# Multiple Regression and Mediation Analyses Using SPSS

Overview

For this computer assignment, you will conduct a series of multiple regression analyses to examine your proposed theoretical model involving a dependent variable and two or more independent variables. Students in the course will be divided into seven groups, with each group performing a different set of analyses that will be reported to the class. You will report your findings to the class in poster format on Wednesday, November 12, 2003.

Data

You will conduct your analyses using data obtained from the questionnaire that you developed to test a specific theoretical model. Prior to conducting your multiple regression analyses, you will need to conduct a series of factor analyses to evaluate the factor structure of the groups of items you developed to assess each of the constructs in your theoretical model. Based on the results of your factor analyses, you will create scores (e.g., the average of the several items you developed to measure a specific construct) for each of the variables in your study.

To illustrate the procedures involved in conducting a multiple regression analysis, we will use data from a campus survey of randomly selected students who completed a self-report questionnaire to assess their attitudes towards alcohol consumption and their own and others' drinking behavior. We can test two competing theoretical models, both of which postulate the role of a mediating variable (see Figure 1a and 1b). The dependent variable in the theoretical models is students' self-reported attitude toward drinking. The independent variables are students' self-reported drinking behavior, and their friends' drinking behavior. Students' attitudes towards drinking were assessed with the following question: Which statement below about drinking alcoholic beverages do you feel best represents your own attitude? The response options were: (1) Drinking is never a good thing to do; (2) Drinking is all right but a person should not get drunk; (3) Occasionally getting drunk is okay as long as it doesn't interfere with academics or other responsibilities; (4) Occasionally getting drunk is okay even if it does interfere with academics or responsibilities; (5) Frequently getting drunk is okay if that's what the individual wants to do. Students' and friends' drinking behavior were assessed with the following questions: How many alcoholic drinks, on average, do you think each of the following students typically consumes at parties and bars? (A drink is a bottle of beer, a glass of wine, a wine cooler, a shot glass of liquor, or a mixed drink.) Students then rated how many drinks they and their friends each drank, with 16 response options ranging from 1 to 15+.

Students'
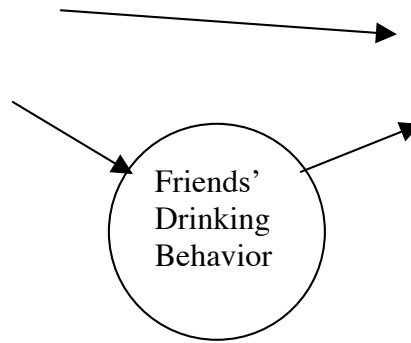Drinking
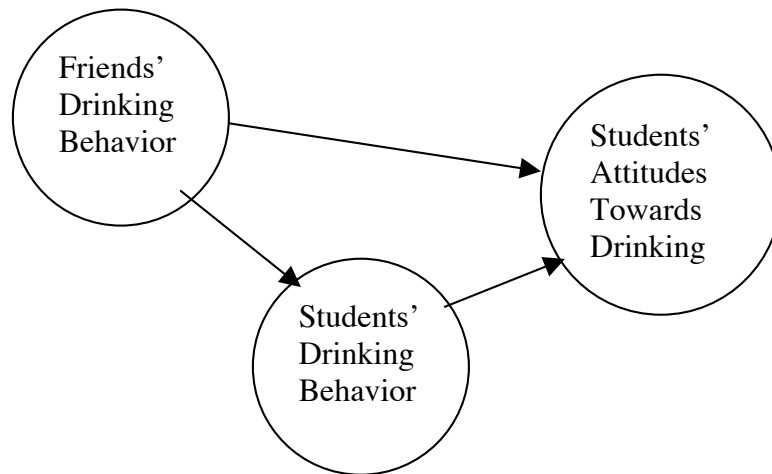Behavior

Students'
Attitudes
Towards
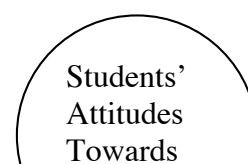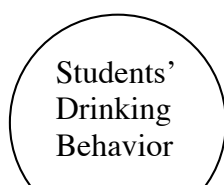
Figure 1a

Figure 1b

The model represented in Figure 1a depicts a process in which students' attitudes towards drinking (i.e., how much drinking is thought to be "okay") are the result of their own drinking behavior—in this case, the more students drink, the more alcohol they think it is okay for individuals to consume. Part of the effect of their drinking behavior on their own attitudes towards drinking is mediated by the impact of their drinking on their friends' drinking behavior. Note, however, that in this model only part of the impact of students' drinking behavior on their attitudes towards alcohol consumption is mediated by their friends' drinking behavior.

The model depicted in Figure 1b makes use of the same variables, but hypothesizes that students' attitudes towards alcohol consumption are caused by their friends' drinking behavior, which some of this impact being mediated by their own (that is, the students') drinking behavior. We will test the mediational model illustrated in Figure 1a for the purposes of this assignment. However, in actual practice, you would want to test both models to determine which model best accounts for the observed associations among the variables.

Conducting Your Analyses

In order to conduct the appropriate regression analyses, you will need to load the SPSS software available on the Citrix server; instructions for doing this are available on a previous handout.

In this assignment, you will encounter several concepts that we have discussed in class as you proceed with your analyses. These include:

coefficient of determination   residuals
shared variance   semi-partial correlation coefficient
unique variance

To begin, we need to establish three conditions in order to determine whether mediate has occurred:

1.   The IV predicts the DV
2.   The IV predicts the mediator
3.   the mediator predicts the DV

In order to test whether these three conditions are met, we need to obtain the correlation coefficients for these three relationships. To do this, you will need to click on the "**Analyze**" menu; you will then need to slide your mouse to the "**Correlate**" option, and select the "**Bivariate**" option (see Figure 2).
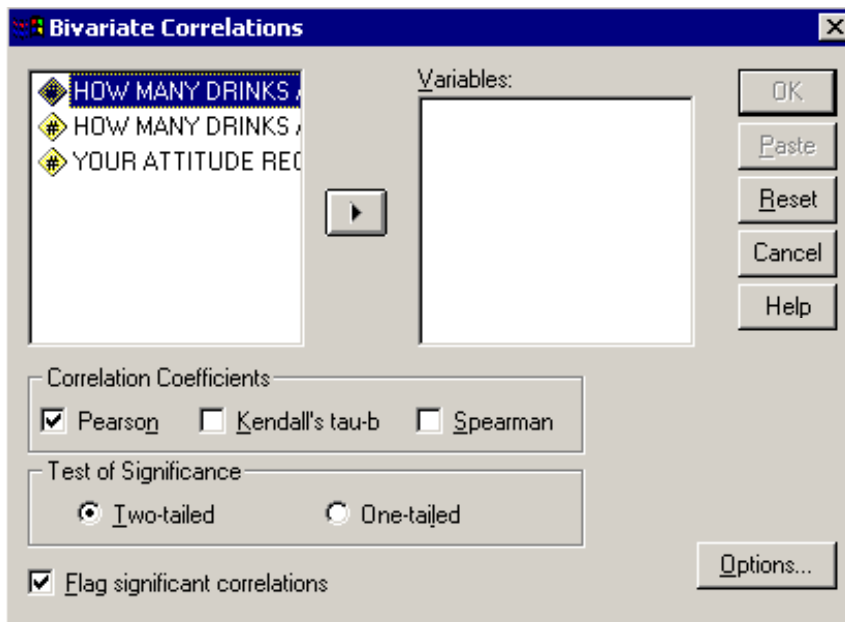

Figure 2

Next, select all three of the variables displayed in the window on the left, and

click on the arrow key [▶] to transfer the variables to the window on the right. The SPSS default settings specify that Pearson Product-Moment correlation coefficients will be computed, and that two-tailed tests of significance will be reported. It is typically desirable to select the "**Options**" button so that you may request the mean and standard deviation for each of the variables (see Figure 3).
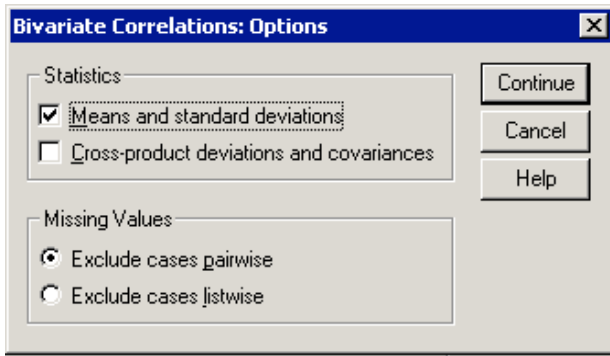
Bivariate Correlations: Options

Statistics
☑ Means and standard deviations
☐ Cross-product deviations and covariances

Missing Values
⦿ Exclude cases pairwise
○ Exclude cases listwise

[Continue] [Cancel] [Help]

Figure 3

The SPSS output will appear as depicted in Figure 4.

Correlations

Descriptive Statistics

	Mean	Std. Deviation	N
HOW MANY DRINKS AT PARTY/BAR: YOURSELF	5.28	3.423	235
HOW MANY DRINKS AT PARTY/BAR: YOUR FRIENDS	5.91	2.924	234
YOUR ATTITUDE REGARDING DRINKING	3.14	.865	234

Correlations

		HOW MANY DRINKS AT PARTY/BAR: YOURSELF	HOW MANY DRINKS AT PARTY/BAR: YOUR FRIENDS	YOUR ATTITUDE REGARDING DRINKING
HOW MANY DRINKS AT PARTY/BAR: YOURSELF	Pearson Correlation	1	.876**	.534**
	Significance(2-tailed)	.	.000	.000
	N	235	234	234
HOW MANY DRINKS AT PARTY/BAR: YOUR FRIENDS	Pearson Correlation	.876**	1	.493**
	Significance(2-tailed)	.000	.	.000
	N	234	234	233
YOUR ATTITUDE REGARDING DRINKING	Pearson Correlation	.534**	.493**	1
	Significance(2-tailed)	.000	.000	.
	N	234	233	234

**. Correlation at 0.01 (2-tailed):...

Figure 4

The correlation coefficients for each path, that is, the links between each of the variables, is statistically significant. Note the particularly strong association between students' reports of their own and their friends' drinking behavior. (This association is sufficiently large that it may lead to a specific problem (termed multicollinearity) in subsequent stages of the analysis)). These results indicate that, at the bivariate level, each of the conditions necessary to test for the possible role of a mediator has been met.

The next part of the analysis is performed with the assistance of information that can be obtained at a web page developed by Kristopher Preacher and Geoffry

Leonardelli (http://www.unc.edu/~preacher/sobel/sobel.htm). (A copy of the web page is attached to this handout.)

In order to conduct the Sobel test for mediation, you will need to compute the raw regression coefficient and the standard error for this regression coefficient for the association between the IV and the mediator, and the association between the mediator and the DV (adjusting for the IV). To compute the regression coefficient and standard error for the association between the IV and the mediator, you will need to click on the "**Analyze**" menu; you will then need to slide your mouse to the "**Regression**" option, and select the "**Linear**" option (see Figure 5).
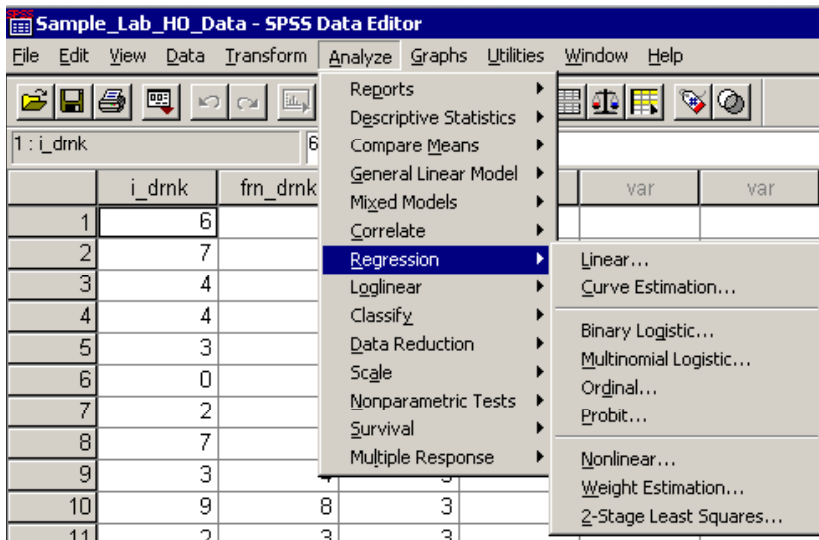

Figure 5

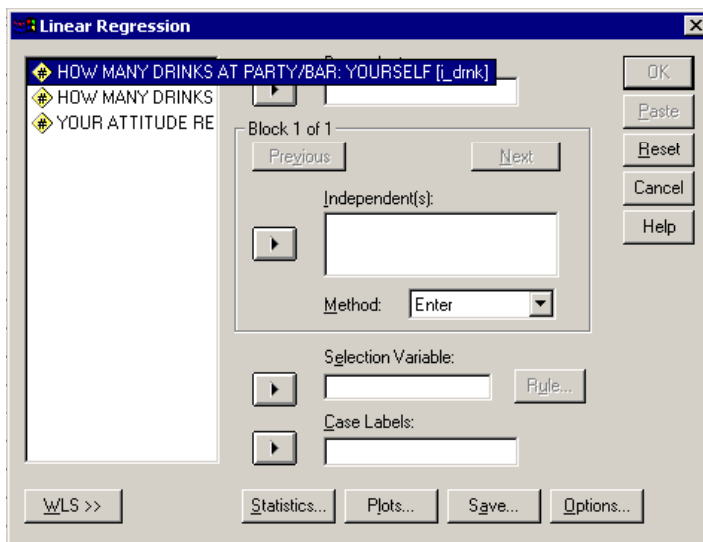A window will appear (see Figure 6).

Figure 6

To define the dependent variable (in this case, the mediator in the model depicted in Figure 1a) for the analysis, click on the second variable listed in the left-hand side of the window (friends' rate of drinking, labeled 'frn_drnk') and

then click on the arrow key [▶] for the window labeled '**dependent**'. To
specify the IV, click on the first variable in the window (participants' own rate of

drinking, labeled 'I_drnk') and then click on the arrow key[▶] for the window
labeled '**independent**'. All of the information we will need for this part of the
analysis is provided by the defaul settings for the SPSS Regression routine. To
complete the analysis, simply click on the '**OK**' option in the upper right-hand
corner of the box. The relevant information is provided in the following portion
of the SPSS output window (see Figure 7).

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Significance
1	(Constant)	1.965	.170		11.526	.000
	HOW MANY DRINKS AT PARTY/BAR: YOURSELF	.753	.027	.876	27.600	.000

a. Dependent Variable: HOW MANY DRINKS AT PARTY/BAR: YOUR FRIENDS

Figure 7

The raw regression coefficient (in the column labeled 'B' under the heading
'unstandardized coefficients' in the printout) for the association between
students' drinking behavior (the IV) and their friends' drinking behavior (the
mediator) is .75 (rounded to two places after the decimal point; this procedure
will be used throughout this handout). The standard error for this raw
regression coefficient (labeled 'Std. Error') is .03.

To compute the corresponding values for the association between friends'
drinking behavior and participants' attitudes towards alcohol consumption
(controlling for participants' drinking behavior), you will need to click on the
"**Analyze**" menu; you will then need to slide your mouse to the "**Regression**"
option, and select the "**Linear**" option. You will need to move the previously
specified dependent variable (friends' drinking behavior) to the left-hand portion
of the window by clicking on the variable in the '**dependent**' box arrow key

[◀] beside the box marked '**dependent'**. You will then need to specify the
new dependent variable (participants' attitudes toward alcohol consumption,
labeled 'alc_att'). You will also need to specify the new IV (in this case, the
mediator variable, labeled 'frn_drnk'). Remember to retain original IV, friends'
drinking behavior, in the analysis as a second IV. When you have completed
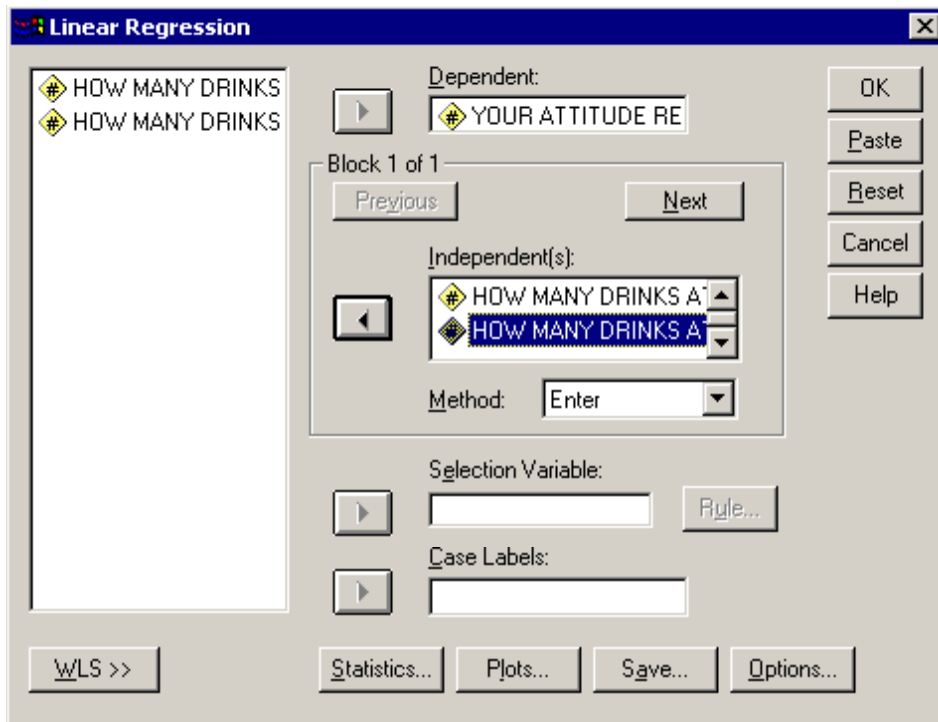these steps, the window should appear as follows (see Figure 8):

Figure 8

Then click on the 'OK' option. The relevant output will appear in the SPSS
Output window (see Figure 9).

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Significance
1	(Constant)	2.361	.111		21.290	.000
	HOW MANY DRINKS AT PARTY/BAR: YOURSELF	.109	.029	.427	3.713	.000
	HOW MANY DRINKS AT PARTY/BAR: YOUR FRIENDS	.035	.034	.119	1.034	.302

a. Dependent Variable: YOUR ATTITUDE REGARDING DRINKING

Figure 9

The raw regression coefficient for the association between friends' drinking
behavior and participants' attitudes towards alcohol consumption (controlling
for participants' drinking behavior) is .04; the standard error for this regression
coefficient is .03.

To complete the analysis, go to the web page for the Sobel test, and find the
portion of the page provided for entering these values (see Figure 10).

Input:		Test statistic:	p-value:
a	Sobel test:		
b	Goodman (I) test:		
s_a	Goodman (II) test:		
s_b	Reset all	Calculate	

Figure 10

Enter the appropriate values in their respective places in the table. To input the raw regression coefficient for the association between participants' drinking behavior and their friends' drinking behavior, enter the appropriate value in the portion of the window next to the letter 'a' under the 'Input:' column. The regression coefficient for the association between friends' drinking behavior and participants' attitudes towards alcohol consumption, enter the value in the portion of the window next to the letter 'b'. The standard errors for these regression coefficients should be entered in the portion of the window next to the labels 's_a' and 's_b' respectively. Then click on the 'Calculate' option. The following output will appear (see Figure 11):

Input:		Test statistic:	p-value:
a 1.97	Sobel test:	1.32459426	0.18530576
b .04	Goodman (I) test:	1.31975342	0.18691736
s_a .17	Goodman (II) test:	1.32948876	0.18368677
s_b .03	Reset all	Calculate	

Figure 11

The test statistic for the Sobel test is 1.32, with an associated p-value of .18. The fact that the observed p-value does not fall below the established alpha level of .05 indicates that the association between the IV and the DV (in this case, participants' drinking behavior and their attitudes towards alcohol consumption) is not reduced significantly by the inclusion of the mediator (in this case, friends' drinking behavior) in the model; in other words, there is no evidence of mediation.