two goods.

For example the two goods might be chocolate ice cream and vanilla ice cream.

a bundle is now an amount of each good.

Let's say good 1 is chocolate and good 2 is vanilla.

$x = (1, 1)$ is the bundle "one scoop of chocolate and one scoop of vanilla.

$(0, 2)$ is two scoops of vanilla.

$(5, 1.8)$ five scoops of chocolate and 1.8 scoops of vanilla.

We could add strawberry to the model. now we have 3 goods.

$(1, 1, 1)$ one scoop of each flavor.

Two goods is "enough" to learn about trade-offs so we work with 2.

Let's go back to chocolate and vanilla ice cream.

Let's define the feasible set for this model. We want the feasible set to be all bowls of ice cream with a positive (non-negative) real number of scoops of each flavor.

$$X = \mathbb{R}^2_+$$

$(0, 2), (1000, 5), (1000000, 29)$ all in the feasible set.

$(-1, 2)$ is not.

$$x = (1, 1) = (x_1, x_2)$$

x_1 is the amount of good 1. and x_2 is the amount of good 2.

Budget set is the set of bundles actually available to a particular consumer. B is the **budget set**.

Budget set might be all the bowls of ice cream with no more than two total scoops. The budget set is always a subset of the feasible set.

$$B \subseteq X$$

Let's write formally the set of all bowls of ice cream with no more than two total scoops.

$$B = \left\{x | x \in \mathbb{R}^2_+ \,\&\, x_1 + x_2 \leq 2\right\}$$

$$B = \left\{x | x \in \mathbb{R}^2 \,\&x_1 \geq 0\&x_2 \geq 0\&\, x_1 + x_2 \leq 2\right\}$$

We could a weird budget set:

$$B = \left\{x | x \in \mathbb{R}^2_+ \& \left(\sqrt{x_1^2 + x_2^2} \leq 1\right)\right\}$$

This is the the set of all bundles less than distance one from the origin. It is a circle. This is technically possible in our framework.

Normally we think of budgets as coming from income m and prices p_1 and p_2. *Competitive budgets.* The price of any bundle is:

$$p_1 x_1 + p_2 x_2$$

scoops of ice cream cost \$2 each $p_1 = 2$ and $p_2 = 2$. The cost of the bundle $(2, 1)$ is:

$$(2 * 2) + (2 * 1) = 6$$

Suppose I have m dollars. What can I afford.

$$p_1 x_1 + p_2 x_2 \leq m$$

This is the formal version of a *competitive budget*.

$$B = \left\{x | x \in \mathbb{R}^2_+ \& p_1 x_1 + p_2 x_2 \leq m\right\}$$

This is the set of all bundles that someone can afford with income m at prices p_1 and p_2.

The **budget line** are all of the bundles that cost exactly m.

$$p_1 x_1 + p_2 x_2 = m$$

We can transform this by isolating x_2.

$$x_2 = \frac{m}{p_2} - \frac{p_1}{p_2} x_1$$

We get the x_2 intercept immediately. $\frac{m}{p_2}$. The slope is $-\frac{p_1}{p_2}$. The other intercept can be found by plugging 0 in for x_2. The x_1 intercept is $\frac{m}{p_1}$.

2 Class 2- 1/24/2022

Budget set is described by:

$$(x_1p_1) + (x_2p_2) \leq m$$

"Spends no more than income"

The important part of this budget is the **Budget Line.**

$$x_1p_1 + x_2p_2 = m$$

$$x_2 = \frac{m}{p_2} - \frac{p_1}{p_2}x_1$$

x_2 intercept is $\frac{m}{p_2}$. The slope is $-\frac{p_1}{p_2}$.

We can also get the x_1 intercept by plugging 0 in for x_2.

$$0 = \frac{m}{p_2} - \frac{p_1}{p_2}x_1$$

$$x_1 = \frac{m}{p_1}$$

x_1 intercept is $\frac{m}{p_1}$,x_2 intercept is $\frac{m}{p_2}$. The slope is $-\frac{p_1}{p_2}$.

Interpreting the intercepts:

The x_1 intercept is "how much x_1 can I have if I only buy x_1"

The x_2 intercept is "how much x_2 can I have if I only buy x_2"

These expressions should make sense. $\frac{m}{p_1}$ says "if i spend m on x_1 how many units do I get"

Let's look at another bundle with a similar expression:

$$\left(\frac{\frac{1}{2}m}{p_1}, \frac{\frac{1}{2}m}{p_2}\right)$$

The slope measures how much good 2 I give up to get one more unit of good 1.

This represents the tradeoff I have to make between the goods given their prices.

$$-\frac{p_1}{p_2}$$

What happens to the budget when one of the parameters of the model p_1, p_2, m changes.

Taxes

Quantity tax:

An amount of money you owe to the government **per unit** of some good you buy. Quantity tax of t on good 1.

$$x_1 t + x_1 p_1 + x_2 p_2 = m$$

$$(p_1 + t)\, x_1 + x_2 p_2 = m$$

Ad valorem tax:

A tax on the value of a good purchased:

You owe the government τ times the value of the x_1 you purchase. In the case of Nashville, $\tau \approx 0.09$

$$\tau\,(p_1 x_1) + p_1 x_1 + p_2 x_2 = m$$

For example, if $p_1 = 10$ and $x_1 = 10$ I've spent \$100. If $\tau = 0.09$ then the tax is 9% and I owe \$9 in tax. The total cost of x_1 becomes \$109.

$$((1+\tau)\, p_1)\, x_1 + p_2 x_2 = m$$

The x_1 intercept when the price of x_1 is p_1 if the amount purchased is less than $\bar{x_1}$ and $p_1 + t$ for any units purchased above $\bar{x_1}$.

Let's calculate the cost of buying $\bar{x_1}$ at price p_1:

$$\bar{x_1} p_1$$

The money I have left over is:

$$m - \bar{x_1} p_1$$

The extra x_1 I can buy with this leftover money at the new price of $p_1 + t$ is:

$$\frac{m - \bar{x_1} p_1}{p_1 + t}$$

The total amount I can afford it $\bar{x_1}$ plus this amount:

$$\bar{x}_1 + \frac{m - \bar{x_1} p_1}{p_1 + t}$$

Preferences:

Now we will try to model "what a consumer wants"

To represent preferences, we use a "relation". A relation is a set of statements about **pairs** of bundles. You are familiar with some relations already like $\geq$ (greater than or equal to).

$$3 \geq 2$$

$$4 \geq 1$$

A another relation on the set of people might be "Is a sibling of". Let's represent this by s. The following statements are true:

$$Greg\, s\, Christina$$

$$Finn\, s\, Remy$$

In economics, we represent preferences as a relation called the "Preference Relation" $\succsim$.

Suppose a consumer doesn't care about flavor, but just likes more ice cream. We represent bundles such as $(1, 1)$ is one scoop of vanilla and one scoop of chocolate. The following formal preference statements are true about this consumer:

$$(1, 1) \succsim (0, 0)$$

$$(2, 1) \succsim (0, 2)$$

$$(0, 2) \succsim (2, 0)$$

The term "preferred" is synonymous to "weakly preferred" and will be true if a consumer either strictly prefers the first bundle to the second (as in the first two cases above) or if they are indifferent such as in the third above.

Contrast this to the term "strictly preferred". The strictly preferred relation is represented by $\succ$.

$$(1, 1) \succ (0, 0)$$

$$(2, 1) \succ (0, 2)$$

but the following statement is **not true** about the consumer:

$$(0, 2) \succ (2, 0)$$

However, the consumer is indifferent between these bundles. The indifference relation is represented by $\sim$. THe following is true.

$$(0, 2) \sim (2, 0)$$