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Spurious Relationship

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A spurious relationship implies that although two or more variables are correlated, these variables are not causally related. Correlation analysis merely establishes covariation, the extent to which two or more phenomena vary together, whereas causation concludes that one phenomenon caused another. Although social scientists are interested in correlation, most would also like to infer causality. For example, although we know that smoking is related to lung cancer, we want to infer the possibility that smoking causes lung cancer. But when seeking inferences of causality, social scientists must beware the possibility of spurious relationships, which falsely imply causation.

Suppose we are estimating a coefficient of correlation r_{xy}, where x is the marital status of an individual and y is the amount of wine consumed annually by that individual. We find a high positive correlation between marital status and wine consumption. If we infer a causal relationship, we may posit that consuming wine causes people to get married. We may also posit that marriage drives individuals to drink wine. Logically, neither of these interpretations makes sense. It is more likely that the relationship between wine consumption and marriage is spurious, and a third variable is causing positive correlation in both variables.

Spurious correlation means that the relationship between two variables disappears when a third variable is introduced. Theory or logic should specify a third variable that may account for the observed correlation between the variables of interest. In the example above, we suspect that variable z, age, may have a joint effect on both marital status and wine consumption. We find a high positive correlation, r_{xz}, between marital status and age, and a high positive correlation, r_{yz}, between wine consumption and age. These strong correlations offer initial evidence that variation in age accounts for the relationship between marital status and wine consumption. To test for spuriousness, we calculate r

r_{xy*z}

, the partial correlation coefficient between marital status and wine consumption, which controls for age, where r_{xy*z}

$= r^{xz} * r_{yz}$

. We find that r_{xy*z}

[p. 1063 ↓] does not significantly differ from zero, meaning that the relationship between marital status and wine consumption disappears when controlling for age. We thus speculate that the correlation between marital status and wine consumption results from the joint effect of variation in age. In other words, the relationship between marital status and wine consumption could be spurious.

Because the value for r_{xy*z}

does not significantly differ from zero, we might also conclude that *z* is a mediating variable between *x* and *y*. In the above example, this would imply that marriage leads to aging, and becoming older leads to more wine consumption. For our example, this is a nonsensical conclusion, but in other cases, the distinction may not be clear. It is up to the researcher to make logical assumptions about the direction of causation and to use those assumptions to conclude if *x* and *y* are spuriously related, or if *z* is a mediating variable. Statistical evidence alone cannot distinguish between these two possibilities.

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References

Blalock, H. M., Jr. (1979). Social statistics (2nd ed.) . New York: McGraw-Hill.

Simon, H. A. Spurious correlation: A causal interpretation . Journal of the American Statistical Association 49 467–479 (1954).