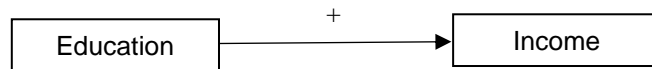**Modeling – Regression**

So far, we have been performing regressions on a dependent variable Y against an independent variable X. For example, we can examine how education (X) affects income (Y). Pictorially, this would appear as:

```
                              +
┌──────────────────┐                      ┌──────────────────┐
│    Education     │ ─────────────────────▶│     Income       │
└──────────────────┘                      └──────────────────┘
```

The line and arrow identify a relationship between education and income. The plus sign above the line indicates that the relationship is positive, i.e., if education increases, then income increases.
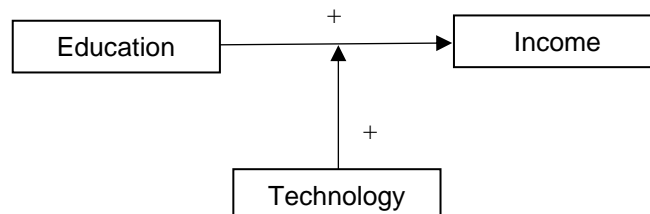
This relationship can be written as:

Income = f(Education)

Which means that income is a function of education. One formulation of this could be the linear relationship:

$Income = \beta_0 + \beta_1 * Education$

Where β_0 is the intercept and β_1 is the coefficient for education.

Now consider a third variable: technology. Technology has the potential for increasing the value of educated employees. Technology itself does not generate income for an employee, but affects the value of education. This is called a moderating variable and is shown as:

```
                              +
┌──────────────────┐                      ┌──────────────────┐
│    Education     │ ─────────────────────▶│     Income       │
└──────────────────┘            ▲          └──────────────────┘
                                │
                                + 
                     ┌──────────────────┐
                     │    Technology    │
                     └──────────────────┘
```

This new model means that as education increases, income increases. The moderating effect of technology on education implies that technology further increases the value of education. This is modeled as an interaction term:

$Income = \beta_0 + \beta_1 * Education + \beta_2 * Education * Technology$

Therefore, the effect of education on income is influenced by the level of technology that an employee has.

Summary

A dummy variable changes the intercept. A moderating effect (interaction) changes the slope.