Introduction to Microeconomics

Income and Substitution Effects

**Introduction**

The income effect is the proportion of the change in demand that is attributed to a change in income. The substitution effect is the change in demanded for good i as the price of good j changes when the consumer is compensated enough to remain on the same indifference curve.

**A Change in Income**

Diagram 1 shows how an increase or decrease in income will change the amount a person will consume of good x and good y. The change in income is represented by $I_1$, $I_2$ and $I_3$ which are three different levels of income. The utility curves indicate the consumers preference for the two goods. When income is $I_1$ then the optimal combination that maximised utility is $(X_1, Y_1)$ which is the point of tangency between the indifference curve and the budget constraint. This point of tangency equates the $\text{MRS}_{xy}$ with the slope of the budget constraint.

$$\text{MRS}_{xy} = -\frac{p_x}{p_y}$$

Diagram 1 An Increase in Income
Normal and Inferior Goods

Normal Good: A good where consumption increases/decreases as income increases/decreases. Diagram 2 is an example where both goods $x$ and $y$ are normal goods because as income increases the quantity consumed for both goods increase.

$$\frac{\partial x_i}{\partial I} \geq 0 \quad \text{Normal Good}$$

Inferior Good: A good where consumption decreases/increases as income increases/decreases. This is shown in diagram 3.

$$\frac{\partial x_i}{\partial I} < 0 \quad \text{Inferior Good}$$
A Relative Price Change

A change in the price of a good will induce a substitution and income effect. The change in the price of one good will cause the intercept of that good to change and thus a change in slope. This will of course change the optimal consumption bundle as the new slopes will be tangent with a new indifference curve. Consequentially, the marginal rate of substitution has also changed.

The substitution effect equates the original MRS to the new budget constraint price ratio.

The income effect arises because a price rise changes the amount of income and therefore the individual must move to a new indifference curve.

Diagram 4 A fall in the price of good x

Diagram 5 illustrates the income and substitution effects for a increase in the price of good x. Firstly the consumer is located at point A where \( X_1 \) of good x and \( Y_1 \) of good y is consumed. Then as the price increases the slope of the budget constraint decreases and the consumer will locate at point B with \( X_2 \) and \( Y_2 \). This is because the given the consumers preferences they will substitute away from the relatively more expensive good y and into the relatively cheaper good x. Point C lies along the dotted red line and has the same slope as \( I_2 \). The dotted red line is tangent to the original indifference curve, holding utility constant and allowing us to observe the substitution effect involving a
change along the initial indifference curve but with new relative prices. The income effect is the movement to a higher utility level $U_2$ because the level of real income has increased because the consumer can now buy more goods for a given amount of income. Both goods $x$ and $y$ are normal good and therefore they will both increase as income increases. It is important to note that we never observe $B$ in consumption behaviour as it is only used in theory to separate the substitution and income effects. We only observe the movement from $A$ to $B$.

**Diagram 5 An Increase the price of good $x$**

As before in the case of a decrease in the price of good $x$ we can see that there is substitution and income effects. The substitution effect is the movement from point $A$ to point $C$. The substitution effect induces the consumer to consume more of good $y$ as it is relatively cheaper and less of good $x$ as it is now more expensive. The price increase creates a loss of purchasing power and thus a movement to a lower indifference curve $U_2$ which is the income effect. This relocation to point $B$ is the income effect. Income and substitution effects both cause the quantity of $x$ consumed to fall to $X_2$. 
Diagram 6 demonstrates the outcome resulting from a change in the relative price of x and y. We have shown the change in relative price by an increase in the price of good y. Now the new budget constraint has a different slope to the original budget constraint as a result of the changing relative price. A change in the relative price will induce the substitution effects. In the diagram the substitution effect is denoted by the move from A to B. The income effect is shown by the move from B to C. The total effect on a change in demand for x is undetermined as C is in line with A. Likewise the total change in demand for good y is the vertical distance from A to C. This makes sense because as the price of good y falls the demand will increase given it is a normal good. Whether demand for x increases or decreases depends on the magnitudes of the income and substitution effects. A change in the price of a good will induce a substitution and income effect. The change in the price of one good will cause the intercept of that good to change and thus a change in slope. This will of course change the optimal consumption bundle as the new slopes will be tangent with a new indifference curve. Consequentially, the marginal rate of substitution has also changed. The substitution effect equates the original MRS to the new budget constraint price ratio. The income effect arises because a price rise changes the amount of income and therefore the individual must move to a new indifference curve.

For more insight into the mathematics behind the income and substitution effects as a response to a price change you should undertake further reading on the Slutsky Decomposition.