

Explanatory and Response Variables

by Sophia



WHAT'S COVERED

This tutorial will explain explanatory and response variables. Our discussion breaks down as follows:

1. Explanatory Variables and Response Variables

1. Explanatory Variables and Response Variables

When examining the relationship between two variables, you often want to see if there's an effect that one has on the other. Does one variable being high or low help to explain why another variable would be high or low? Why would something being high or low cause one to increase or decrease? It doesn't necessarily have to cause the increase or decrease; it just has to be associated with an increase or decrease in the other.

An **explanatory variable** is a variable that might cause an effect; it is the thing that we are looking to cause something to happen. The **response variable** is the variable that will reflect that effect.

On a graph, the explanatory variable will go on the horizontal x-axis, and the response variable will go on the vertical y-axis.



HINT

Here is a mnemonic device to help you remember which variable goes on which axis: "explanatory" has an "x" in it, so it's the x-axis, the horizontal axis.

IN CONTEXT

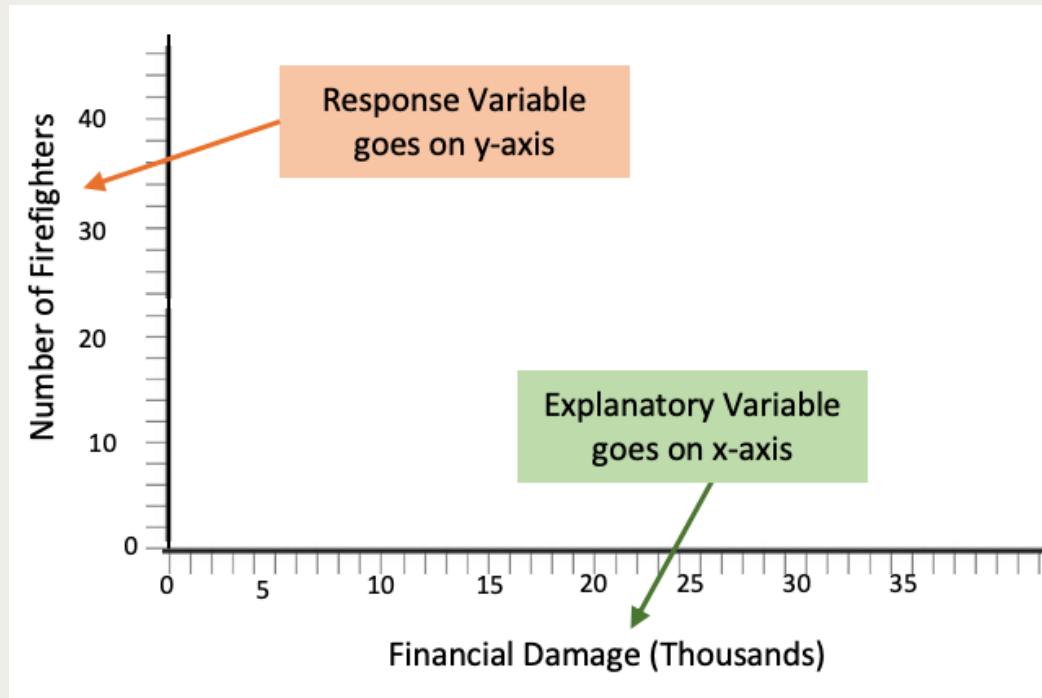
A fire breaks out, and you want to determine the relationship between the number of firefighters at the fire and the financial damage caused by the fire. There's a positive association between these two because as one goes up, the other goes up. Which one helps to explain the other?

The financial damage caused by the fire will help explain the number of firefighters at the fire. It's important to know that it doesn't work the other way--meaning, if there are more firefighters, there will

be more damage.

They are associated, though, with each other. Because the severity of the fire is going to cause more damage, it's also going to cause more firefighters to arrive on-scene.

When you put it on the graph, the explanatory variable, financial damage, goes on the x-axis. The response variable, number of firefighters, goes on the y-axis.



THINK ABOUT IT

Consider the following examples and identify the explanatory and response variable:

Example	Explanation
Maximum Daily Temperature and Cooling Costs	Explanatory: Maximum Daily Temperature Response: Cooling Costs The maximum daily temperature is going to cause a change in cooling costs. The higher the temperature, the more it will cost to cool your house.
Rent and Square Footage of an Apartment	Explanatory: Square Footage of an Apartment Response: Rent The square footage is going to cause a change in the cost of the rent. As the square footage of an apartment increases, the rent of the apartment will also go up.

SAT Verbal Score and SAT Math Score

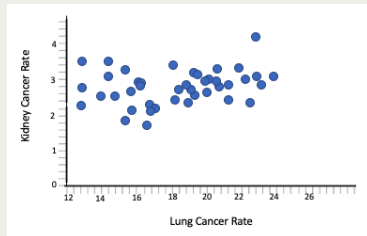
These two variables may be associated, meaning someone who does well on the verbal portion of the test may also do well in the math portion. Here, however, one variable does not necessarily cause a change in the other, so we would not assign either as the explanatory variable, and you can choose any axis for the variables.

Occasionally, there is not a clear explanatory variable. What happens then?

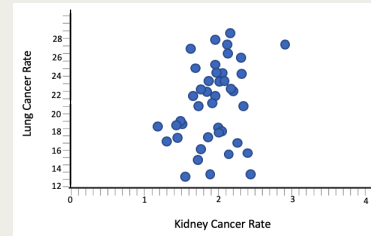
IN CONTEXT

Cancer rates for kidney and lung cancer is known for the 50 states in the U.S. You don't think that one type of cancer causes the other type. You don't really even think that an increase in one corresponds to an increase or decrease in the other. The types of cancer don't seem to be related.

So in this case, when you graph them, it really doesn't matter which one is talking about being the explanatory or response variable. They can be graphed either way.



OR



BIG IDEA

It only matters which variable goes on the x-axis if there's some obvious choice for an explanatory or response variable. In situations where there is no clear explanatory variable, more investigation would be required.



TERMS TO KNOW

Explanatory Variable

The variable whose increase or decrease we believe helps explain a tendency to increase or decrease in some other variable.

Response Variable

The variable that tends to increase or decrease due to an increase or decrease in the explanatory variable.



SUMMARY

In a scatter plot, an explanatory variable is one variable that helps to explain an increase or decrease in another; it is on the x-axis. The variable that appears to increase or decrease due to the increase or decrease in the explanatory variable is called the response variable and is placed on the y-axis. If it's not clear whether one variable is associated with an increase or decrease in the other at all, or we believe that there's no real association between the two, then it doesn't really matter which one we call the explanatory or response.

Good luck!

Source: THIS TUTORIAL WAS AUTHORED BY JONATHAN OSTERS FOR SOPHIA LEARNING. PLEASE SEE OUR [TERMS OF USE](#).



TERMS TO KNOW

Explanatory Variable

The variable whose increase or decrease we believe helps explain a tendency to increase or decrease in some other variable.

Response Variable

The variable that tends to increase or decrease due to an increase or decrease in the explanatory variable.