**Income and substitution effects**

The effects of price change on the amount of consumption are decomposed into two effects: substitution and income effects. Substitution effect is the change of your demand when you are compensated after the change of the price. Income effect is the change of consumption due to the change of income with the prices set constant. Income effect is assumed to be positive to avoid unnecessary complications in most of applied economic literature.

\[ px_1 + x_2 = y \]
\[ p_2 = 1 \]

The price of the second good is set unity for simplicity. Now, let us assume the price of the first good increases. How does this affect the demand of the first good? Show the effects in the figure below with A the choice before the change.

<table>
<thead>
<tr>
<th>Substitution effect</th>
<th>Income effect</th>
<th>Total effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1: normal good</td>
<td>N+N ( \Rightarrow ) N</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>B2: inferior good</td>
<td>N+P ( \Rightarrow ) N</td>
<td></td>
</tr>
<tr>
<td>B3 Giffen good</td>
<td>N+P ( \Rightarrow ) P</td>
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</tbody>
</table>

N: Negative, and P: Positive
Extensions
In the case above, your income $y$ is fixed (lump-sum income). But in many other occasions, you have a certain endowment (say 24 hours) and your income, too, depends on price. If your endowment is $\omega$ and you do not consume it at all, and the price of it is $p$, then your income is $P\omega$. That is, the higher the price, the higher your income. In this case your budget constraint is, $px_1 + x = p\omega$

What will be the effects of price change on your consumption in this case? What will change from our observation with fixed income?

There are in fact very important problems related to this question. One is the effect of interest rate on your savings. Suppose you split your income into consumption when you are young and the one when you are old. Does the decrease of interest rate due to a tax on it decrease your savings (that is, you increase your consumption when young)? Do you rather increase your savings, because your income from interest when you become old is decreased? Do substitution and income effects have something to do with the change of savings?

Another interesting example is the effect of wages on your labor supply (another side of the coin is, leisure demand). Does the decrease of wages due to the tax on it decrease your labor supply? Do you rather increase your labor supply (that is, decrease your leisure demand), because you get poorer due to the decline of wages?

A bit formally let us discuss the two problems.

1. Saving
   
   $U(c_1, c_2)$ and $c_1 + \frac{c_2}{1+r} = y$
   
   Note your budget is written as
   
   $(1 + r)c_1 + c_2 = (1 + r)y$
   
   The price of the current consumption, $(1+r)$, affects your total income $(1+r)y$ as well. When the interest is taxed, how does it affect your consumption when young, $c_1$?

2. Labor supply

   $U(m, l)$ and $m = w(T - l)$, this is the same with $m + wl = wT$
   
   $m$: income from labor, $l$:leisure, $T$: labor supply
   
   When your wages is taxed, how does it affect your leisure demand (therefore, labor supply)?