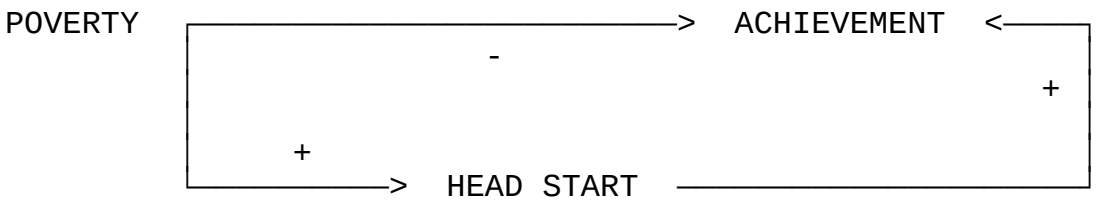
EXAMPLE 1:

Head Start is a program designed to give students from disadvantaged backgrounds a "head start" in schooling that will hopefully lead to greater academic achievement. For the variable HEAD START, let 1 = participates in Head Start, 0 = does not participate in Head Start. We can then come up with the following model:



According to the model, the poorer the family, the more likely a child is to participate in Head Start. Poorer families have lower levels of achievement than richer families. Participation in Head Start increases academic achievement.

Q. What is the correlation between HEAD START and ACHIEVEMENT? That is, do Head Start participants do better or worse than those not in Head Start?

A. There is not enough information in the above diagram to answer this question. However, previous research has shown that the correlation is negative - Head Start participants tend to do worse than those not in Head Start.

Q. How, then, can we say that HEAD START positively affects achievement?

A. The positive effect of Head Start means that, on an all other things equal basis, students who participate in Head Start will tend to outperform students who do not participate. That is, if you had two students with equal family incomes, the Head Start participant would be likely to do better than the non-participant. (Or, you can say that a student will tend to do better if s/he participates in Head Start than if s/he doesn't.)

Unfortunately in life, not all other things are equal. Non-participants in Head Start tend to come from wealthier families than the participants - and their family background works to their advantage.

In short, Head Start is a good program - those who participate in it benefit - but it isn't good enough to wipe out disadvantages produced by social class differences. The poor children who participate in Head Start will still do worse in school than the middle class and wealthy children who do not participate - but the gap will not be as large as it would be if Head Start did not exist at all. Hence, the correlation between HEAD START and ACHIEVEMENT is negative, even though participation in Head Start increases achievement. We would observe a positive correlation between HEAD START and ACHIEVEMENT if we had a sample that was restricted to students from similar economic backgrounds.

EXAMPLE 2: The variables Gender, Union, and Liberalism are coded as follows:

Gender:	1 = Female	0 = Male
Liberalism:	1 = Liberal	0 = Conservative
Union:	1 = Union member	0 = Nonunion

The following four tables were generated from a hypothetical sample of 100 men and 100 women. The 2-way cross-classifications of Tables 2, 3, and 4 can easily be derived from the 3-way cross-classification presented in Table 1.

1. Gender by Union by Liberalism

	Union		Nonunion	
	Lib	Cons	Lib	Cons
Female	21	9	21	49
Male	42	28	6	24

2. Union by Liberalism

	Liberal	Conservative
Union	63	37
Nonunion	27	73

Union members are much more likely to be liberal than are non-union members; the correlation between union and liberalism is positive.

3. Gender by Union

	Union	Nonunion
Female	30	70
Male	70	30

Women are much less likely than men to be union members.

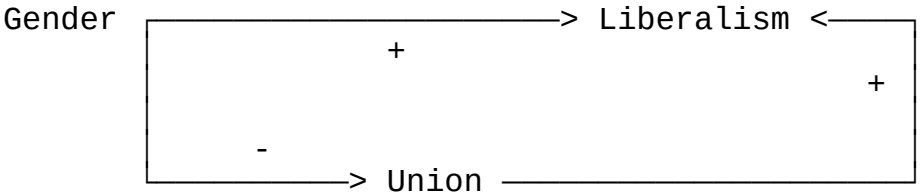
4. Gender by Liberalism

	Liberal	Conservative
Female	42	58
Male	48	52

A higher percentage of males are liberal than are females; the correlation between Gender and Liberalism is negative.

Referring back to Table 1: Note that, among Union members, 70% of the women (21 out of 30) are liberal, as compared to only 60% of the men (42 out of 70). Further, among Nonunion members, 30% of the women are liberal (21 of 70), as compared to only 20% of the men (6 of 30). Hence, Union women are more liberal than union men, Nonunion women are more liberal

than Nonunion men, yet (as table 4 showed) women as a whole are less liberal than men are. A model that is consistent with these findings is



Thus, suppressor effects are present. The direct effect of gender on liberalism is positive, as is the direct effect of Union on Liberalism. Because women are much less likely than men to be union members, women as a whole are more conservative than men. The positive direct effect of gender on liberalism is more than offset by the negative indirect effect. If as many women were union members as are men, there would be more liberal women than there are liberal men.

To put it another way: according to this model, if we had two people and the only way in which they differed was that one was male and the other was female (i.e. they were both union members or they were both nonunion members), the female would be more likely to be liberal. Likewise, if you had two men (or two women), we would expect the one who was a union member to be more liberal. In other words, on an all other things equal basis, a woman will tend to be more liberal than a man, and a union member will tend to be more liberal than a nonunion member. Alas, not all other things are equal. Women are less likely than men to be union members, and this "handicap" results in men as a whole being somewhat more liberal than women are.

EXAMPLE 3: Suppose new union recruiting practices completely eliminated gender differences in union membership shown in example 3 - 70% of both men and women were union members. Suppose further it continued to be the case that, among Union members, 70% of the women (49 out of 70) were liberal, as compared to only 60% of the men (42 out of 70). And, among Nonunion members, 30% of the women were still liberal (9 of 30), as compared to only 20% of the men (6 of 30). We would then observe the following:

1. Gender by Union by Liberalism

	Union		Nonunion	
	Lib	Cons	Lib	Cons
Female	49	21	9	21
Male	42	28	6	24

2. Union by Liberalism

	Liberal	Conservative
Union	91	49
Nonunion	15	45

Union members are much more likely to be liberal than are non-union members; the correlation between union and liberalism is positive.

3. Gender by Union

	Union	Nonunion
Female	70	30
Male	70	30

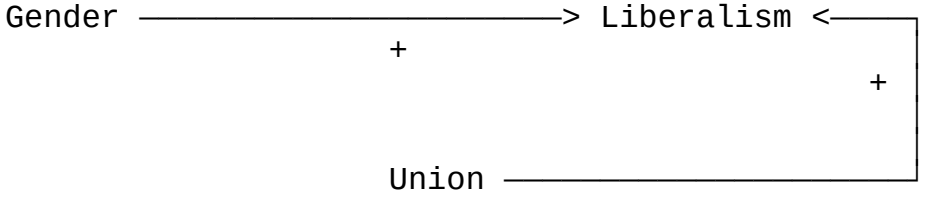
Women are just as likely as men to be union members; no correlation between gender and union membership.

4. Gender by Liberalism

	Liberal	Conservative
Female	58	42
Male	48	52

A higher percentage of females are liberal than are males; the correlation between Gender and Liberalism is positive.

Referring back to Table 1: As before, among union members, 70% of the women are liberal, as compared to only 60% of the men. Among nonunion members, 30% of the women are liberal, compared to only 20% of the men. The model can be written as:



Gender has no effect on union membership; women are just as likely as men to be union members. Both gender and union positively affect liberalism. There are no longer any suppressor effects in the model, hence women as a whole are more liberal than men are.

EXAMPLE 4 (From January 1992): It has been a rough week for Arkansas Governor Bill Clinton. First, the Supermarket Tabloid *The Star* ran a story claiming Clinton had a 12-year-long extramarital affair. Then, in an effort to quell the rising controversy, Clinton appeared on the TV show *60 Minutes* to defend himself. Clinton wants to know whether his high-risk gamble paid off. Data are therefore collected from a random sample of 1000 registered voters on the following:

RATING	Rating of Clinton (1 = very unfavorable towards Clinton, 10 = very favorable)
TV	Did the voter see the 60 minutes story? (1 = yes, 0 = No)
STAR	Did the voter see the Star article? (1 = yes, 0 = no)

He gets the following results:

Correlation:

	RATING	TV	STAR
RATING	1.000	-.200	-.600
TV	-.200	1.000	.600
STAR	-.600	.600	1.000

Much to Clinton's disappointment, he sees that those who saw the 60 Minutes interview actually have a *lower* opinion of him than those who did not see it (note the negative correlation between TV and Rating). His good friends Mario Cuomo and Robert Kerrey tell him that the TV appearance did him more harm than good, and that he should avoid such interviews in the future. Should he follow their advice?

Answer. Here are the results for the multiple regression of Rating on both independent variables:

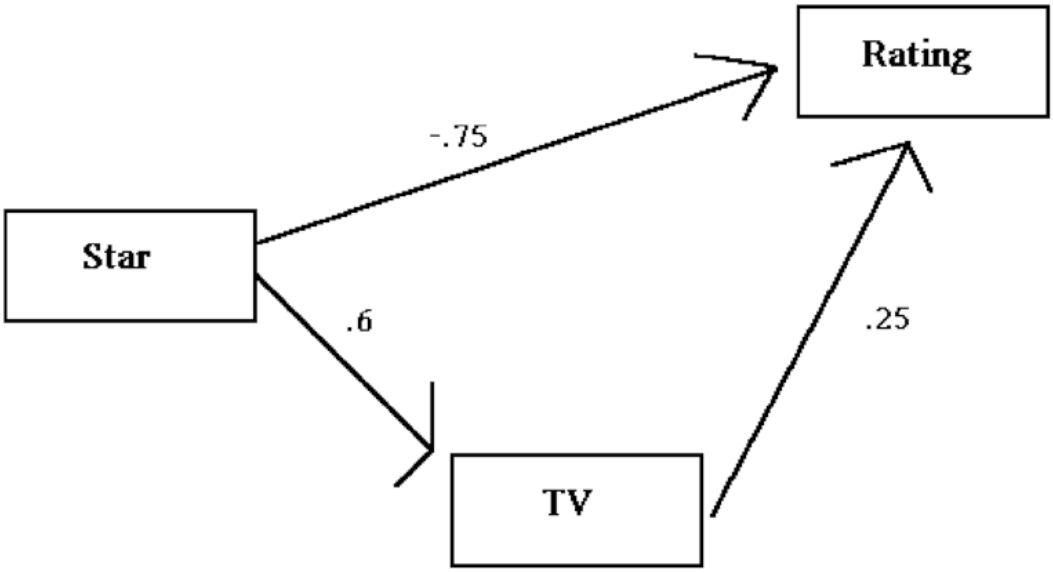
Equation Number 1 Dependent Variable.. RATING

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
TV	1.091703	.133907	.250000	8.153	.0000
STAR	-3.061224	.125162	-.750000	-24.458	.0000
(Constant)	6.896979	.064122		107.560	.0000

Note that, in the multiple regression, the effect of the TV appearance is *positive*, even though the bivariate correlation between TV and Rating is *negative*. How can one account for this seeming discrepancy???

Possible Model:



Corr	Formula	Reasons correlated
$r_{TV,Star}$	$b'_{TV,\ Star} = .6$	Direct effect of Star on TV
$r_{Rating,TV}$	$(b'_{TV,Star} \times b'_{Rating,Star}) + b'_{Rating,TV}$ $= (.6 \times -.75) + .25 = -.20$	Spurious association produced by the common cause, Star + Direct effect of TV on Rating
$r_{Rating,Star}$	$b'_{Rating,Star} + (b'_{TV,Star} \times b'_{Rating,TV})$ $= -.75 + (.6 \times .25) = -.60$	Direct effect of Star on Rating + Indirect effect of Star working through TV

Evaluation of Clinton: **Rating = 6.897 + 1.092 * TV - 3.061 * Star**		
TV / Star	Didn't read Star	Did Read Star
Didn't see 60 Minutes	6.897	3.836
Did see 60 Minutes	7.989	4.928