QxQxQ GLM Example

Starting with the QxQ Buffering Hypothesis:

Does Social support moderates the Stress → Depression relationship?

The purpose of the study was to explore the "buffering hypothesis." The buffering hypothesis states that social support "buffers" or moderates the effect of stress upon depression. Specifically, depression is expected to be greater for those with more stress. However, this positive linear relationship is expected to be less-positive for those with more social support. For this study, social support of friends (FRSS) was chosen as the buffering/moderator variable to be explored.l

We need to construct mean-centered versions of each quantitative variable, then include them and their interaction, in a GLM.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
stress	405	0	39	8.70	7.448
friend social support	405	1.00	7.00	5.5705	1.30679
Valid N (listwise)	405				

compute stress_mcen = stress – 8.70.
compute frss_mcen = frss - 5.5705.
exe.

UNIANOVA dep WITH stress_mcen frss_mcen
  /METHOD=SSTYPE(3)
  /PRINT=PARAMETER
  /DESIGN= stress_mcen   frss_mcen
           frss_mcen*stress_mcen.

Tests of Between-Subjects Effects

Dependent Variable: depression (BDI)

| Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5453.342[a]	3	1817.781	61.528	.000
Intercept	21817.482	1	21817.482	738.479	.000
stress_mcen	3112.295	1	3112.295	105.345	.000
frss_mcen	1112.726	1	1112.726	37.664	.000
stress_mcen * frss_mcen	164.567	1	164.567	5.570	.019
Error	11847.063	401	29.544		
Total	39805.000	405			
Corrected Total	17300.405	404			

a. R Squared = .315 (Adjusted R Squared = .310)

Parameter Estimates

Dependent Variable: stress

Parameter	B	Std. Error	t	Sig.
Intercept	8.700	1.002E-013	3.556E+16	.000
stress_mcen	1.000	1.000E-013	2.973E+16	.000
frss_mcen	-1.032E-013	1.002E-013	-17.238	.000
stress_mcen * frss_mcen	-1.004E-013	1.000E-013	-16.125	.000

Here's the plot of the resulting QxQ model
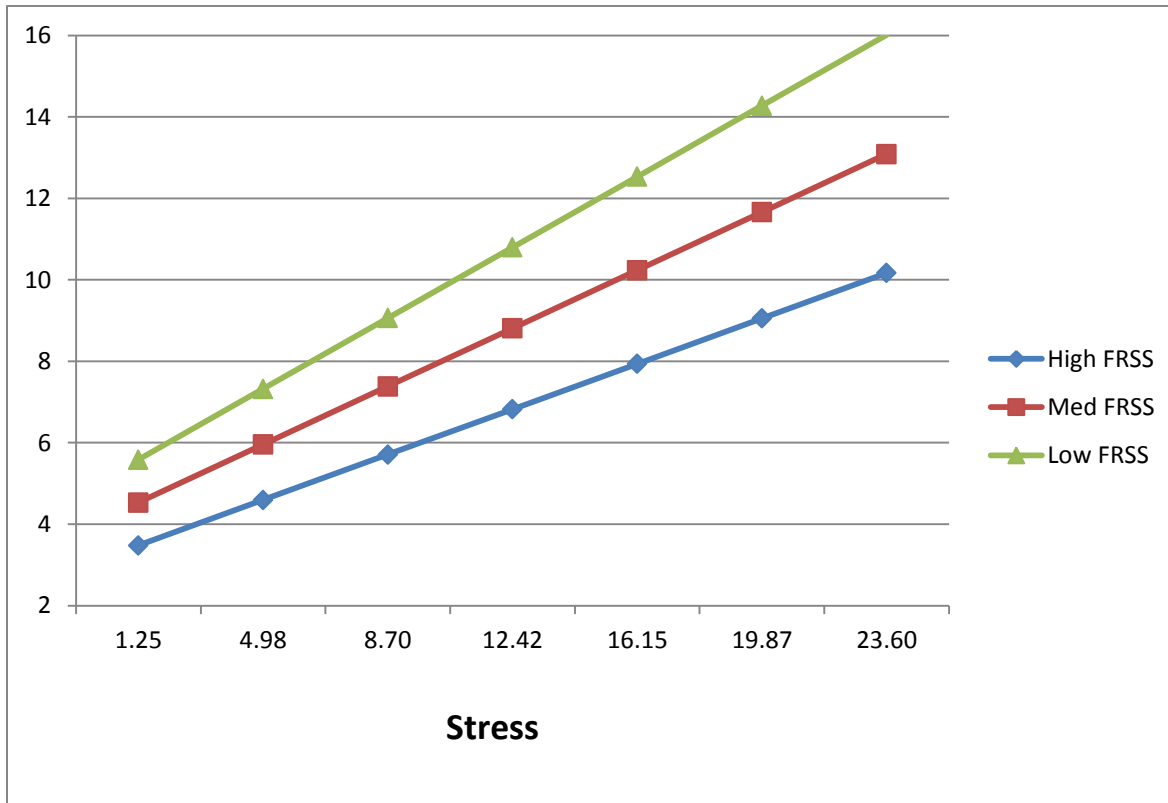
These results show good support for the Buffering Hypothesis!

As expected, there is an overall positive relationship between Stress and Depression. We know that this slope is significantly positive for those with a mean level of FRSS (FRSS = 5.57, b=.383, p< .001).

As expected, there is also an overall negative relationship between Friend Social Support and Depression. We know this slope is significantly negative for those with a mean level of Stress (Stress = 8.70, b=-1.282, p < .001).

As expected, there is a significant negative interaction (b = .064, p = .019). The negative interaction weight tells us that the linear relationship between Stress and Depression is less positive for those with higher FRSS values (or, that the linear relationship between FRSS and Depression is less negative for those with lower FRSS values).

Looking at the graph, we can see that there is less of a "stress effect" for those with higher FRSS. That is, the slope of the Depression-Stress regression line is flatter for those with more social support from their friends.

Is this "buffering effect" further moderated by additional variables? One important variable that might moderate the interaction between Stress and Social Support upon Depression is Loneliness!!! We know that people with equivalent levels of Social Support have considerable variation in self-reported Loneliness. Thus, Loneliness is an interesting "moderator" to explore.

QxQxQ → Does Loneliness Moderate the Buffering Effect of Social Support on the Stress → Depression Relationship?

We need to construct mean-centered versions of each quantitative variable, then include them and their interaction, in a GLM.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
loneliness	405	20	73	37.21	11.377
friend social support	405	1.00	7.00	5.5705	1.30679
stress	405	0	39	8.70	7.448
Valid N (listwise)	405				

compute ruls_mcen = ruls - 37.21.
compute frss_mcen = frss - 5.5705.
compute stress_mcen = stress - 8.70.
exe.

UNIANOVA dep WITH stress_mcen frss_mcen ruls_mcen
 /METHOD=SSTYPE(3)
 /PRINT=PARAMETER
 /CRITERIA=ALPHA(.05)
 /DESIGN=stress_mcen frss_mcen ruls_mcen
        frss_mcen*ruls_mcen
        frss_mcen*stress_mcen
        ruls_mcen*stress_mcen
        frss_mcen*ruls_mcen*stress_mcen.

Tests of Between-Subjects Effects

Dependent Variable: depression (BDI)

| Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	7403.588[a]	7	1057.655	42.427	.000
Intercept	15451.872	1	15451.872	619.835	.000
stress_mcen	1228.066	1	1228.066	49.263	.000
frss_mcen	1.727	1	1.727	.069	.793
ruls_mcen	1578.374	1	1578.374	63.315	.000
frss_mcen * ruls_mcen	47.601	1	47.601	1.909	.168
stress_mcen * frss_mcen	.232	1	.232	.009	.923
stress_mcen * ruls_mcen	2.859	1	2.859	.115	.735
stress_mcen * frss_mcen * ruls_mcen	105.132	1	105.132	4.217	.041
Error	9896.817	397	24.929		
Total	39805.000	405			
Corrected Total	17300.405	404			

a. R Squared = .428 (Adjusted R Squared = .418)

Parameter Estimates

Dependent Variable: depression (BDI)

| Parameter	B	Std. Error	t	Sig.
Intercept	7.181	.288	24.896	.000
stress_mcen	.274	.039	7.019	.000
frss_mcen	.066	.250	.263	.793
ruls_mcen	.229	.029	7.957	.000
frss_mcen * ruls_mcen	-.022	.016	-1.382	.168
stress_mcen * frss_mcen	.003	.036	.096	.923
stress_mcen * ruls_mcen	.001	.003	.339	.735
stress_mcen * frss_mcen * ruls_mcen	-.004	.002	-2.054	.041

High Loneliness
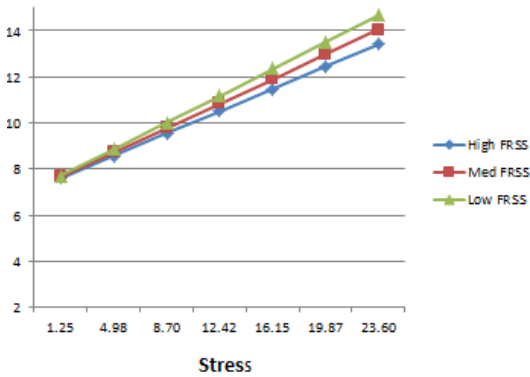
At high levels of Loneliness (mean = 48.59), we get the expected buffering effect of Social Support upon the Stress → Depression relationship!

However, at moderate levels of Loneliness (mean = 37.21), we get no buffering effect – the relationship between Stress and Depression has equivalent slope for all levels of Friend Social Support.
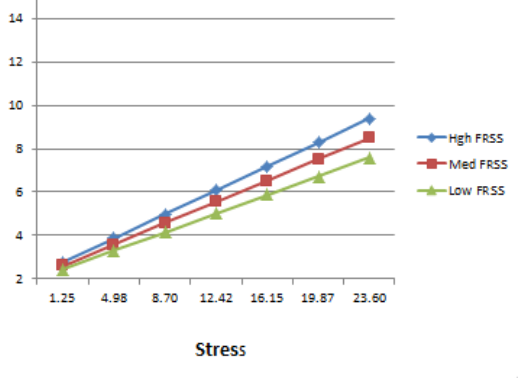

Medium Loneliness
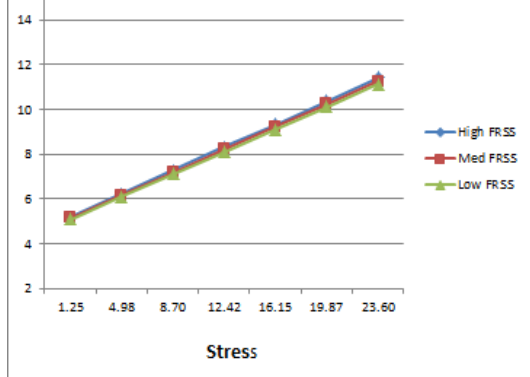
And, at low levels of Loneliness (mean = 25.83) pattern of the moderating effect of Social Support on the Stress → Depression relationship *reverses*!

At low levels of Loneliness, the slope of the Depression – Stress regression line is more positive for those with greater social support!

Low Loneliness

Described informally:
For lonely folks, friend social support reduces the tendency for those with greater stress to have greater depression.

For moderately lonely folks, social support does not alter the positive relationship between stress and depression.

For folks who are not lonely, social support augments the tendency for those with greater stress to have greater depression.