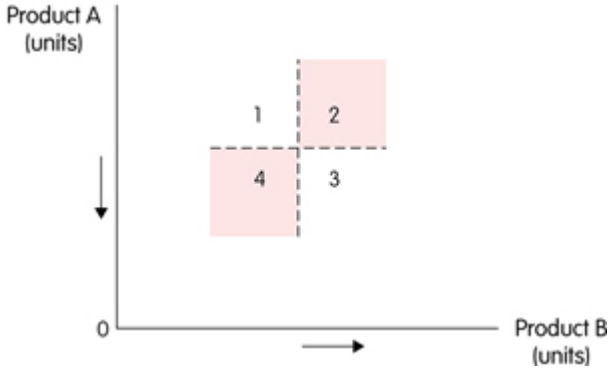
Indifference curve analysis

Indifference curve analysis lies behind a demand curve. It can be used to examine the effect of price changes and income changes.

Indifference curves

An indifference curve shows the combination of two products that provide an individual with a given level of utility (satisfaction).

Assuming the products are "good" (i.e. we want more of them rather than less) then if we have more of one product we must give up some of the other to compensate and still maintain the same total utility; therefore an indifference curve must slope downwards from left to right from quadrant 1 to 3 on the diagram.
No combination in quadrant 2 could be on the same indifference curve as combination X because it would have more of product A and product B and would therefore have a higher utility.
No combination of products in quadrant 4 could be on the same indifference curve as combination X because it would have less of product A and B and would therefore have lower utility.



According to the law of diminishing marginal utility each extra unit of product B will provide successively less extra utility. This means successively less of product A has to be sacrificed to keep the same utility overall. This can be seen by the gradient of the indifference curve.

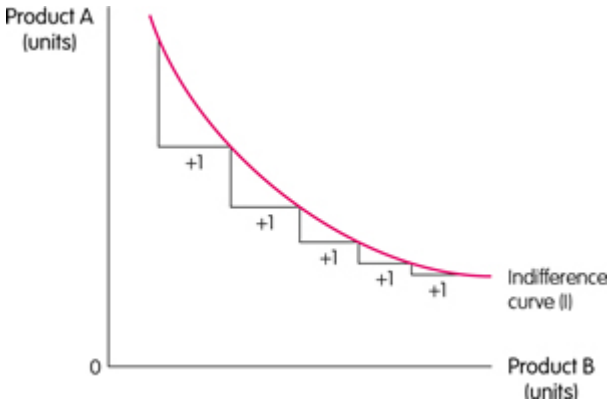
The gradient of an indifference curve is given by the Marginal Rate of Substitution (MRS). This shows the amount of product A a consumer would be prepared to give up for another unit of B and still maintain the same total utility. The Marginal Rate of Substitution is given by:

$$\frac{\text{Marginal Utility of B}}{\text{Marginal Utility of A}} = \frac{\text{MU B}}{\text{MU A}}$$

I.e., if an additional unit of product B provides twice as much utility as product A then the consumer would sacrifice 2A for 1B.

The gradient of the indifference curve at this point is:

$$\frac{-2}{1} = -2$$



The further away from the origin on an indifference curve, the higher the total utility; this is because the higher the indifference curve, the more products are being consumed and if goods are "good" our utility must be therefore be greater.

I3 has a higher level of utility than I1. Assuming the aim of consumers is to maximize utility, this means they will want to consume on the highest possible indifference curve.

The budget line

The constraint for consumers is their income. Given the prices of the products and given an amount of income, there is a limit to what a consumer can buy. The maximum affordable combination of products that a consumer can afford is shown by the budget line.

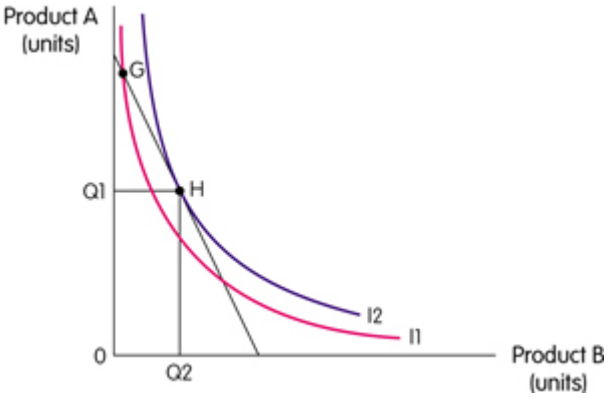
The slope of the budget line depends on the relative prices of the products. It is given by:

$$\frac{\text{Price of B}}{\text{Price of A}} = \frac{PB}{PA}$$

Imagine the consumer's income is £100, the price of A is £10, and the price of B is £20. If all the income is spent on A then 10 units of these can be bought. If all the income is spent on B

then 5 units can be bought. The budget line shows the maximum combinations that can be afforded given the prices of A and B and an income of £100.

Maximizing utility



A consumer will maximize utility by consuming on the highest possible indifference curve (i.e. we assume all income is spent). This is where an indifference curve is tangent to the highest possible budget line. A consumer could consume at G, for example, but would be on a higher indifference curve at H. This means that to maximize utility the consumer would consume Q1 of product A and Q2 of product B.

The consumer is maximizing utility where the budget line and indifference curve are tangent, i.e.:

$$\frac{MU\ B}{MU\ A} = \frac{P\ B}{P\ A}$$

Rearranging this equation we get:

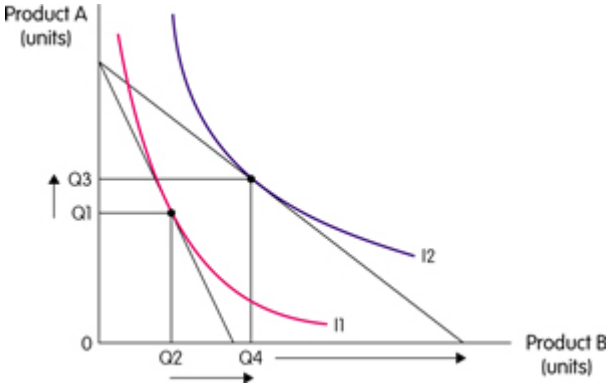
$$\frac{MUa}{Pa} = \frac{MUb}{Pb}$$

This is the equi-marginal condition. The last unit of A per pound provides the same utility as the last unit of B per pound. The consumer cannot increase her utility by rearranging her consumption patterns; she is maximizing her utility.

If there were more products available the condition would be:

$$\frac{MUa}{Pa} = \frac{MUb}{Pb} = \frac{MUc}{Pc} = \frac{MUd}{Pd} \ldots$$

A fall in the price of a product: substitution and income effects

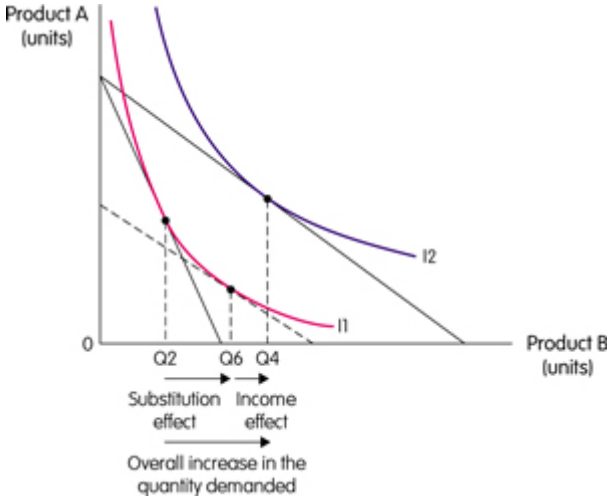


If the price of B now falls, the budget line now pivots. The consumer now maximizes utility consuming Q3 of product A and Q4 of product B. The fall in the price of product B has led to an increase in quantity demanded of Q2Q4. This can be shown on a demand curve.

The increase in quantity demanded as a result of the fall in price can be divided into two parts: the substitution effect and the income effect.

1. *The substitution effect* shows the effect of the relatively lower price of product B compared to product A following a price fall. To isolate this effect diagrammatically we move the new budget line inwards and parallel until it is tangent to the old indifference curve. The new slope reflects the new relative prices but the utility is the same as it was originally. The substitution effect is Q2Q6. The substitution effect will always lead to more of the relatively cheaper product being demanded.
2. *The income effect* is identified by shifting the budget line back outwards again. In this case this leads to an increase in quantity demanded of Q6 Q4. The income effect shows the effect of an increase in real income following a price fall. If the price of a product falls you can buy more products because you have more purchasing power.

In the case of a **normal good** the higher real income leads to an increase in quantity demanded; this complements the increase due to the substitution effect. This is shown in diagram 1.



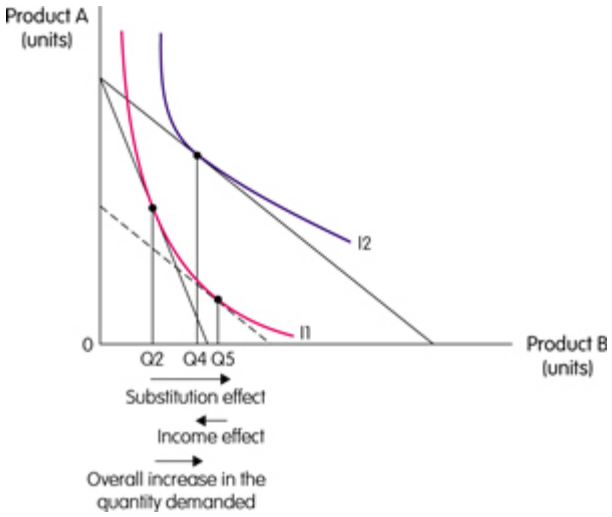
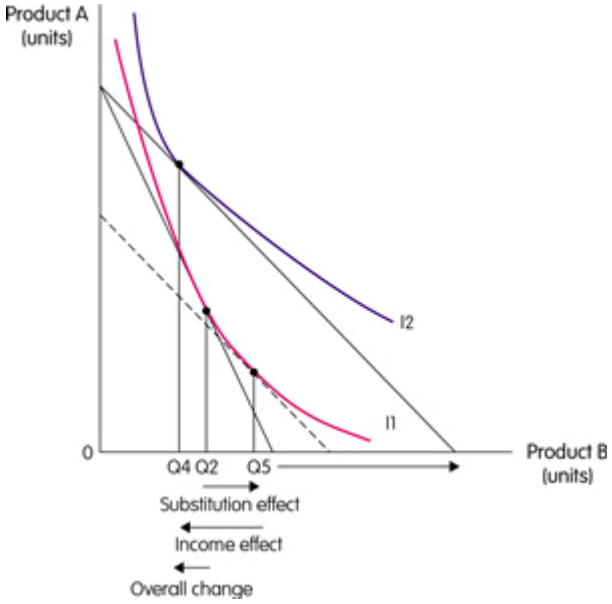


Diagram 1

Diagram 2

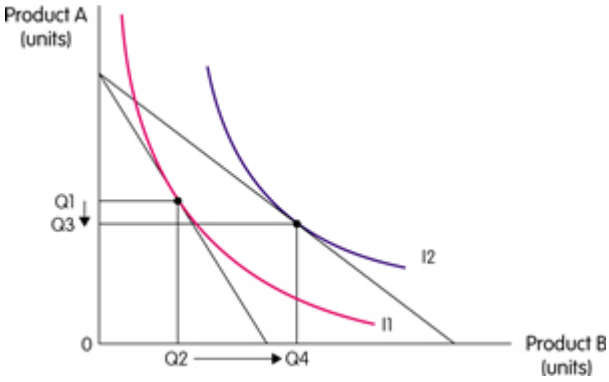
In the case of an **inferior product** the income effect leads to a fall in the quantity demanded which will work against the substitution effect. In diagram 2 the substitution effect is Q2 Q5; the income effect in Q5 Q4. However the substitution effect outweighs the income effect and overall the quantity demanded rises. The overall change in quantity demanded in an increase of Q2Q4. This means the demand curve is downward sloping because a price fall increases the quantity demanded.



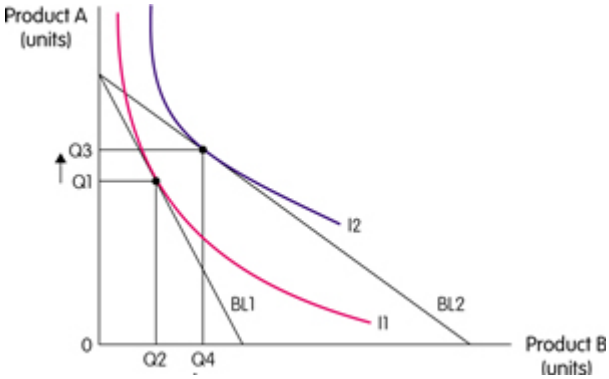
In the case of a **Giffen product** the income effect leads to a fall in the quantity demanded which will work against the substitution effect and outweigh it. This means that following a price fall the overall the quantity demanded falls. This means the demand curve is upward sloping. This is shown in the diagram above.

The effect of a fall in price			
	Substitution effect	**Income effect**	**Overall**
Normal good	Increases quantity demanded	Increases quantity demanded	Increases quantity demanded; downward sloping demand curve
Inferior good	Increases quantity demanded	Decreases quantity demanded	Increases quantity demanded; downward sloping demand curve
Giffen good	Increases quantity demanded	Decreases quantity demanded	Decreases quantity demanded; upward sloping demand curve

Substitutes and complements

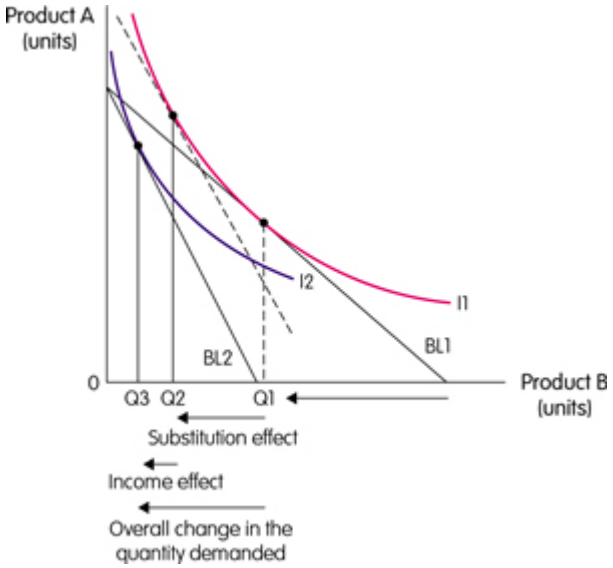


Indifference curve analysis will also allow us to see whether two products are substitutes or complements. In the diagram above a fall in the price of product B has led to a change in the budget line. As a result, more of product B and less of product A are bought. The products are substitutes. The consumer has switched from product A to product B.



In the diagram above the price of product B has fallen. This has led to an increase in the quantity demanded of A and B; the two products are complements. A lower price leads to more of both goods being bought.

The impact of a price increase

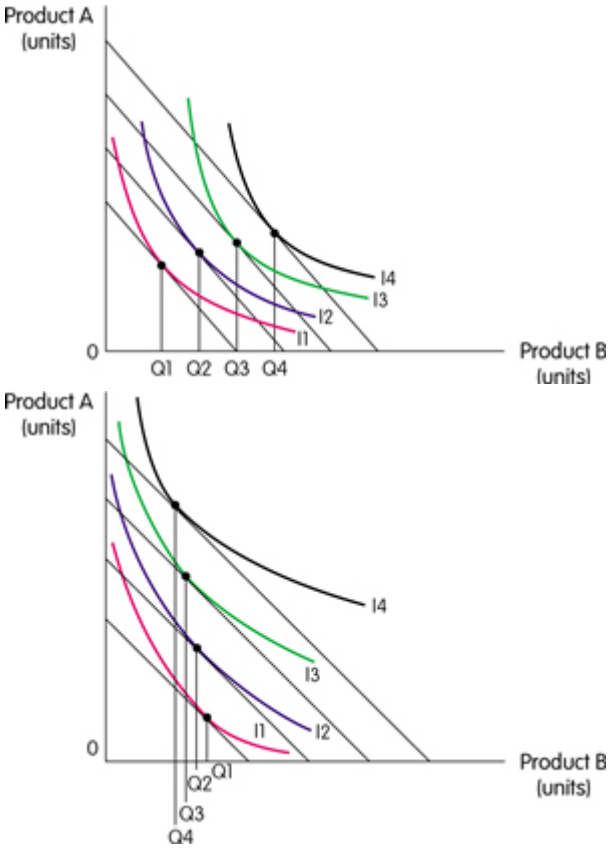


A price increase can be analysed in exactly the same way as a price decrease. Imagine B increases in price, this leads to the budget line pivoting. To identify the substitution effect we shift the budget line outwards and parallel until it is just tangent with the original indifference curve. This shows the substitution effect Q1Q2. Consumers will always substitute away from the relatively more expensive product. Given an increase in the price of a product then real income falls- the consumer has less purchasing power. This can be shown by the effect of shifting the budget line back in and parallel. In this case the income effect is to further reduce the quantity demanded (which means it is a normal good) by Q2Q3. The overall change in quantity demanded is Q1Q3 which can be shown on a demand curve.

The effect of an increase in price			
	Substitution effect	**Income effect**	**Overall**
Normal good	Decreases quantity demanded	Decreases quantity demanded	Decreases quantity demanded; downward sloping demand curve
Inferior good	Decreases quantity demanded	Increases quantity demanded	Decreases quantity demanded; downward sloping demand curve
Giffen good	Decreases quantity demanded	Increases quantity demanded	Increases quantity demanded; upward sloping demand curve

An increase in income

The effect on the demand for a product as a result of an increase in income can also be analysed using indifference curve analysis. An increase in income shifts the budget line out parallel. The relative prices of the products have not changed so the gradient of the budget line is the same; income has increased so the budget line has shifted outwards as more of the products can be purchased. The new combinations of products that maximize utility can be identified; from this the impact of income changes on the demand for a product can be analysed.



In the diagram above on the left B is a normal good. An increase in income increases the quantity demanded. In the diagram above on the right product B is inferior. An increase in income reduces the quantity demanded.