

The Residual Fallacy

D. McManaman

The claim that women are still paid less than men for doing the same work is one that has not died, but it has been tested, and the claim has been found wanting. The root of this claim is the residual fallacy, a pervasive statistical fallacy that involves assuming that all unexamined factors that might contribute to an explanation of a particular phenomenon are equal, such that all remaining differences in outcome can be attributed to discrimination.

Allow me to explain using the conditional reasoning we studied in class. We know that the logic of the scientific method requires testing a conclusion, because the method is fundamentally inductive. This means we begin with the evidence and proceed to account for that evidence through conjecture. Corroborating evidence does not prove a hypothesis; rather, confirming a hypothesis leaves a conclusion underdetermined (a matter of affirming the consequent), and so rigorous testing is required in order to determine which alternative possibilities are the most plausible. You are familiar with the following argument:

q
p \supset **q**
 \therefore **p**

In the context of scientific experimentation, we speak of *independent* and *dependent* variables. If we were to put this in the context of the conditional syllogism, it would look like the following:

Dependent variable

If (independent variable), then (dependent variable)

Therefore, independent variable.

For example,

I've been experiencing stomach pains recently (q). My wife tells me that it is the result of the cookies I've been eating, which are high in fibre (p). Hence,

I am experiencing stomach pains (q).

<If I eat cookies that are high in fibre, then I will experience stomach pains> (p \supset q) .

Therefore, it is the result of eating cookies that are high in fibre (p)

This argument obviously requires testing. The independent variable in this case is **the high fibre cookies**; the dependent variable is the **symptoms**, that is, **the stomach pains**.

The problem is there are other factors that can account for the dependent variable, so to test this particular hypothesis, we must control for these other variables, that is, we must try to reduce the effect of **confounding variables**, which are variables that influence both the dependent variable and the independent variable. For example, I like to drink diet soda when snacking on a high fibre cookie; hence, we will need to try to reduce the effect of soda, which is a possible factor in having a stomach ache as well as reaching for a cookie. What this means is that the effects of all other **variable predictors** need to be taken into account as much as possible. Other variable predictors might include soda pop, grains, sugar, certain dairy products, fish, processed foods, turkey, etc.

What we want to do now is assess the effect of changing or manipulating one or more of the independent variables on the dependent variable. What is the effect of manipulating the independent variable “cookies high in fibre” on stomach pains. I am instructed by my doctor to cut out cookies high in fibre from my diet; in time we discover that it has no effect on my stomach pains. We conclude that the high fibre cookies are an **irrelevant variable**.

$p \supset q$

$\sim p$

q

Hence, p is an irrelevant variable. Notice, however, that if the effect of manipulating the independent variable brought about a change in the dependent variable, that would still not prove the hypothesis:

$p \supset q$

$\sim p$

$\therefore \sim q$

This is a matter of **denying the antecedent**, which is deductively invalid. It certainly corroborates the theory, but it does not prove it, so further testing is required. For example, I find that I break out in pimples about four times a year. I also notice that my breakouts are preceded by chocolate binges. Hence, I conjecture and settle on a major premise:

<If I eat chocolate, then I break out in pimples>

In other words, I conclude that chocolate is the reason I break out in pimples. In terms of enthymemes, it would look like this:

I break out in pimples 4 times a year

Therefore, chocolate is the reason I break out in pimples.

The enthymematic premise is: **<If I eat chocolate, then I break out in pimples>**

The argument needs to be tested; to do so, we want to assess the effect of manipulating the independent variable on the dependent variable. What is the effect of manipulating the independent variable “chocolate” on the dependent variable (pimples)? We are instructed to abstain from chocolate, and we discover that we continue to break out in pimples four times a year. We conclude that chocolate is an irrelevant variable. The effect of pimples must be influenced by other factors. We notice that the periods in which I break out in pimples coincide with exam time, and I tend to get stressed at these times. I also tend to consume chocolate during stressful periods of my life. So, perhaps the stress of exams causes me to crave chocolate and it causes me to break out in pimples (stress, in other words, might have been a confounding variable). We know that chocolate is not a factor, so perhaps stress is a factor.

So we manipulate the independent variable, stress, to see how it affects the dependent variable (pimples). I went one full year without the stress of exams, and the result was that I did not break out in pimples. This, of course, does not prove that stress was the reason for my breakouts, but it certainly strengthens the hypothesis. I may not even care whether or not stress is a factor if changing the independent variable works; rather, I will continue to live my life without breakouts by avoiding stressful situations when possible. In this way, the validation of the test is pragmatic (not theoretic). In other words, it works, and that’s good enough for me. If I begin to break out in pimples in non-stressful situations, then I know that stress was not the cause (is an irrelevant variable) and we are back to the drawing board.

Control variables must be held constant in order to discern the relationship between independent and dependent variables. If I am comparing the flights of two badminton birdies made by two different companies, I must hold constant certain control variables if my conclusion is to have plausibility. For example, if I were to test one birdie on a bright and sunny day, without the slightest breeze in the air and the other birdie on a cloudy and windy day, my conclusion about their quality would be unwarranted; for the differences in their flight might be due to factors other than the quality of the birdie, such as the weather, or even the person testing the birdie, the kind of racquet he is using, etc. So the weather is a control variable that must be held constant in this case, or the athlete testing the birdie, the racquet he is using, etc. We must test both birdies in the same conditions. If the flights of the two birdies are significantly different within the same conditions (with the control variables held constant), we know the flight difference was not due to the differences in weather, for there were no differences in weather.

Now, the claim that income disparity between men and women is the result of unjust discrimination must undergo the same kind of testing. Hence,

There is income disparity between men and women.

Hence, women are victims of income discrimination in the workforce.

The enthymematic premise in this case is: <If there is income discrimination against women in the workforce, there will be income disparity between men and women>

Once again, we know this is a deductively invalid argument, so it must be tested. Other factors might account for the evidence (income disparity). We must control for confounding variables. In other words, discrimination might be an irrelevant variable. We must test for other variable predictors, such as quantity of education, quality of education, type of degree one has, years of experience (often interrupted by maternity leave), skill level, number of hours worked on a weekly basis, etc. If income disparity disappears when we control for certain confounding variables, then discrimination becomes an irrelevant variable (just as when we controlled for stress by removing all exam stress, pimples vanished, rendering chocolate an irrelevant variable).

Control variables must be the same for our conclusion to be warranted. For example, consider the following argument:

If white Americans are genetically superior to Africans, then white people will score higher on IQ tests.

White Americans have scored higher on IQ tests than African kids.

Therefore, white Americans are genetically superior.

Immediately one suspects that we need to control for other variables, such as education, language, and other cultural factors. The **residual** is what is left over after other such factors have been controlled. But at what point do we stop controlling? Often, the point chosen is arbitrary or emotionally motivated. A racist, for example, may stop controlling too soon because he wants to believe that whites are genetically superior.

In the discussion of whether discrimination is the reason for income disparity between men and women, we will refer to the two groups under consideration as group A (males) and group B (females). Although two groups may be made up of those with college degrees, there may be other variable predictors discovered through a more precise analysis of the category than the very general category of “college degree”. That is why it is misleading to hold years of education constant, since there are not only quantitative differences in education, but qualitative as well. Qualitative differences in education are a variable predictor. Quality can be measured by academic performance, the ranking of the university, or the difficulty and remuneration factor in the particular field of study. In other words, it is unreasonable of me to expect a master’s degree in philosophy or English to equal a master’s degree in biochemistry or electrical engineering degree in terms of remuneration capacity. Most industries have no use for a person with a graduate degree in philosophy or English,

but have use for one with a master's in biochemistry or engineering (that is why philosophy or English majors are more likely to be waiting on tables after they earn their degree; engineers are usually working as engineers).

The category of "college educated" women and men is problematic from another angle. The reason is that college graduates include people who go on to postgraduate study, and this too influences income. More people in group A may choose postgraduate studies than those in group B. In fact, the ratio of women and men with postgraduate degrees differs from the ratios of those with college degrees. At the bachelors degree level, women outnumber men, but men outnumber women by more than a two to one ratio at the master's level and by 59% at the PhD level. So comparing college educated men and women, which includes those who have gone on to pursue postgraduate work, we are really comparing apples and oranges. In other words, the category "college-educated" lacks precision.

If we wish to compare men and women at the PhD level, we discover once again disparities between men and women, and changing ratios. Women receive 37% of all PhDs; moreover, the areas of study differ significantly from those of the 63% of males who receive a PhD. The PhDs which men receive tend to be more heavily concentrated in math and science and other fields of greater remunerative capacity. Women received almost half of the PhDs in the social sciences, and more than half in the area of education. Men received more than 80% of the PhDs in the sciences and more than 90% in engineering. Even the social sciences are not equally remunerative. For example, two people with a social science degree may show a difference in income by virtue of the fact that one degree is in sociology while the other is in econometrics, the latter of which has greater remunerative capacity--and more men enter econometrics than do women.

And so it is simply not the case that the disparity of income between men and women is due to discrimination any more than the disparity of income between me and Oprah Winfrey is due to a pervasive discrimination against philosophy teachers.

As Thomas Sowell writes:

Although comparing women and men who are in fact comparable is not easy to do, when you look at women and men who are similar on multiple factors, the sex differential in pay shrinks drastically and gets close to the vanishing point. **In some categories, women earn more than men with the same range of characteristics.**

The fallacy at the heart of the claim that women make less than men for doing the same work is the fallacy of assuming that all variables left unexamined must be equal so that all residual differences in outcome (in this case, income) can be attributed to discrimination. Such a conclusion is always underdetermined, and it is very often unwarranted.