Income and substitution effects

The inverse relationship between price and quantity demanded results from both an income effect and a substitution effect. A change in price causes a change in both the relative price of the product and the purchasing power of the consumer's income. Either one of these changes taken in isolation would bring about a change in the quantity demanded. One can think of the total change in quantity demanded brought about by a change in price as being the sum of these two isolated changes. In algebraic terms, we can write: $\frac{\Delta Q_d}{\Delta P} = \left(\frac{\Delta Q_d}{\Delta P}\right)_{\text{substitution effect}} + \left(\frac{\Delta Q_d}{\Delta P}\right)_{\text{income effect}}$. Our strategy will be to find the income effect; the substitution effect is then found as the difference between the total effect (the left-hand side of the equation) and the income effect.

Consider, then, the income effect term. It can be rewritten as $\left(\frac{\Delta Q_d}{\Delta P}\right)_{\text{income effect}} = \frac{\Delta Q_d}{\Delta I}\frac{\Delta I}{\Delta P}$. That is, the income effect is the product of two terms. The first term measures the amount by which a change in income changes quantity demanded; the second term measures the amount by which a change in the price changes a consumer's income, or purchasing power. Multiplying them gives us the income effect: a price increase reduces the consumer's purchasing power by $\frac{\Delta I}{\Delta P}$ dollars; each one of these dollars reduces the quantity demanded by $\frac{\Delta Q_d}{\Delta I}$ units.

For example, consider an individual who is currently purchasing four DVDs per month. How might we measure the income effect of a $1 increase in the price of DVDs? Each of these four discs now costs $1 more so, all else equal, our consumer will be spending $4 more each month on DVDs. This <u>reduces</u> her purchasing power by $4. In general, each dollar increase in the price will reduce purchasing power by an amount equal to the quantity demanded: $\frac{\Delta I}{\Delta P} = -Q_d$. Substituting this into our formula, we can write[1]: $\frac{\Delta Q_d}{\Delta P} = \left(\frac{\Delta Q_d}{\Delta P}\right)_{\text{substitution effect}} - Q_d\frac{\Delta Q_d}{\Delta I}$.

Having found the income effect, the substitution effect can be found as the difference between the total effect and the income effect. We saw above that a price change affects a consumer's purchasing power and that this change in purchasing power affects her quantity demanded. Removing this effect leaves us with the substitution effect. The important point to note here, however, is that the substitution effect is always negative – an increase in price always causes substitution away from the product. As long as consumers buy less of the good when income decreases (that is, this is a *normal good*, $\frac{\Delta Q_d}{\Delta I} > 0$), the second term will also be negative because of the minus sign in front of Q_d. That is, for a normal good, the income and substitution effects work together to reduce quantity demanded when the price of the product increases.

[1] This equation is known as the Slutsky Equation.