HE+ Economics – Income and Substitution Effects

Changes in demand due to changes in prices
It is quite natural that when the price of a good changes, the quantity in demand will change too. This can be simply illustrated by considering how many chocolate bars you would be willing to buy if they cost 5p and how that would change if they cost 10p, 15p, etc.

Hopefully this little thought experiment will reveal that there is a negative relationship between price and quantity demanded – as the price of a good goes up, you demand less of it. The change in the quantity demanded due to a price change can be decomposed into two effects: the income effect and the substitution effect.

Total change in demand = income effect + substitution effect.

The substitution effect
At school, you may have encountered complements and substitutes.¹ The substitution effect is a different concept to these.

The substitution effect is about what happens to the demand for good x when the price of good x changes. It is the part of the total change in demand caused by the change in the relative price of x (relative to other goods).

When the price of x rises, it always becomes more expensive, and therefore less attractive, relative to other goods. Therefore, the substitution effect is always negative. This means that, when the price of good x rises, the change in demand for x caused by the substitution effect is negative. When the price of good x falls, the change in demand for x caused by the substitution effect is positive.

The income effect
The income effect is the part of the change in demand caused by the change in a consumer’s purchasing power. Let’s say the price of x rises and the prices of all other goods remain the same, as does the consumer’s income. This means the consumer’s purchasing

¹ Technically, you have encountered the concept of gross substitutes and gross complements.
power has decreased; if she spends the same amount of money on all other goods as before, she can no longer afford as many units of x as she used to be able to. Income effects can also be caused by changes to the consumer’s income (without prices changing) as, if income increases their purchasing power increases, and vice versa for an income decrease.

The income effect can be positive or negative. Inferior goods (the sort of goods you would expect people to buy less of as they get richer, e.g. bus travel) are defined as being goods that have a negative income effect: when the price of good x rises or the consumer’s income falls, the change in demand for x caused by the income effect is negative. The opposite is true for normal goods (the sort of goods you would expect people to buy more of as they get richer, e.g. cars).

**Giffen goods**
For almost all goods, the relationship between price and demand is negative: demand falls as the price rises. Since the substitution effect is always negative, this means that goods are either normal or that, for inferior goods, the substitution effect is stronger than the income effect.

Very rarely, it may be the case that there is a positive relationship between price and demand. There is debate as to whether such goods have ever existed. See, e.g., [http://www.investopedia.com/terms/g/giffen-good.asp](http://www.investopedia.com/terms/g/giffen-good.asp). The main objection to the existence of Giffen goods is that the conditions the good must meet are extreme and occur only when the good is very scarce (i.e. when aggregate consumption of it falls). This is illustrated in the following example.

Consider a stylised version of the Irish potato famine of the 18th century. Peasants were earning only just enough money to buy enough food to keep them alive and obtained their calories from meat and potatoes. When the famine hit, the price of potatoes increased substantially, but potatoes remained a cheaper source of calories than meat. Therefore, in order to sustain themselves, i.e. buy the minimum number of calories needed to survive, the peasants had to buy more potatoes and less meat. While the substitution effect was negative, as always, the income effect was so positive, it outweighed the substitution effect.
The example illuminates the conditions necessary for a Giffen good:

- The good is an inferior good (otherwise the income effect would be negative as well).
- The good has few close substitutes that are readily available (this weakens the substitution effect).
- The good must still be preferable to the (distant) substitutes available after the price change.
- The good takes up a large portion of consumers' budgets (to strengthen the income effect – this means the price rise causes a severe fall in purchasing power and thus a strong income effect).

There are some objections to classifying potatoes here as a Giffen good, the main argument being that, given that Ireland was in the grip of a potato famine at the time and there were very few imports of potatoes, total potato consumption must have fallen (Dwyer and Lyndsay, 1984).

Potatoes may have been a Giffen good for peasant farmers, but not on aggregate. Dwyer and Lyndsay (1984) further argue that this was unlikely as meat took up very little of peasant farmers’ budgets in non-famine times. This would mean that few calories would be lost from being able to afford less meat, so the income effect described above would be somewhat weaker.

**Income and substitution effects through time**

We can model an individual’s saving decision by considering consumption at different points in time as different goods.

For simplicity, we consider a situation where the individual lives for only two periods (and knows that they will live for only two periods), they can borrow and lend freely at the interest rate \( r \), they know their income in each period in advance and there is one consumption good, \( c \), which is a normal good. Consumption in the first period is \( c_1 \); consumption in the second period is \( c_2 \).
The opportunity cost\(^2\) of consuming one unit of \(c_1\) is \((1+r)\), meaning if I’d saved that one unit of \(c_1\) instead of consuming it, I’d be able to consume \((1+r)\) more units of \(c_2\). The opportunity cost of consuming one unit of \(c_2\) in terms of \(c_1\) is \(\frac{1}{(1+r)}\).

If income in either period increases, there is a pure wealth effect and consumption in both periods will increase. Total income across the two periods has increased and the fact that your income in each period is known with certainty in advance means you can borrow against higher second period income. If the interest rate increases, we will have a negative substitution effect for \(c_1\) and a positive one for \(c_2\). The opportunity cost of \(c_1\) in terms of \(c_2\) has risen and the opportunity cost of \(c_2\) in terms of \(c_1\) has fallen.

The sign of the income effect will depend on whether the individual borrows or saves at the end of period one. If he is a borrower, a higher interest rate increases interest payments in period two and so effectively reduces the borrower’s total income. The income effect is therefore negative. If the substitution and income effects arising from a change in \(r\) have opposite signs for consumption in a given period, the total effect on consumption in that period is ambiguous: we don’t know if it will increase or decrease.

Arguments about Giffen goods not existing don’t apply in this case as a change in interest rates affects nominal as well as real income. In the Giffen good analysis above, it was implicitly assumed that nominal income remained constant, which weakened the income effect.

References

The above article is an academic article, so may be a bit dense, and is also behind a pay wall. You do not need to read it.

\(^2\) See [https://www.tutor2u.net/economics/reference/opportunity-cost](https://www.tutor2u.net/economics/reference/opportunity-cost) if you are yet to encounter the concept of opportunity costs.