

## Soc 63993, Homework #4 Answer Key: The Logic of Causal Order

Richard Williams, University of Notre Dame, <https://www3.nd.edu/~rwilliam/>  
Last revised February 15, 2015

1. The chair of the Sociology Department wants to recruit the best faculty possible. But, at the same time, he can't afford to waste a lot of time making offers to people who are unlikely to accept. He suspects that the likelihood that a job offer will be accepted is somehow dependent on the IQ (intelligence) of the candidate, and the number of job offers the person has. For each of the following models, indicate which person is more likely to accept a job offer from N.D. Your options are: Smith is more likely to accept; Jones is more likely to accept; Smith and Jones are equally likely to accept; or DK, don't know, not enough information. (Note: All three models agree that the more intelligent the person is, the more job offers he or she will tend to have.)

	Smith	Jones	Fig 1	Fig 2	Fig 3
1.	High IQ Many offers	Low IQ Many offers	a.	b.	c.
2.	Many offers	Few offers	d.	e.	f.
3.	High IQ Few offers	High IQ Many offers	g.	h.	i.

Figure 1.

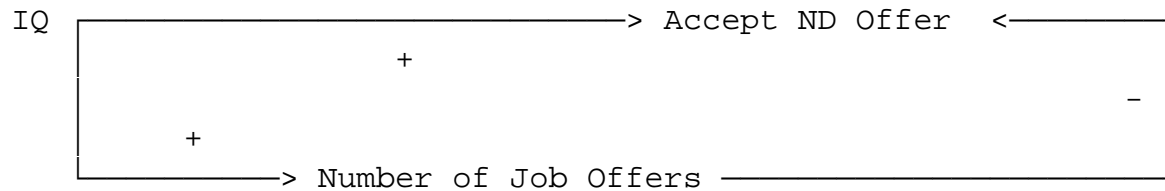


Figure 2.

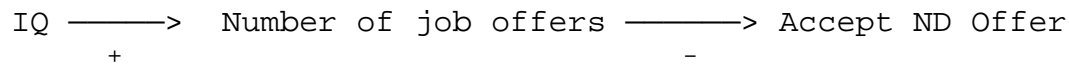
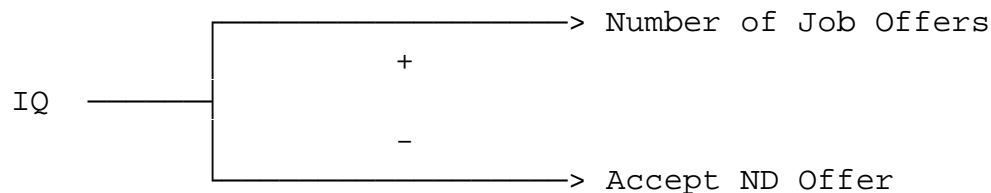


Figure 3.



## **Solution.**

- a. Smith. Both have many offers, so the effect of # of offers cancels out. People with higher IQs are more likely to accept ND offers.
- b. Equal. The # of job offers is the only determinant of accepting an ND offer, and both have many offers.
- c. Jones. In this obviously fictitious and totally unrealistic model, those with low IQs are more likely to come to ND.
- d. DK. Note that there are suppressor effects here. On the one hand, the direct effect of # of offers on accepting is negative. Since Smith has more offers, this makes it less likely she will accept. But, those with more job offers tend to have higher IQs, and those with higher IQs are more likely to accept. Since Smith is more likely to have a higher IQ, this increases the likelihood she will accept. Without knowing the relative magnitude of these opposing effects, we have no basis for making a prediction.

Alternatively, note that the negative direct effect of Number of job offers on accepting Notre Dame's offer contributes to a negative correlation between number of offers and accepting ND; but their common cause of IQ contributes to a positive correlation between them. Without knowing which is stronger (the negative direct effect or the positive correlation produced by the common cause) and without knowing the value of IQ we don't have enough information to say who is more likely to be employed.

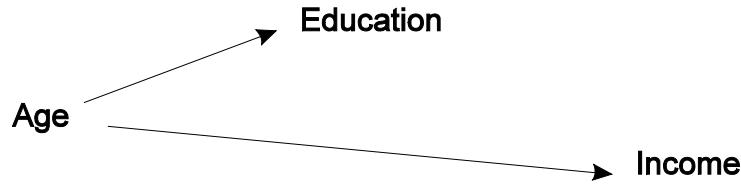
- e. Jones. Jones has fewer offers and hence is more likely to accept.
- f. Jones. People with fewer job offers tend to have lower IQs, and those with lower IQs are more likely to accept ND offers.

Or, just note that the model implies that, because of the common cause of IQ (whose value is unknown), there is a negative correlation between number of offers and accepting ND's offer, so a person with fewer offers (in this case Jones) is more likely to accept than somebody who has more offers (e.g. Smith).

- g. Smith. Both have high IQs so the effect of IQ is equal for both. Since Smith has fewer offers, she is more likely to accept.
- h. Smith. Smith has fewer offers so is more likely to accept.
- i. Equal. Both have high IQs so both are equally likely to accept.

2. Consider the variables age, education, and income. Assume that income and education cannot affect age, and that income cannot affect education.

(a) Draw a model in which education and income are correlated, yet neither variable is a cause of the other.



Education and income are correlated because they share a common cause, Age. The correlation is spurious and completely non-causal.

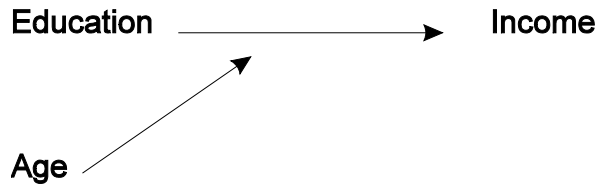
(b) Draw a model in which older individuals tend to have higher incomes, yet age has no direct effect on income.



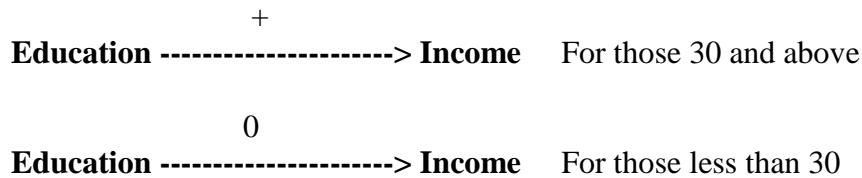
The effect of Age on income is indirect. Education is the mechanism by which Age affects income.

(c) Draw a model in which education affects the incomes of those who are at least 30 years old, but has no effect on those who are younger.

There could be interaction effects:



Which might be more clearly drawn as



Such models would imply that it takes a while for education to start affecting income.

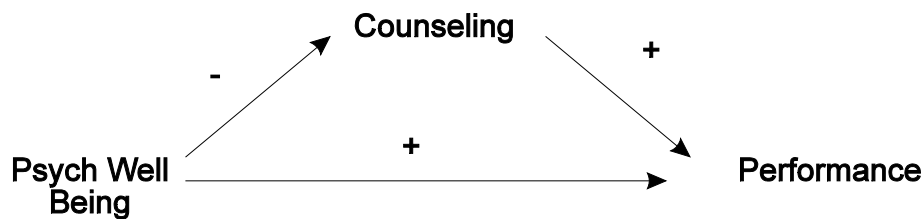
You could also come up with a model of suppressor effects but it would not be very plausible in this case.

3. A university offers a number of services to students, such as psychological counseling and career counseling. Much to its surprise, a recent study has shown that students who participate in these programs actually do less well than students who do not participate. Participants score lower on tests of psychological wellbeing, are less clear on their career plans, and get worse jobs upon graduation. Some critics are therefore arguing the programs do more harm than good and should be abolished, while others continue to maintain that the programs are beneficial. The university has hired you, a professionally trained social scientist, to give it insight on why these relationships exist. Drawing on your

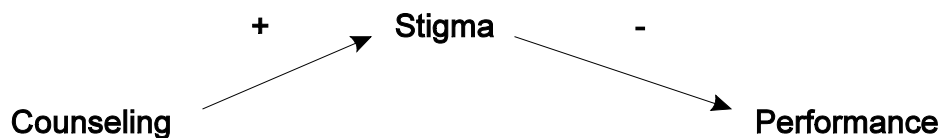
knowledge of the logic of causal order, present different models that could account for the observed relationships. Indicate what implications the different models have for policies that should be adopted. To be fair, you will want to present one or more models that suggest that the counseling programs are good, one or more models which imply the programs are not good, and one or two models which suggest that the programs are not good but the problems are correctable (i.e. you don't have to abolish the counseling programs to solve the problem). (HINT: This problem shares a number of similarities with our classroom discussion of why Catholic school students do better than public school students.) When presenting your answer, keep in mind that the university officials do not know very much about the logic of causal order, so you will have to make things very clear for them.

**Possible answers:**

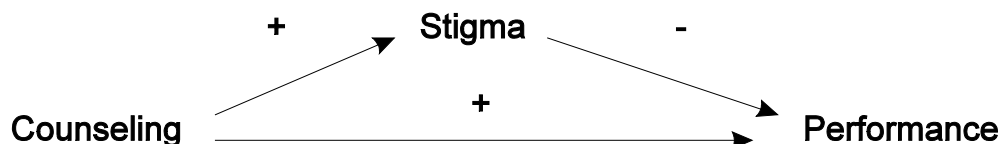
Programs are good: There could be suppressor effects. Suppose there is a variable, “Psychological wellbeing.” Students who score higher on this measure are less likely to use the counseling center and are more likely to get good jobs, etc. Nevertheless, counseling has a positive effect on those who use it. This suggests that counseling partially, but not completely, compensates for the disadvantage of weak psychological wellbeing. Hence, those who use counseling do not fare as well as those who do not; but they would fair even worse if counseling were eliminated.



Programs are bad: Just have a model in which counseling has a negative effect on jobs, etc. Such a model suggests that the programs do more harm than good. Perhaps poor counseling is provided. Perhaps there is a negative stigma attached to counseling. Maybe counseling programs cause their users to forego other options which would be more effective.



Programs are bad but correctable: Here, the trick is to figure out what is the “secret of their lack of success.” It may be that using counseling leads to stigma which leads to lack of success later. Counseling also produces some benefits, but these are outweighed by the stigma. So, the trick is to find some way to eliminate the stigma. Perhaps an advertising campaign could put counseling in a better light; or, maybe more could be done to preserve student confidentiality. If the negative consequences of counseling were eliminated, only the beneficial consequences would remain, and the program would then do more good than harm.



4. A researcher is interested in the relationship between a woman's education, her marital status, and her employment. For each of the following models, indicate which woman would be more likely to be employed. Your options are: Sue is more likely to be employed; Jane is more likely to be employed; Sue and Jane are equally likely to be employed; or DK, don't know, not enough information. (Note: EDUC is coded 1 = educated, 0 = uneducated; MARR is coded 1 = married, 0 = not married; EMPLOYMENT is coded 1 = employed outside the home, 0 = not employed outside the home. All three models agree that educated women are more likely to be married.)

	Sue	Jane	Fig 1	Fig 2	Fig 3
1.	Married	Not Married	a.	b.	c.
2.	Educated Married	Not educated Married	d.	e.	f.
3.	Educated Not Married	Not educated Married	g.	h.	i.

Figure 1.

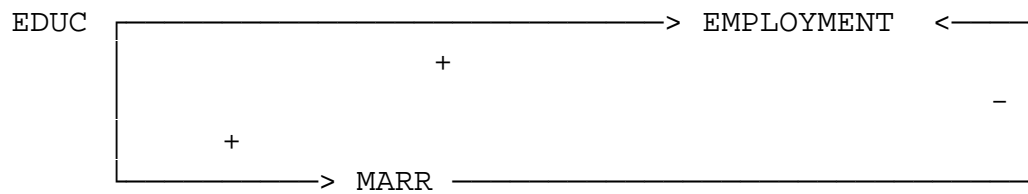


Figure 2.

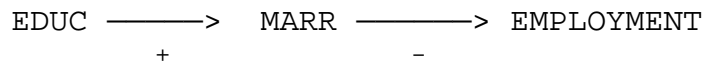
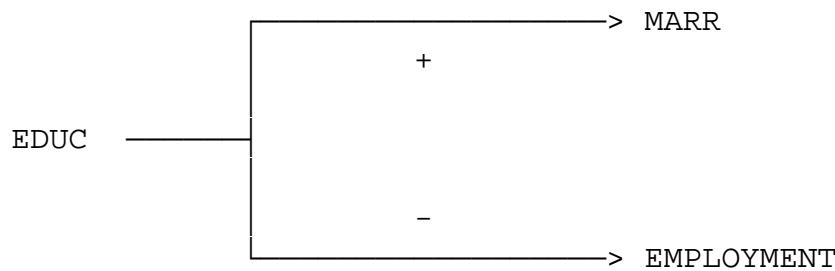


Figure 3.



## **Solution.**

a. DK. Suppressor effects are present. On the one hand, married women tend to be better educated, and better educated people tend to be more likely to be employed. On the other hand, being married tends to lessen the likelihood of being employed. Since we don't know whether the negative direct effect of being married is greater or lesser than the positive association between marriage and employment produced by the common cause of education, we have no way of predicting which individual is more likely to be employed.

Alternatively, note that the negative direct effect of marriage on employment contributes to a negative correlation between marriage and employment; but the common cause of education contributes to a positive correlation between them. Without knowing which is stronger (the negative direct effect or the positive correlation produced by the common cause) and without knowing the value of Education we don't have enough information to say who is more likely to be employed.

b. Jane. People who are not married are more likely to be employed.

c. Jane. People who are not married tend to have lower levels of education, and those with less education are more likely to be employed.

d. Sue. Both are married, so the effect of marital status on them is the same. Sue is educated, and educated people are more likely to be employed.

e. Equal. Both are married, and marriage is the only direct determinant of employment.

f. Jane. Education is the only direct determinant of employment, and less educated people are more likely to be employed.

g. Sue. Better educated people, and people who are not married, are more likely to be employed.

h. Sue. People who are not married are more likely to be employed.

i. Jane. Less educated people are more likely to be employed.