Week 1 –Budget Constraint (Chapter 2)

- The economic theory of the consumer is very simple.

  - ➢ Economists assume that consumers choose the best bundle of goods that they can afford.

- To give meaning to this theory, we have to describe more precisely what we meant by **'best'** and **'can afford'**.

2.1 The Budget Constraint

- Suppose that there is some set of goods from which the consumer can choose.

  - ➢ For our purposes, it is convenient to consider the case of **only two goods**.

- We will indicate the **consumption bundle** by (x_1, x_2).

  - ➢ This is simply a list of two numbers that tells us how much the consumer is choosing to consumer of good 1, x_1, and good 2, x_2.

  - ➢ The consumer's bundle is denoted by a single symbol X, where $X = (x_1, x_2)$.

- Suppose we can observe the prices of the two goods, (p_1, p_2), and the amount of money the consumer has to spend, m.

  - ➢ Then the **budget constraint** of the consumer can be written as:

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

  - ➢ Here $p_1 x_1$ is the amount of money that the consumer is spending on good 1, and $p_2 x_2$ is the amount of money that the consumer is spending on good 2.

- *The budget constraint of the consumer requires that the amount of money spent on the two goods be **no more** than the total amount the consumer has to spend.*

- The **budget set** of the consumer is the **set of affordable consumption bundles** at prices (p_1, p_2) and income m.

  - ➢ <u>Budget set</u>: $\{X = (x_1, x_2): p_1 x_1 + p_2 x_2 \leq m\}$

2.2 Two Goods are Often Enough

- The **two-good assumption** is more **general** than it appears.

  - ➢ We can interpret good 2 as represents **everything else** that the consumer may want to consume.

- Good 2 represents a **composite good**.

> ➢ Such a composite good is measured in dollars to be spent on goods other than good 1.

- It is convenient to think of good 2 as being the dollars that the consumer can use to spend on other goods.

  > ➢ Under this interpretation, the price of good 2 will automatically be $1, since the price of one dollar is one dollar.

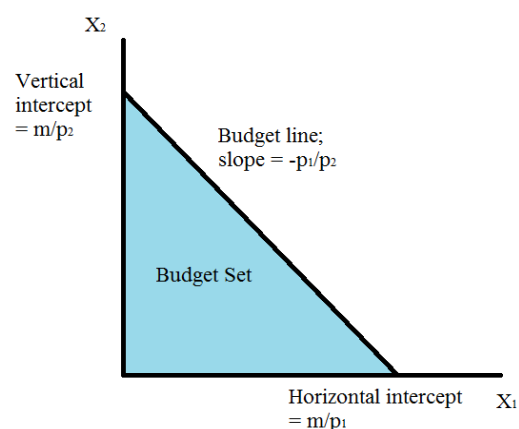- Thus, the **budget constraint** will take the form:

$$p_1 x_1 + x_2 \leq m$$

- This equation is just a special case of the formula above, with $p_2 = 1$.

  > ➢ This is known as the **numeraire price**, which we assign to good 2.

2.3 Properties of the Budget Set

- The **budget line** is the set of consumption bundles that cost exactly m:

$$p_1 x_1 + p_2 x_2 = m \ (*)$$

  > ➢ These are bundles of goods that <u>just</u> exhaust the consumer's income.

- We can rearrange the equation to obtain:

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

  > ➢ This is a straight line with a slope of $-\frac{p_1}{p_2}$ and vertical intercept $\frac{m}{p_2}$.

- The **slope** of the **budget line** has a nice **economic interpretation**.

  > ➢ The slope measures the amount of good 2 forgone in order to consume one additional unit of good 1.

  > ➢ <u>Economic interpretation</u>: The slope represents the **opportunity cost** of consuming **good 1**. (Note: $OC_{good\ 1} = \frac{1}{OC_{good\ 2}}$)

- The **intercepts** of the **budget line** also have an interpretation.
  - ➢ The vertical intercept represents the amount of good 2 that can be consumed if the total amount of money the consumer has to spend is entirely spent on good 2 i.e. $\frac{m}{p_2}$.
  - ➢ The horizontal intercept represents the amount of good 1 that can be consumed if the total amount of money the consumer has to spend is entirely spent on good 1 i.e. $\frac{m}{p_1}$.

2.3 How the Budget Line Changes

- When prices and incomes **change**, the set of goods that a consumer can afford changes as well.
 - ➢ **How do these changes affect the budget set?**

2.3.1 Changes in Income

- From the equation of the budget line (*), it is clear that an **increase in income**, m, will **increase the vertical intercept** but will **not affect the slope**.
  - ➢ This increase in income will result in a **parallel shift upward** (*outward*) of the budget line.
  - ➢ A decrease in income will result in a **parallel shift downward** (*inward*).

Increasing income. An increase in income causes a parallel shift outward of the budget line.
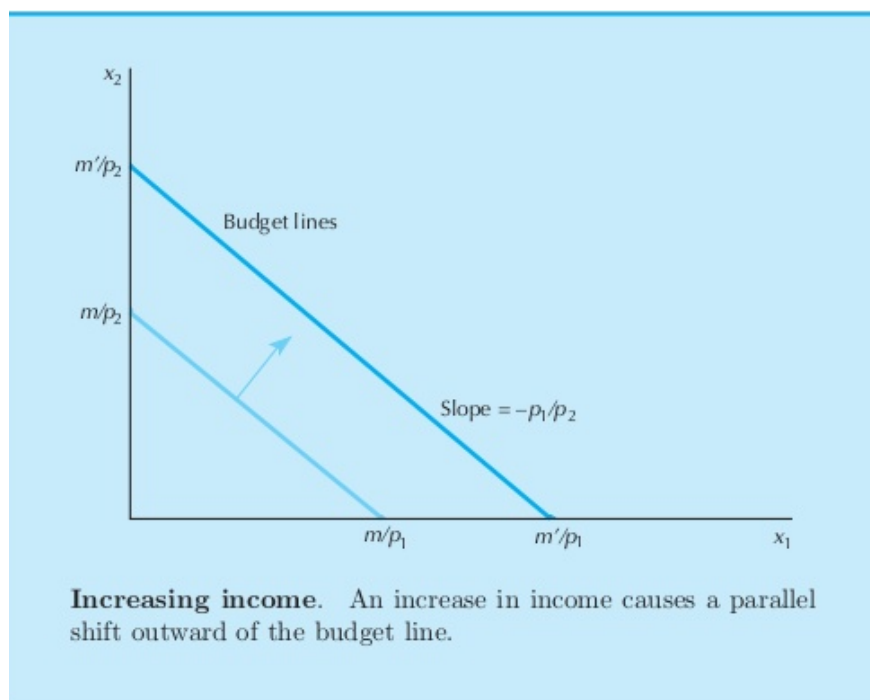
2.3.2 Change in Prices

- From (*), it is clear that if the price of (say) good 1 increases then the (absolute) **slope** ($\frac{p_1}{p_2}$) of the budget line also **increases** but the **vertical intercept** ($\frac{m}{p_2}$) **does not change**.
  - ➤ This leads to a **steeper budget line** with a lower horizontal intercept ($\frac{m}{p_1}$).

Increasing price. If good 1 becomes more expensive, the budget line becomes steeper.
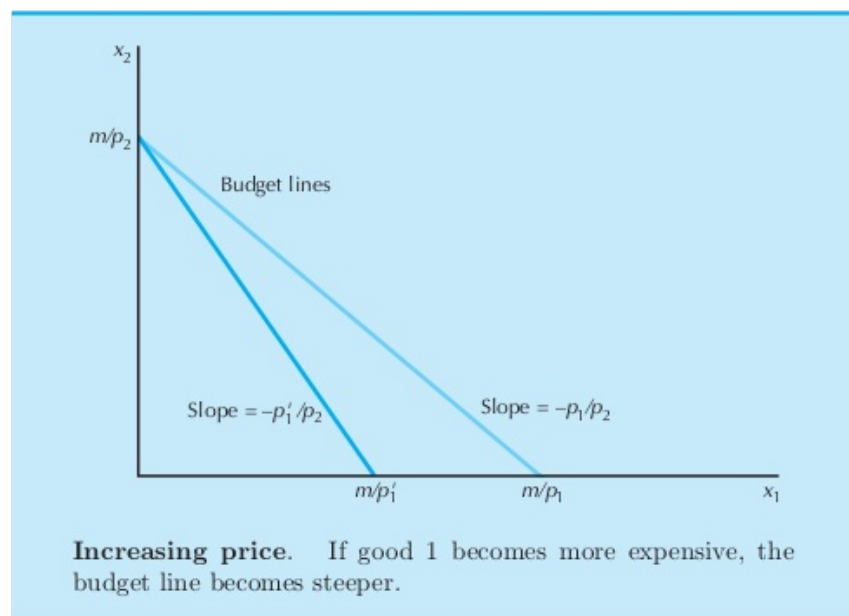
- If the price of good 2 increases then the (absolute) **slope** ($\frac{p_1}{p_2}$) of the budget line **decreases** but the **horizontal intercept** ($\frac{m}{p_1}$) **does not change**.
  - ➤ This leads to a **flatter budget line** with a lower vertical intercept ($\frac{m}{p_2}$).
- If the prices of both goods increase by the **same factor**, t, at the **same time**, then both the horizontal and vertical intercepts will decrease by the **same factor**, shifting the budget line inward.
  - ➤ This is **equivalent** to decreasing the income m by the factor t.
- We can see this algebraically:
  - ➤ Suppose that the original budget line is: $p_1 x_1 + p_2 x_2 = m$
  - ➤ If the price of these goods increase by a factor t then:
  $$tp_1 x_1 + tp_2 x_2 = m \rightarrow p_1 x_1 + p_2 x_2 = \frac{m}{t}$$
  - ➤ Thus, multiplying both prices by a constant amount t is equivalent to a decrease in income by the same factor t.
  - ➤ If prices and income increase by factor t, the budget line won't change.

2.5 Taxes, Subsidies and Rationing

- Economic policy often uses tools that affect a consumer's budget constraint, such as taxes.

2.5.1 Taxes

- If the government imposes a **quantity tax**, the consumer has to pay a certain amount to the government for each unit of the good he purchases.
  - ➢ Example: In the US, the federal gas tax is 15 cents per gallon.
- **How does a quantity tax affect the budget line of a consumer?**
  - ➢ From the viewpoint of a consumer, the tax effectively increases the price of the good.
  - ➢ Thus, a quantity tax of t dollars per unit of good 1 simply changes the price of good 1 from p_1 to $p_1 + t$.
  - ➢ This implies that the **budget line** becomes **steeper**.
- Another kind of tax is a **value tax (ad valorem tax or sales tax)**, where a tax is imposed on the **value of the good** rather than the quantity purchased.
  - ➢ Example: If the sales tax is 6%, then a good worth $1 will actually sell for $1.06.
  - ➢ **If good 1 has a price p_1 but is subject to a sales tax at rate τ, then the actual price facing the consuming is $(1 + \tau)p_1$.**
  - ➢ The consumer has to pay p_1 to the supplier and τp_1 to the government for each unit of the good so that the total cost of the good to the consumer is $(1 + \tau)p_1$.
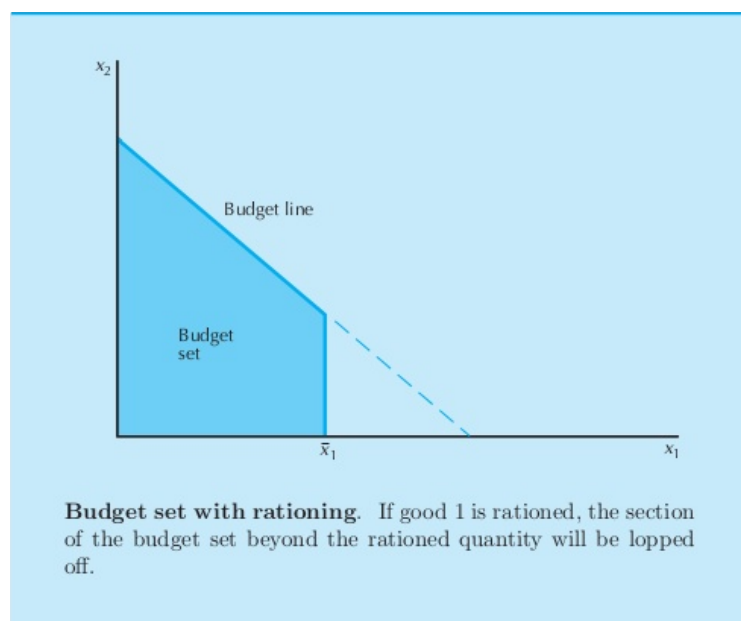
2.5.2 Subsidies

- A **subsidy** is the **opposite of a tax**.
  - ➢ **Quantity subsidy**: the government gives the consumer an amount of money that depends on the **amount** of the good consumed.
    - o If the subsidy is s dollars per unit consumed of good 1, then the actual price of good 1 is $p_1 - s$.
    - o Since the quantity subsidy lowers the actual price of the good, this results in a **flatter budget line**.
  - ➢ **Ad valorem (value) subsidy**: a subsidy based on the **price** of the good being consumed.
    - o **If the price of good 1 is p_1 and an ad valorem subsidy is imposed on the good at a rate σ, then the actual price of the good is $(1 - \sigma)p_1$.**

2.5.3 Effect on Budget Line of a Consumer – Taxes and Subsidies

- In summary, *taxes increase the price* of a good whilst **subsidies decrease the price** of the good.

- Another kind of tax or subsidy that the government might use is a **lump-sum** tax or subsidy.

    - ➢ **Lump-sum tax**: a tax where the government **takes away a fixed amount** of money from the consumer, regardless of their behaviour.

        - ○ This **reduces** the money income m.

        - ○ Thus, there is an **inward shift of the budget line**.

    - ➢ **Lump-sum subsidy**: a subsidy where the government **provides a fixed amount** of money to the consumer, regardless of their behaviour.

        - ○ This **increases** the money income m.

        - ○ Thus, there is an **outward shift of the budget line**.

- Quantity taxes and value taxes **tilt** the budget line one way or the other, depending on which good is being taxed.

    - ➢ Similarly, quantity subsidies and value subsidies tilt the budget line one way or the other, depending on which good is subsidised.

- Contrarily, a lump-sum tax or subsidy results in a **SHIFT** of the budget line.
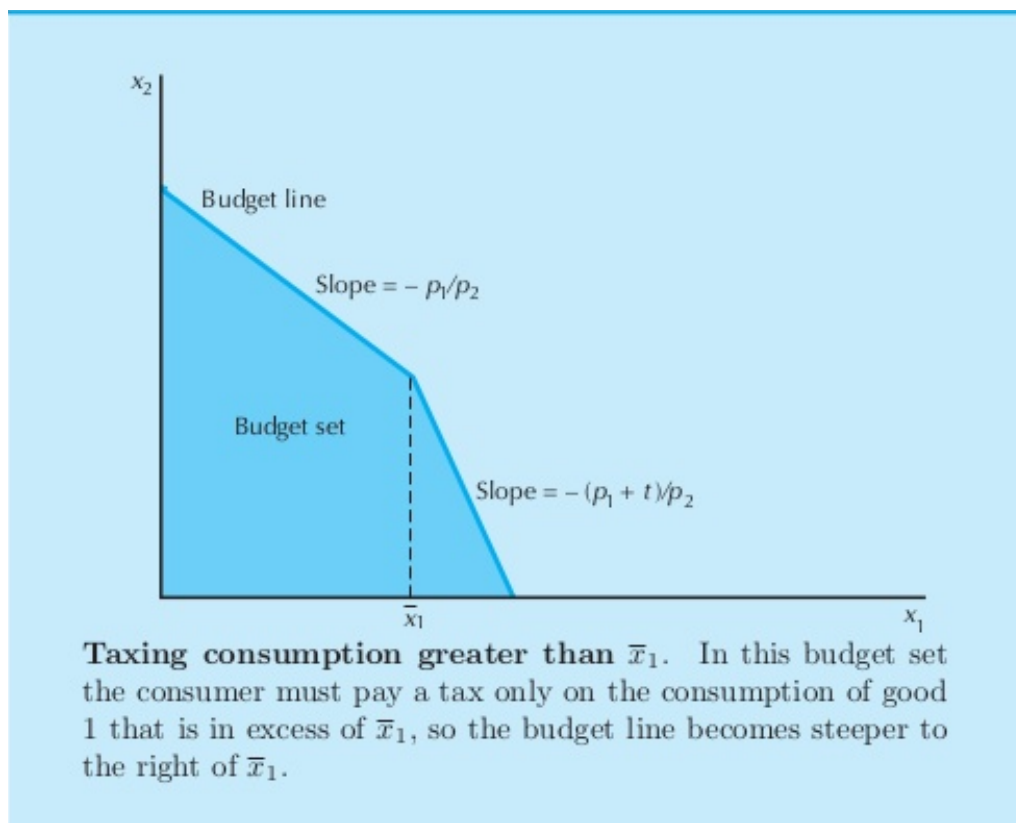
2.5.4 Rationing

- Governments also sometimes impose **rationing constraints**.

    - ➢ This means that the level of consumption for some good is **fixed** to be **no larger than a certain amount**.

Budget set with rationing. If good 1 is rationed, the section of the budget set beyond the rationed quantity will be lopped off.

- Suppose that good 1 was rationed so that no more than $\overline{x_1}$ could be consumed by a given consumer.

  ➢ Then the **budget set** would appear as in the picture above.

  ➢ It is the set of all affordable bundles of good 1 and good 2 with a piece lopped off

  ➢ The lopped-off piece consists of all consumption bundles that are affordable but have $x_1 > \overline{x_1}$.

2.6 Example – Tax + Rationing

- Example: Consider a situation where a consumer could consume good 1 at a price of p_1 up to some level $\overline{x_1}$ (rationed amount), and then had to pay a quantity tax of t per unit in excess of $\overline{x_1}$.

  ➢ The budget set for this consumer is depicted in the picture below.

- The budget line has a slope of $-\frac{p_1}{p_2}$ to the left of $\overline{x_1}$ and a slope of $-\frac{p_1+t}{p_2}$ to the right of $\overline{x_1}$.

  ➢ Reason: After the rationed amount $\overline{x_1}$ is exceeded, the price of good 1 increases from p_1 to $p_1 + t$ due to the quantity tax. This increases the opportunity cost of consuming good 1, resulting in an increase in the (absolute) slope and causing the budget line to become **steeper**.

Taxing consumption greater than $\overline{x}_1$. In this budget set the consumer must pay a tax only on the consumption of good 1 that is in excess of $\overline{x}_1$, so the budget line becomes steeper to the right of $\overline{x}_1$.

Week 2 (I) – Preferences (Chapter 3)

- Last chapter was devoted to clarifying the meaning of **'can afford'**.

  - ➢ This chapter will be devoted to clarifying the economic concept of **'best things'**.

3.1 Consumer Preferences

- We will suppose that given any two consumption bundles, $X = (x_1, x_2)$ and $Y = (y_1, y_2)$, the consumer can **rank** them based on their **desirability**.

  - ➢ Desirability: which bundle of goods the consumer would choose if given the option of both.

- If the consumer **prefers** bundle X to bundle Y, then bundle X is **strictly preferred** to bundle Y.

  - ➢ That is, $X \succ Y$.

  - ➢ Equivalently, $Y \prec X$.

- If the consumer is **indifferent** between X and Y, then they would be **equally satisfied** with bundle X as they would be with bundle Y.

  - ➢ That is, $X \sim Y$.

- If the consumer **prefers** X to Y **or is indifferent** between them, then they **weakly prefers** bundle X to bundle Y.

  - ➢ That is, $X \succeq Y$.

- The relations of strict preference, weak preference and indifference are themselves **related**.

  - ➢ If a consumer **weakly prefers** X to Y, but also **weakly prefers** Y to X, then the consumer is **indifferent** between bundle X and bundle Y.

  - ➢ That is, **if $X \succeq Y$ and $Y \preceq X$, then $X \sim Y$**.

3.2 Assumptions about Preferences

- For the sake of consistency of consumers' preferences, economists make assumptions about how preference relations work i.e. **axioms**.

- **Complete**: Any two bundles can be compared.

  - ➢ That is, given any bundles X and Y, we can assume that $X \succeq Y$ or $Y \succeq X$, or both, in which case $X \sim Y$.

- **Reflexive**: Any bundle is at least as good as itself.

  - ➢ That is, $X \succeq X$.

- **Transitive**: If X is weakly preferred to Y and Y is weakly preferred to Z, then X is weakly preferred to Z.