

## **CORRELATIONS OF OUTCOME MEASURES**

### **Correlations**

		<b>Correlations</b>		
		X19 - Satisfaction	X20 - Likely to Recommend	X21 - Likely to Purchase
X19 - Satisfaction	Pearson Correlation	1	.762**	.726**
	Sig. (2-tailed)		.000	.000
	N	200	200	200
X20 - Likely to Recommend	Pearson Correlation	.762**	1	.661**
	Sig. (2-tailed)	.000		.000
	N	200	200	200
X21 - Likely to Purchase	Pearson Correlation	.726**	.661**	1
	Sig. (2-tailed)	.000	.000	
	N	200	200	200

\*\* . Correlation is significant at the 0.01 level (2-tailed).

## **EXAMPLE 1 -- X5 BY X19 X20 X21**

### **General Linear Model**

#### **Between-Subjects Factors**

		Value Label	N
X5 - Distribution System	0	Indirect through broker	108
	1	Direct to customer	92

#### **Descriptive Statistics**

	X5 - Distribution System	Mean	Std. Deviation	N
X19 - Satisfaction	Indirect through broker	6.325	1.0328	108
	Direct to customer	7.688	1.0488	92
	Total	6.952	1.2411	200
X20 - Likely to Recommend	Indirect through broker	6.488	.9859	108
	Direct to customer	7.498	.9300	92
	Total	6.953	1.0829	200
X21 - Likely to Purchase	Indirect through broker	7.336	.8802	108
	Direct to customer	8.051	.7449	92
	Total	7.665	.8932	200

## EXAMPLE 1 -- X5 BY X19 X20 X21

### Box's Test of Equality of Covariance Matrices<sup>a</sup>

Box's M	4.597
F	.753
df1	6
df2	265275.824
Sig.	.607

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + x5

### Multivariate Tests<sup>a</sup>

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.989	6094.102 <sup>b</sup>	3.000	196.000	.000
	Wilks' Lambda	.011	6094.102 <sup>b</sup>	3.000	196.000	.000
	Hotelling's Trace	93.277	6094.102 <sup>b</sup>	3.000	196.000	.000
	Roy's Largest Root	93.277	6094.102 <sup>b</sup>	3.000	196.000	.000
x5	Pillai's Trace	.307	28.923 <sup>b</sup>	3.000	196.000	.000
	Wilks' Lambda	.693	28.923 <sup>b</sup>	3.000	196.000	.000
	Hotelling's Trace	.443	28.923 <sup>b</sup>	3.000	196.000	.000
	Roy's Largest Root	.443	28.923 <sup>b</sup>	3.000	196.000	.000

## **EXAMPLE 1 -- X5 BY X19 X20 X21**

### **Multivariate Tests<sup>a</sup>**

Effect		Partial Eta Squared	Noncent. Parameter	Observed Power <sup>c</sup>
Intercept	Pillai's Trace	.989	18282.307	1.000
	Wilks' Lambda	.989	18282.307	1.000
	Hotelling's Trace	.989	18282.307	1.000
	Roy's Largest Root	.989	18282.307	1.000
x5	Pillai's Trace	.307	86.769	1.000
	Wilks' Lambda	.307	86.769	1.000
	Hotelling's Trace	.307	86.769	1.000
	Roy's Largest Root	.307	86.769	1.000

a. Design: Intercept + x5

b. Exact statistic

c. Computed using alpha = .05

### **Levene's Test of Equality of Error Variances<sup>a</sup>**

		Levene Statistic	df1	df2	Sig.
X19 - Satisfaction	Based on Mean	.001	1	198	.978
	Based on Median	.000	1	198	.999
	Based on Median and with adjusted df	.000	1	197.112	.999
	Based on trimmed mean	.001	1	198	.973
X20 - Likely to Recommend	Based on Mean	.643	1	198	.424
	Based on Median	.634	1	198	.427
	Based on Median and with adjusted df	.634	1	197.960	.427
	Based on trimmed mean	.643	1	198	.424
X21 - Likely to Purchase	Based on Mean	2.832	1	198	.094
	Based on Median	2.995	1	198	.085
	Based on Median and with adjusted df	2.995	1	195.366	.085
	Based on trimmed mean	2.905	1	198	.090

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

## **EXAMPLE 1 -- X5 BY X19 X20 X21**

a. Design: Intercept + x5

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F
Corrected Model	X19 - Satisfaction	92.300 <sup>a</sup>	1	92.300	85.304
	X20 - Likely to Recommend	50.665 <sup>b</sup>	1	50.665	54.910
	X21 - Likely to Purchase	25.396 <sup>c</sup>	1	25.396	37.700
Intercept	X19 - Satisfaction	9755.432	1	9755.432	9015.970
	X20 - Likely to Recommend	9717.522	1	9717.522	10531.655
	X21 - Likely to Purchase	11762.528	1	11762.528	17461.366
x5	X19 - Satisfaction	92.300	1	92.300	85.304
	X20 - Likely to Recommend	50.665	1	50.665	54.910
	X21 - Likely to Purchase	25.396	1	25.396	37.700
Error	X19 - Satisfaction	214.239	198	1.082	
	X20 - Likely to Recommend	182.694	198	.923	
	X21 - Likely to Purchase	133.379	198	.674	
Total	X19 - Satisfaction	9972.600	200		
	X20 - Likely to Recommend	9900.810	200		
	X21 - Likely to Purchase	11909.220	200		
Corrected Total	X19 - Satisfaction	306.539	199		
	X20 - Likely to Recommend	233.359	199		
	X21 - Likely to Purchase	158.775	199		

## **EXAMPLE 1 -- X5 BY X19 X20 X21**

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Sig.	Partial Eta Squared	Noncent. Parameter
Corrected Model	X19 - Satisfaction	.000	.301	85.304
	X20 - Likely to Recommend	.000	.217	54.910
	X21 - Likely to Purchase	.000	.160	37.700
Intercept	X19 - Satisfaction	.000	.979	9015.970
	X20 - Likely to Recommend	.000	.982	10531.655
	X21 - Likely to Purchase	.000	.989	17461.366
x5	X19 - Satisfaction	.000	.301	85.304
	X20 - Likely to Recommend	.000	.217	54.910
	X21 - Likely to Purchase	.000	.160	37.700
Error	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			
Total	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			
Corrected Total	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			

## **EXAMPLE 1 -- X5 BY X19 X20 X21**

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Observed Power <sup>d</sup>
Corrected Model	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
Intercept	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
x5	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
Error	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	
Total	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	
Corrected Total	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	

- a. R Squared = .301 (Adjusted R Squared = .298)
- b. R Squared = .217 (Adjusted R Squared = .213)
- c. R Squared = .160 (Adjusted R Squared = .156)
- d. Computed using alpha = .05

## **EXAMPLE 1 -- X5 BY X19 X20 X21**

### **Parameter Estimates**

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% ... Lower Bound
X19 - Satisfaction	Intercept	7.688	.108	70.891	.000	7.474
	[x5=0]	-1.363	.148	-9.236	.000	-1.654
	[x5=1]	0 <sup>a</sup>	.	.	.	.
X20 - Likely to Recommend	Intercept	7.498	.100	74.869	.000	7.300
	[x5=0]	-1.010	.136	-7.410	.000	-1.279
	[x5=1]	0 <sup>a</sup>	.	.	.	.
X21 - Likely to Purchase	Intercept	8.051	.086	94.089	.000	7.882
	[x5=0]	-.715	.116	-6.140	.000	-.945
	[x5=1]	0 <sup>a</sup>	.	.	.	.

### **Parameter Estimates**

Dependent Variable	Parameter	95% Confidence ... Upper Bound	Partial Eta Squared	Noncent. Parameter	Observed Power <sup>b</sup>
X19 - Satisfaction	Intercept	7.902	.962	70.891	1.000
	[x5=0]	-1.072	.301	9.236	1.000
	[x5=1]	.	.	.	.
X20 - Likely to Recommend	Intercept	7.695	.966	74.869	1.000
	[x5=0]	-.741	.217	7.410	1.000
	[x5=1]	.	.	.	.
X21 - Likely to Purchase	Intercept	8.220	.978	94.089	1.000
	[x5=0]	-.485	.160	6.140	1.000
	[x5=1]	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

## **Estimated Marginal Means**



## **EXAMPLE 1 -- X5 BY X19 X20 X21**

### **X5 - Distribution System**

Dependent Variable	X5 - Distribution System	Mean	Std. Error	95% ... Lower Bound
X19 - Satisfaction	Indirect through broker	6.325	.100	6.128
	Direct to customer	7.688	.108	7.474
X20 - Likely to Recommend	Indirect through broker	6.488	.092	6.306
	Direct to customer	7.498	.100	7.300
X21 - Likely to Purchase	Indirect through broker	7.336	.079	7.180
	Direct to customer	8.051	.086	7.882

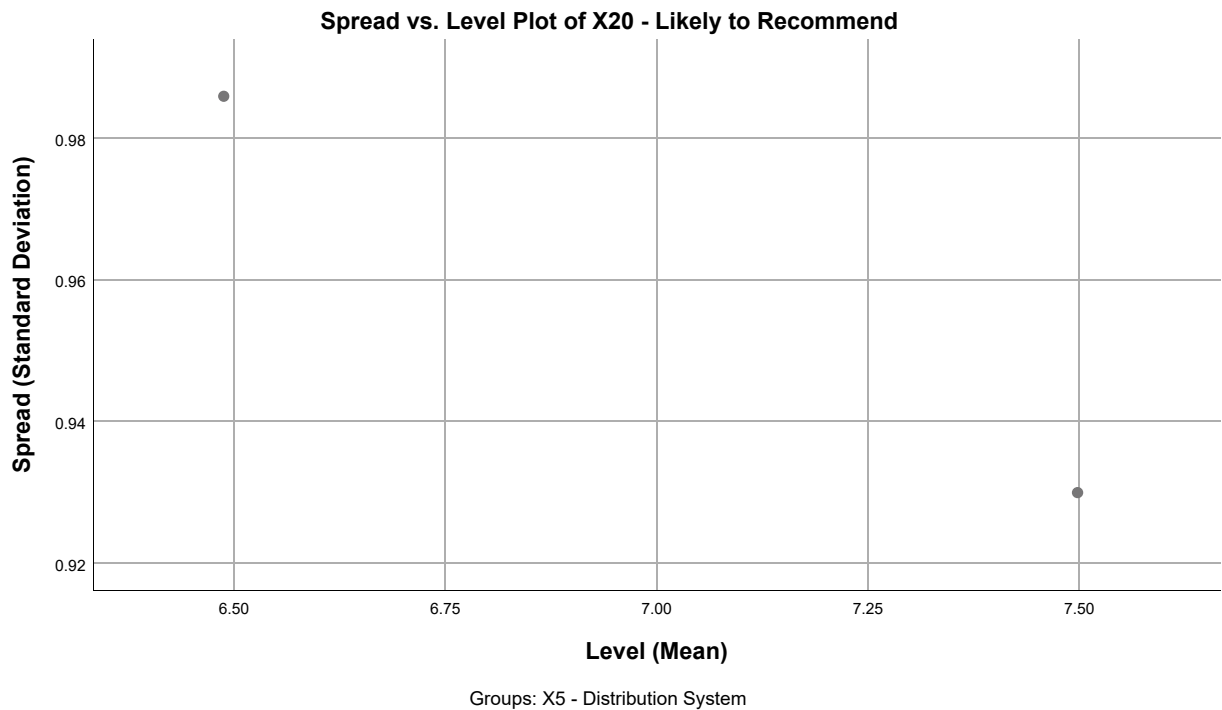
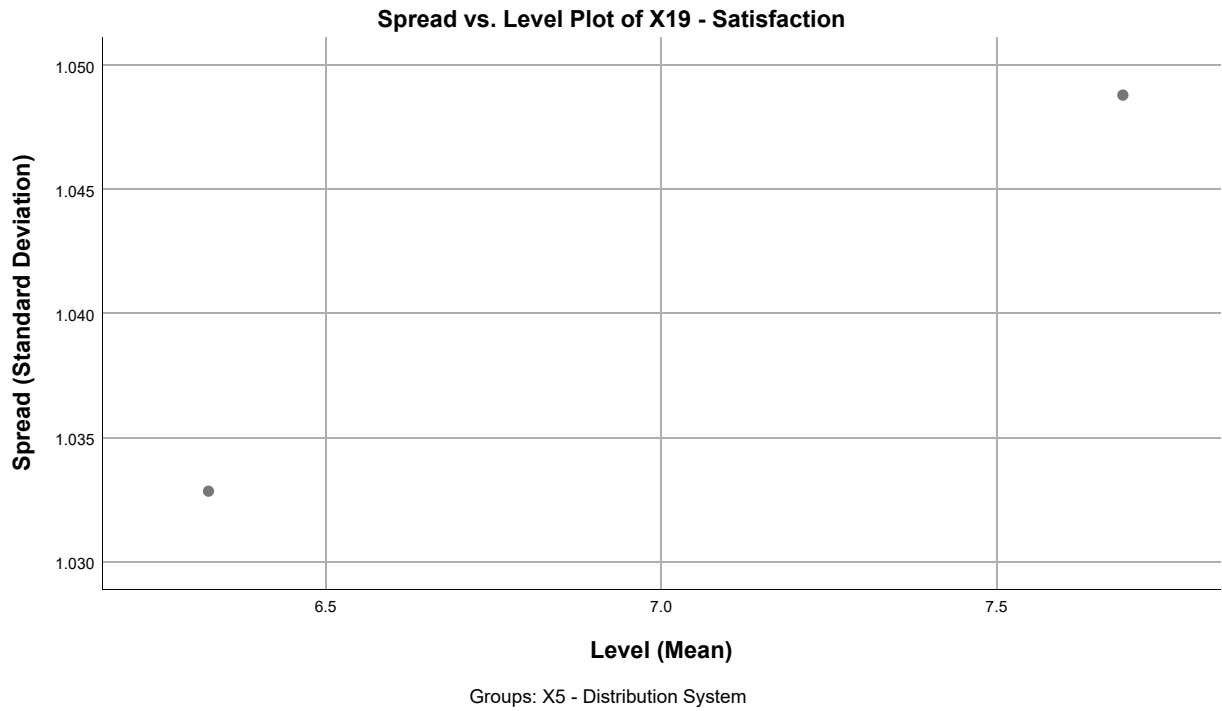
### **X5 - Distribution System**

Dependent Variable	X5 - Distribution System	95% Confidence . Upper Bound
X19 - Satisfaction	Indirect through broker	6.522
	Direct to customer	7.902
X20 - Likely to Recommend	Indirect through broker	6.670
	Direct to customer	7.695
X21 - Likely to Purchase	Indirect through broker	7.492
	Direct to customer	8.220

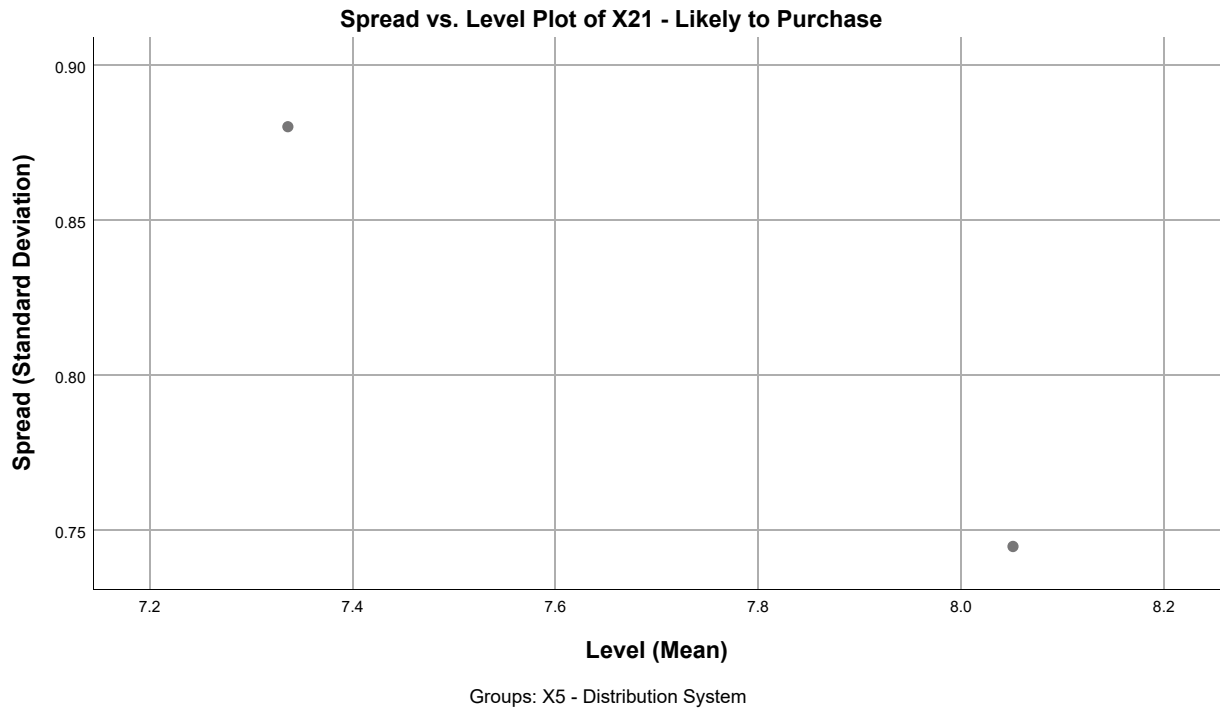
### **Spread-versus-Level Plots**

### **Standard Deviations versus Means**

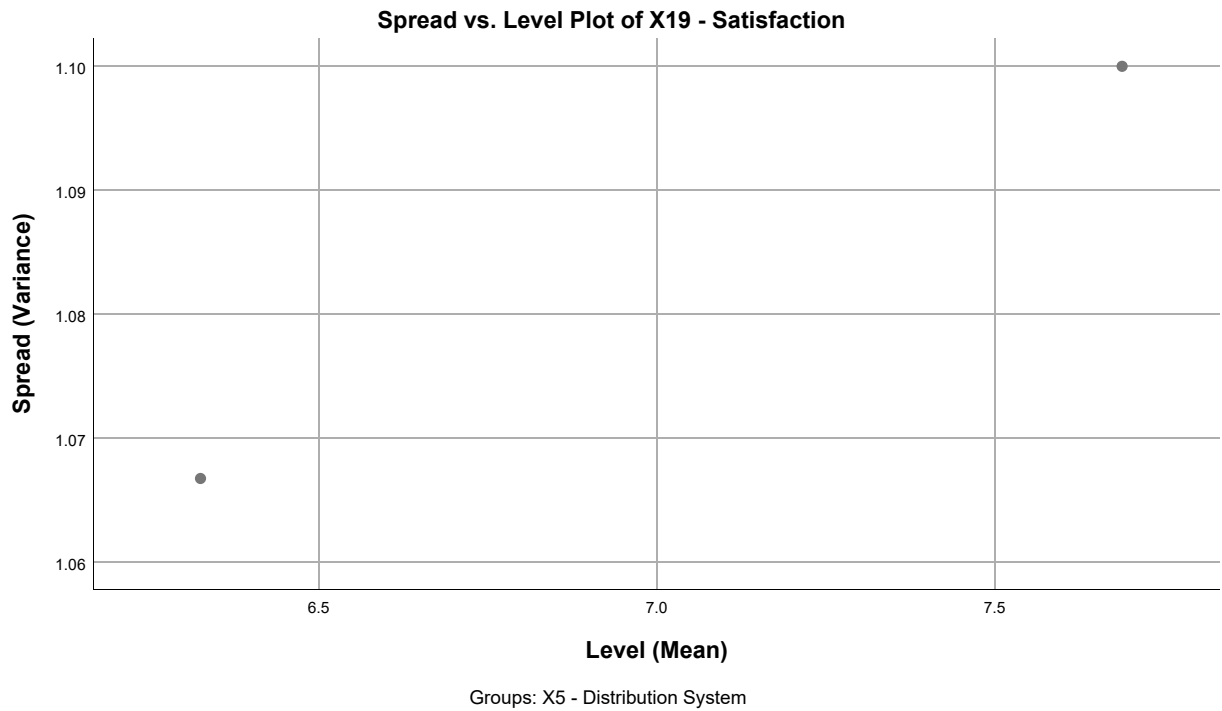
## **EXAMPLE 1 -- X5 BY X19 X20 X21**



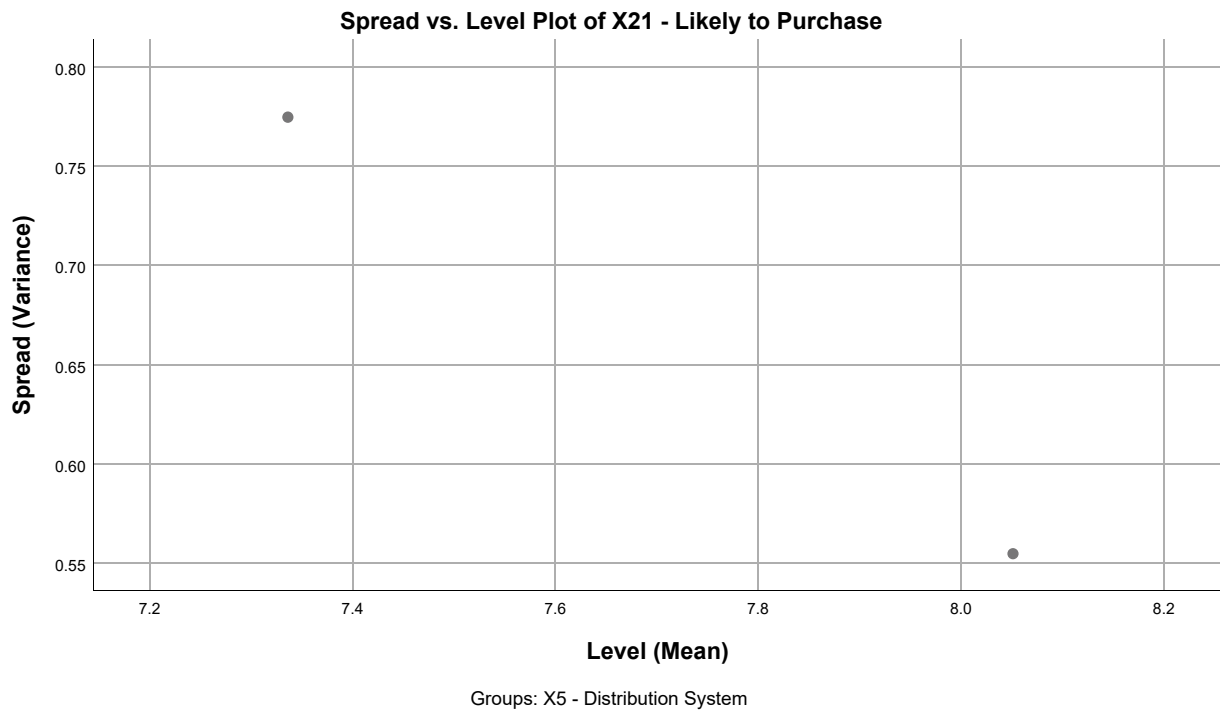
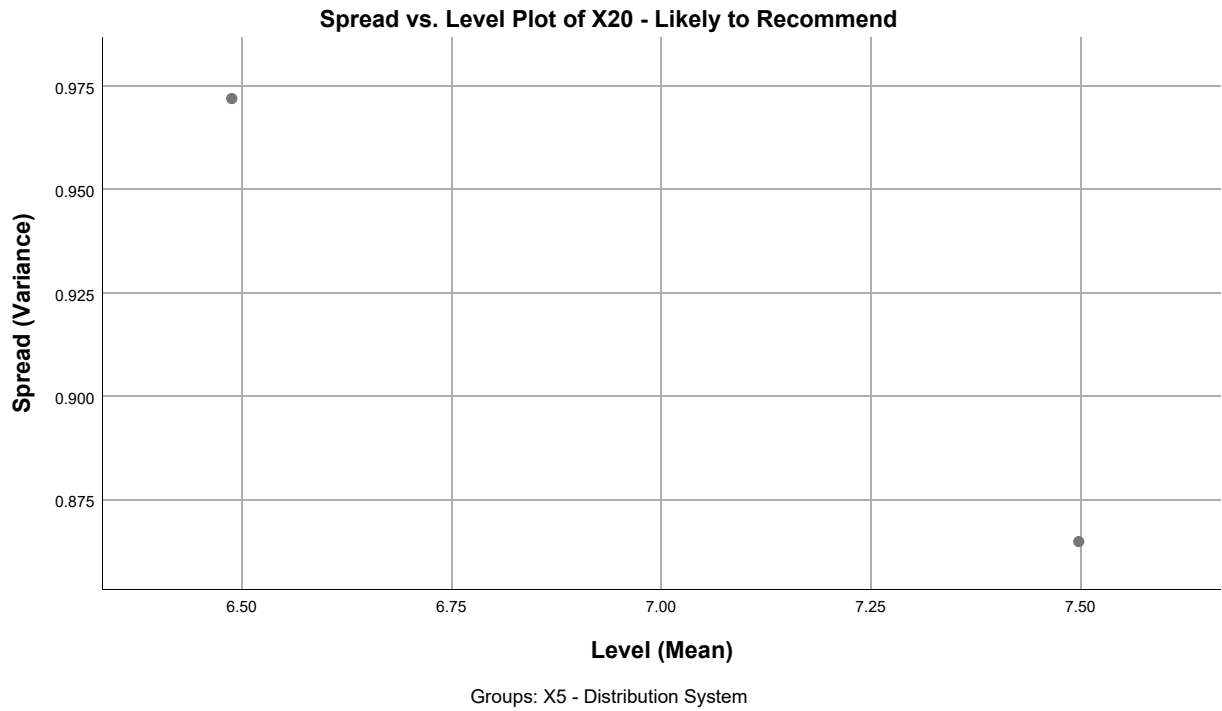
## **EXAMPLE 1 -- X5 BY X19 X20 X21**



### **Variances versus Means**



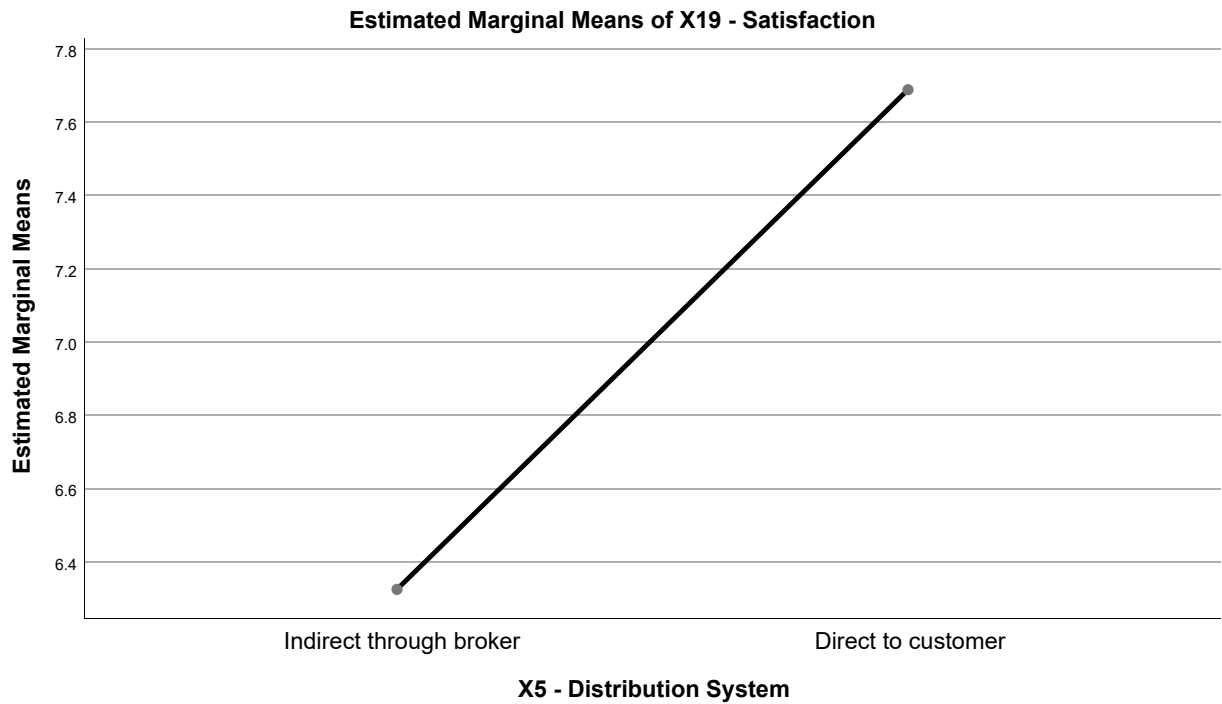
## **EXAMPLE 1 -- X5 BY X19 X20 X21**



## **Profile Plots**

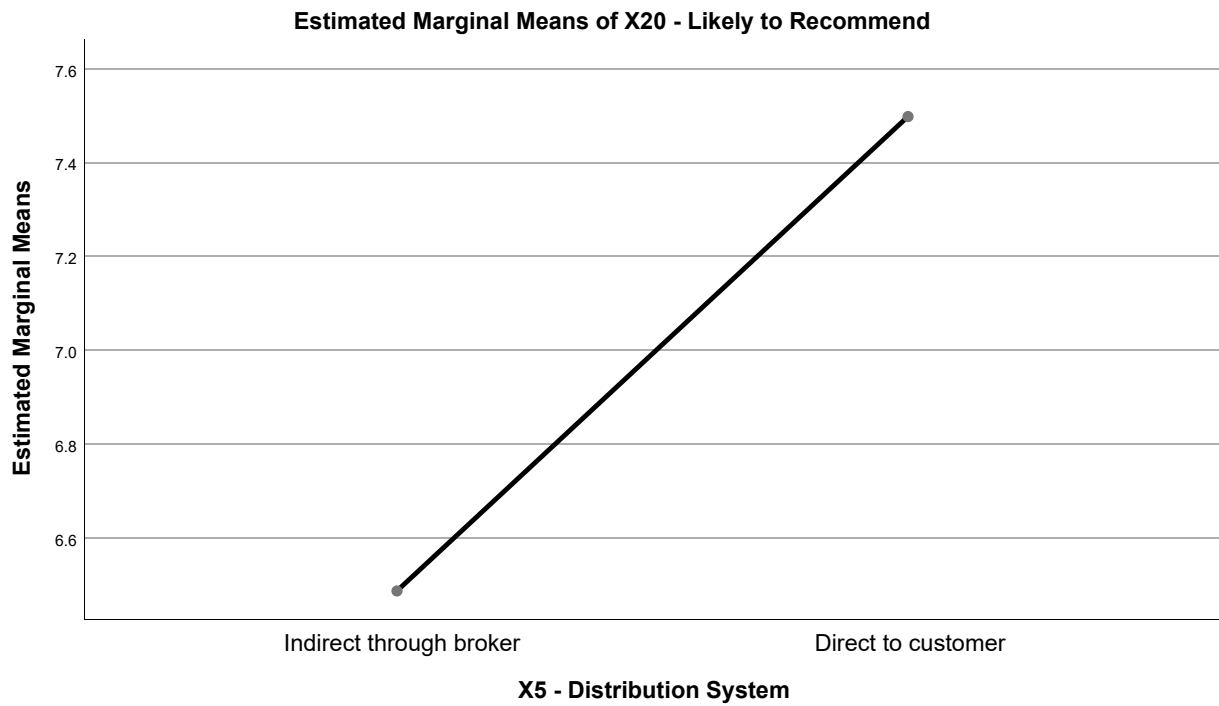
## **EXAMPLE 1 -- X5 BY X19 X20 X21**

### **X19 - Satisfaction**

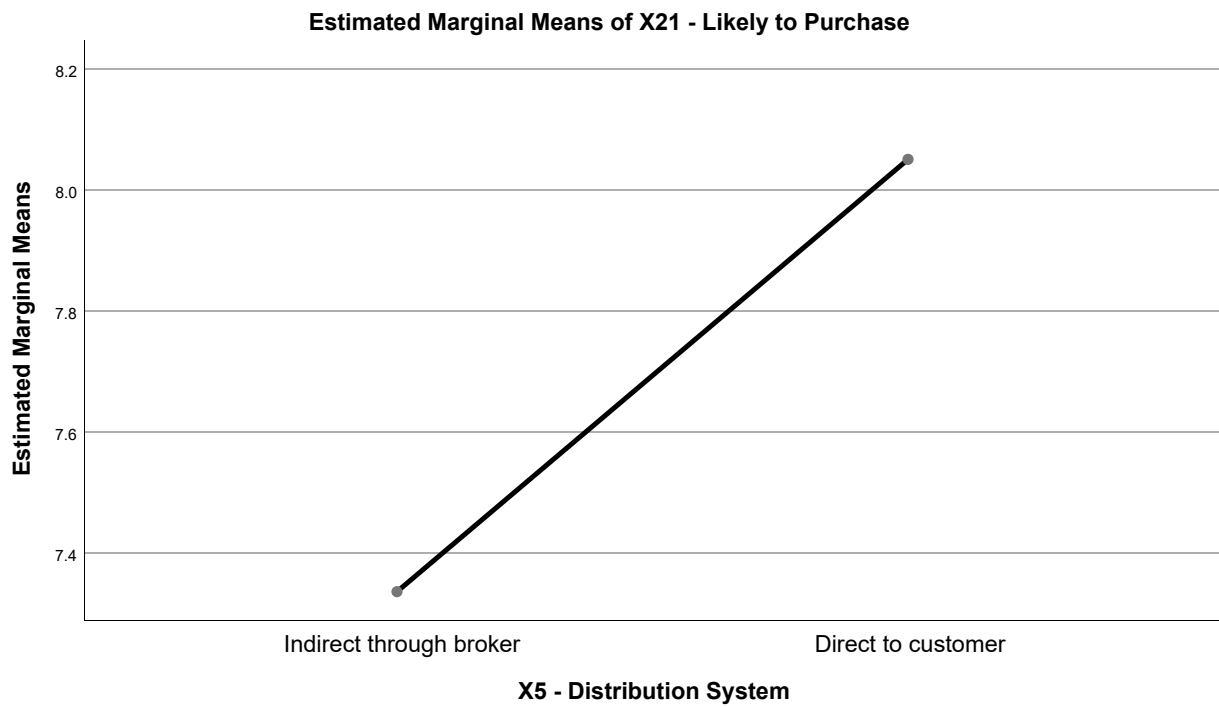


### **X20 - Likely to Recommend**

## **EXAMPLE 1 -- X5 BY X19 X20 X21**



### **X21 - Likely to Purchase**



## EXAMPLE 1 -- X5 BY X19 X20 X21

### EXAMPLE 1 -- STEPDOWN TESTS -- X19, X20, X21

#### **Manova**

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The default error term in MANOVA has been changed from WITHIN CELLS to  
WITHIN+RESIDUAL. Note that these are the same for all full factorial designs.

**EXAMPLE 1 -- X5 BY X19 X20 X21**  
**EXAMPLE 1 -- STEPDOWN TESTS -- X19, X20, X21**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e \* \*  
\* \* \* \* \*

200 cases accepted.  
0 cases rejected because of out-of-range factor values.  
0 cases rejected because of missing data.  
2 non-empty cells.

1 design will be processed.

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# **EXAMPLE 1 -- X5 BY X19 X20 X21** **EXAMPLE 1 -- STEPDOWN TESTS -- X19, X20, X21**

\* \* \* \* \* A n a l y s i s o f V a r i a n c e -- D  
 esign 1 \* \* \* \* \*

EFFECT .. x5

Multivariate Tests of Significance (S = 1, M = 1/2, N = 97 )

Test Name	Value	Exact F	Hypoth. DF	Error D
F Sig. of F				
Pillais	.30686	28.92305	3.00	196
.00 .000				
Hotellings	.44270	28.92305	3.00	196
.00 .000				
Wilks	.69314	28.92305	3.00	196
.00 .000				
Roys	.30686			
Note.. F statistics are exact.				

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 EFFECT .. x5 (Cont.)

Univariate F-tests with (1,198) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S F Sig. of F				
x19	92.29985	214.23935	92.29985	1.0820
2 85.30352		.000		
x20	50.66483	182.69392	50.66483	.9227
0 54.90953		.000		
x21	25.39594	133.37906	25.39594	.6736
3 37.70005		.000		

# **EXAMPLE 1 -- X5 BY X19 X20 X21** **EXAMPLE 1 -- STEPDOWN TESTS -- X19, X20, X21**

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x19	92.29985	1.08202	85.30352	
1	198	.000		
x20	.77071	.49357	1.56149	
1	197	.213		
x21	.02612	.36070	.07240	
1	196	.788		

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EFFECT .. x5 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1
x19	-.82655
x20	-.24081
x21	.05806

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Standardized discriminant function coefficients

Function No.

Variable	1
x19	-.85977
x20	-.23132
x21	.04765

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## EXAMPLE 1 -- X5 BY X19 X20 X21

### EXAMPLE 1 -- STEPDOWN TESTS -- X19, X20, X21

Estimates of effects for canonical variables

Canonical Variable

Parameter	1
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2	.66415
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Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
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x19	-.98650
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x20	-.79147
-----	---------

x21	-.65582
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## EXAMPLE 1 -- X5 BY X19 X20 X21

## EXAMPLE 1 -- STEPDOWN TESTS -- X21, X20, X19

### **Manova**

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The default error term in MANOVA has been changed from WITHIN CELLS to  
WITHIN+RESIDUAL. Note that these are the same for all full factorial designs.

**EXAMPLE 1 -- X5 BY X19 X20 X21**  
**EXAMPLE 1 -- STEPDOWN TESTS -- X21, X20, X19**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e \* \*  
\* \* \* \* \*

200 cases accepted.  
0 cases rejected because of out-of-range factor values.  
0 cases rejected because of missing data.  
2 non-empty cells.  
  
1 design will be processed.

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# **EXAMPLE 1 -- X5 BY X19 X20 X21** **EXAMPLE 1 -- STEPDOWN TESTS -- X21, X20, X19**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e -- D  
esign   1 \* \* \* \* \*

EFFECT .. x5

Multivariate Tests of Significance (S = 1, M = 1/2, N = 97 )

Test Name	Value	Exact F	Hypoth. DF	Error D
F      Sig. of F				
Pillais	.30686	28.92305	3.00	196
.00      .000				
Hotellings	.44270	28.92305	3.00	196
.00      .000				
Wilks	.69314	28.92305	3.00	196
.00      .000				
Roys	.30686			
Note.. F statistics are exact.				

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EFFECT .. x5 (Cont.)

Univariate F-tests with (1,198) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S      F      Sig. of F				
x21	25.39594	133.37906	25.39594	.6736
3      37.70005		.000		
x20	50.66483	182.69392	50.66483	.9227
0      54.90953		.000		
x19	92.29985	214.23935	92.29985	1.0820
2      85.30352		.000		

# EXAMPLE 1 -- X5 BY X19 X20 X21

## EXAMPLE 1 -- STEPDOWN TESTS -- X21, X20, X19

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x21	25.39594	.67363	37.70005	
1	198	.000		
x20	11.29574	.60988	18.52118	
1	197	.000		
x19	9.90609	.46888	21.12700	
1	196	.000		

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EFFECT .. x5 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1
x21	.05806
x20	-.24081
x19	-.82655

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Standardized discriminant function coefficients

Function No.

Variable	1
x21	.04765
x20	-.23132
x19	-.85977

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## EXAMPLE 1 -- X5 BY X19 X20 X21

### EXAMPLE 1 -- STEPDOWN TESTS -- X21, X20, X19

Estimates of effects for canonical variables

Canonical Variable

Parameter	1
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2	.66415
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Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
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x21	-.65582
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x20	-.79147
-----	---------

x19	-.98650
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## **EXAMPLE 2 -- X1 BY X19 X20 X21**

### **General Linear Model**

#### **Between-Subjects Factors**

		Value Label	N
X1 - Customer Type	1	Less than 1 year	68
	2	1 to 5 years	64
	3	Over 5 years	68

#### **Descriptive Statistics**

	X1 - Customer Type	Mean	Std. Deviation	N
X19 - Satisfaction	Less than 1 year	5.729	.7643	68
	1 to 5 years	7.294	.7078	64
	Over 5 years	7.853	1.0332	68
	Total	6.952	1.2411	200
X20 - Likely to Recommend	Less than 1 year	6.141	.9949	68
	1 to 5 years	7.209	.7144	64
	Over 5 years	7.522	.9761	68
	Total	6.953	1.0829	200
X21 - Likely to Purchase	Less than 1 year	6.962	.7598	68
	1 to 5 years	7.883	.6430	64
	Over 5 years	8.163	.7775	68
	Total	7.665	.8932	200

## EXAMPLE 2 -- X1 BY X19 X20 X21

### Box's Test of Equality of Covariance Matrices<sup>a</sup>

Box's M	20.363
F	1.659
df1	12
df2	186673.631
Sig.	.069

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + x1

### Multivariate Tests<sup>a</sup>

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.992	7993.265 <sup>b</sup>	3.000	195.000	.000
	Wilks' Lambda	.008	7993.265 <sup>b</sup>	3.000	195.000	.000
	Hotelling's Trace	122.973	7993.265 <sup>b</sup>	3.000	195.000	.000
	Roy's Largest Root	122.973	7993.265 <sup>b</sup>	3.000	195.000	.000
x1	Pillai's Trace	.543	24.368	6.000	392.000	.000
	Wilks' Lambda	.457	31.103 <sup>b</sup>	6.000	390.000	.000
	Hotelling's Trace	1.184	38.292	6.000	388.000	.000
	Roy's Largest Root	1.183	77.280 <sup>c</sup>	3.000	196.000	.000

## **EXAMPLE 2 -- X1 BY X19 X20 X21**

### **Multivariate Tests<sup>a</sup>**

Effect		Partial Eta Squared	Noncent. Parameter	Observed Power <sup>d</sup>
Intercept	Pillai's Trace	.992	23979.796	1.000
	Wilks' Lambda	.992	23979.796	1.000
	Hotelling's Trace	.992	23979.796	1.000
	Roy's Largest Root	.992	23979.796	1.000
x1	Pillai's Trace	.272	146.210	1.000
	Wilks' Lambda	.324	186.619	1.000
	Hotelling's Trace	.372	229.752	1.000
	Roy's Largest Root	.542	231.839	1.000

a. Design: Intercept + x1

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

d. Computed using alpha = .05

### **Levene's Test of Equality of Error Variances<sup>a</sup>**

		Levene Statistic	df1	df2	Sig.
X19 - Satisfaction	Based on Mean	6.871	2	197	.001
	Based on Median	6.748	2	197	.001
	Based on Median and with adjusted df	6.748	2	183.944	.001
	Based on trimmed mean	6.853	2	197	.001
X20 - Likely to Recommend	Based on Mean	2.951	2	197	.055
	Based on Median	2.720	2	197	.068
	Based on Median and with adjusted df	2.720	2	178.833	.069
	Based on trimmed mean	2.804	2	197	.063
X21 - Likely to Purchase	Based on Mean	.800	2	197	.451
	Based on Median	.662	2	197	.517
	Based on Median and with adjusted df	.662	2	187.052	.517
	Based on trimmed mean	.782	2	197	.459

## **EXAMPLE 2 -- X1 BY X19 X20 X21**

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + x1

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F
Corrected Model	X19 - Satisfaction	164.311 <sup>a</sup>	2	82.156	113.794
	X20 - Likely to Recommend	71.043 <sup>b</sup>	2	35.521	43.112
	X21 - Likely to Purchase	53.545 <sup>c</sup>	2	26.773	50.121
Intercept	X19 - Satisfaction	9676.798	1	9676.798	13403.324
	X20 - Likely to Recommend	9673.560	1	9673.560	11740.626
	X21 - Likely to Purchase	11753.940	1	11753.940	22004.478
x1	X19 - Satisfaction	164.311	2	82.156	113.794
	X20 - Likely to Recommend	71.043	2	35.521	43.112
	X21 - Likely to Purchase	53.545	2	26.773	50.121
Error	X19 - Satisfaction	142.228	197	.722	
	X20 - Likely to Recommend	162.316	197	.824	
	X21 - Likely to Purchase	105.230	197	.534	
Total	X19 - Satisfaction	9972.600	200		
	X20 - Likely to Recommend	9900.810	200		
	X21 - Likely to Purchase	11909.220	200		
Corrected Total	X19 - Satisfaction	306.539	199		
	X20 - Likely to Recommend	233.359	199		
	X21 - Likely to Purchase	158.775	199		

## **EXAMPLE 2 -- X1 BY X19 X20 X21**

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Sig.	Partial Eta Squared	Noncent. Parameter
Corrected Model	X19 - Satisfaction	.000	.536	227.587
	X20 - Likely to Recommend	.000	.304	86.223
	X21 - Likely to Purchase	.000	.337	100.242
Intercept	X19 - Satisfaction	.000	.986	13403.324
	X20 - Likely to Recommend	.000	.983	11740.626
	X21 - Likely to Purchase	.000	.991	22004.478
x1	X19 - Satisfaction	.000	.536	227.587
	X20 - Likely to Recommend	.000	.304	86.223
	X21 - Likely to Purchase	.000	.337	100.242
Error	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			
Total	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			
Corrected Total	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			

## **EXAMPLE 2 -- X1 BY X19 X20 X21**

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Observed Power <sup>d</sup>
Corrected Model	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
Intercept	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
x1	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
Error	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	
Total	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	
Corrected Total	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	

- a. R Squared = .536 (Adjusted R Squared = .531)
- b. R Squared = .304 (Adjusted R Squared = .297)
- c. R Squared = .337 (Adjusted R Squared = .331)
- d. Computed using alpha = .05

## **EXAMPLE 2 -- X1 BY X19 X20 X21**

**Parameter Estimates**

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% ... Lower Bound
X19 - Satisfaction	Intercept	7.853	.103	76.213	.000	7.650
	[x1=1]	-2.124	.146	-14.573	.000	-2.411
	[x1=2]	-.559	.148	-3.779	.000	-.851
	[x1=3]	0 <sup>a</sup>	.	.	.	.
X20 - Likely to Recommend	Intercept	7.522	.110	68.335	.000	7.305
	[x1=1]	-1.381	.156	-8.871	.000	-1.688
	[x1=2]	-.313	.158	-1.978	.049	-.624
	[x1=3]	0 <sup>a</sup>	.	.	.	.
X21 - Likely to Purchase	Intercept	8.163	.089	92.104	.000	7.988
	[x1=1]	-1.201	.125	-9.586	.000	-1.449
	[x1=2]	-.280	.127	-2.203	.029	-.531
	[x1=3]	0 <sup>a</sup>	.	.	.	.

**Parameter Estimates**

Dependent Variable	Parameter	95% Confidence ... Upper Bound	Partial Eta Squared	Noncent. Parameter	Observed Power <sup>b</sup>
X19 - Satisfaction	Intercept	8.056	.967	76.213	1.000
	[x1=1]	-1.836	.519	14.573	1.000
	[x1=2]	-.267	.068	3.779	.964
	[x1=3]	.	.	.	.
X20 - Likely to Recommend	Intercept	7.739	.960	68.335	1.000
	[x1=1]	-1.074	.285	8.871	1.000
	[x1=2]	-.001	.019	1.978	.503
	[x1=3]	.	.	.	.
X21 - Likely to Purchase	Intercept	8.338	.977	92.104	1.000
	[x1=1]	-.954	.318	9.586	1.000
	[x1=2]	-.029	.024	2.203	.592
	[x1=3]	.	.	.	.

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

## EXAMPLE 2 -- X1 BY X19 X20 X21

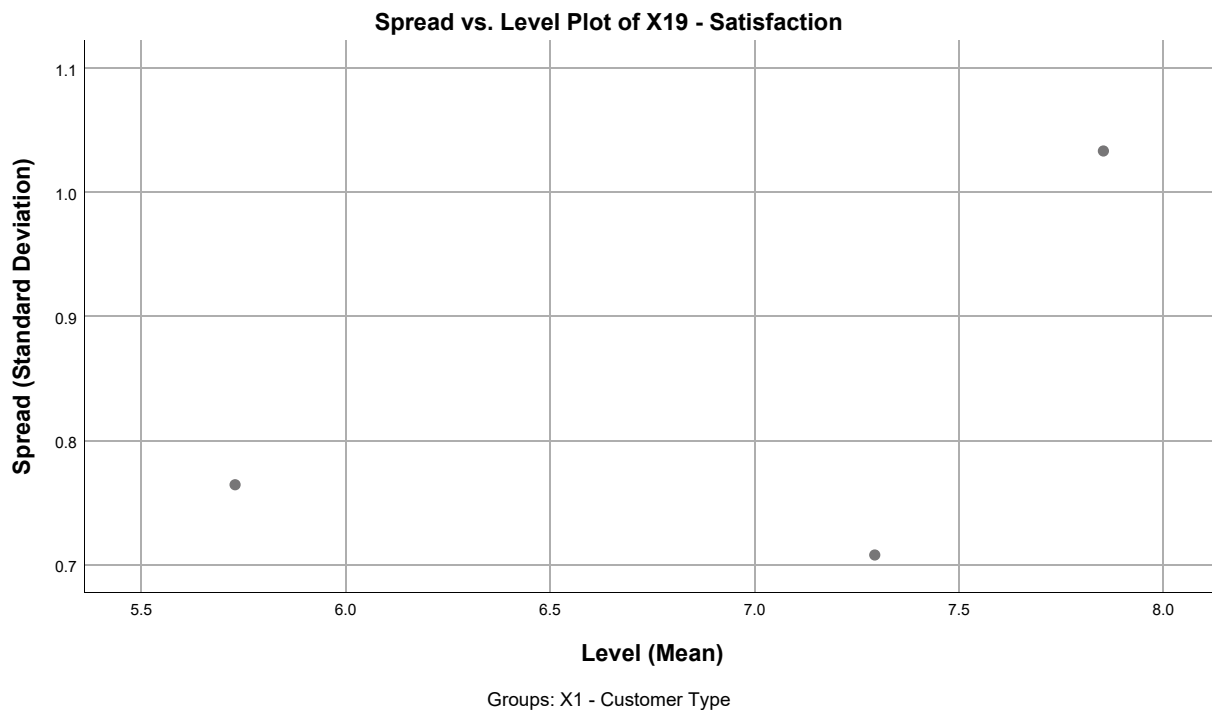
### Estimated Marginal Means

#### X1 - Customer Type

Dependent Variable	X1 - Customer Type	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
X19 - Satisfaction	Less than 1 year	5.729	.103	5.526	5.933
	1 to 5 years	7.294	.106	7.084	7.503
	Over 5 years	7.853	.103	7.650	8.056
X20 - Likely to Recommend	Less than 1 year	6.141	.110	5.924	6.358
	1 to 5 years	7.209	.113	6.986	7.433
	Over 5 years	7.522	.110	7.305	7.739
X21 - Likely to Purchase	Less than 1 year	6.962	.089	6.787	7.137
	1 to 5 years	7.883	.091	7.703	8.063
	Over 5 years	8.163	.089	7.988	8.338

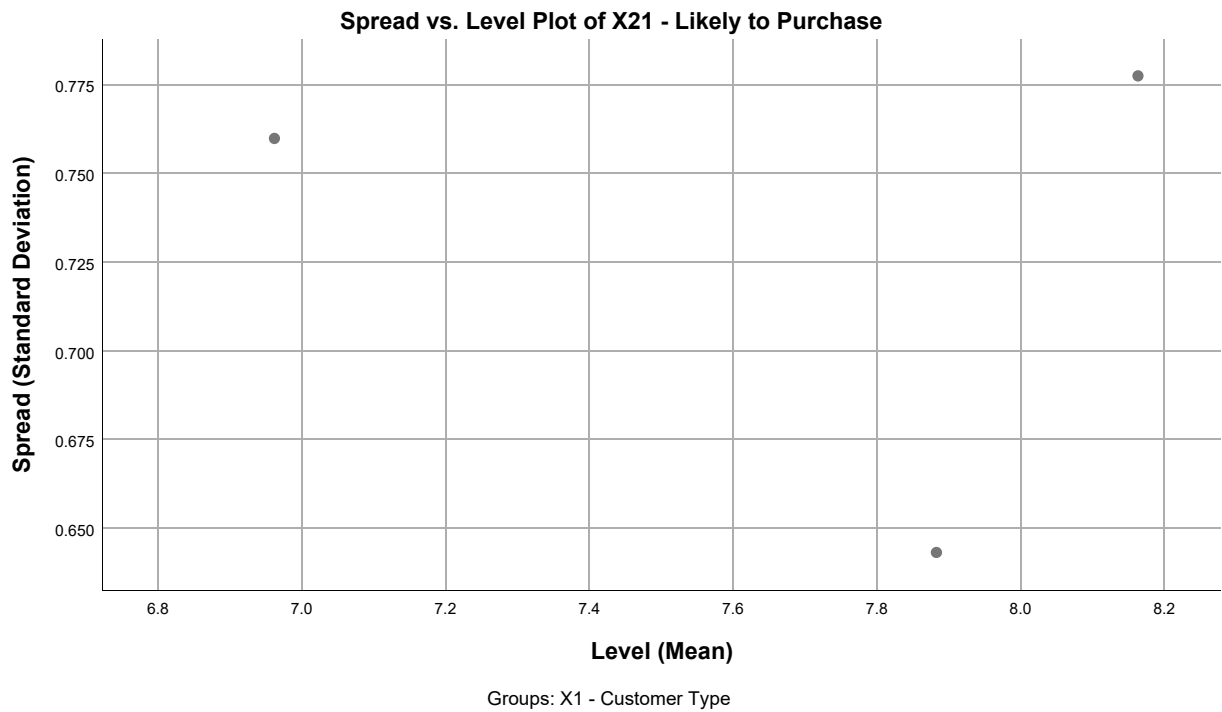
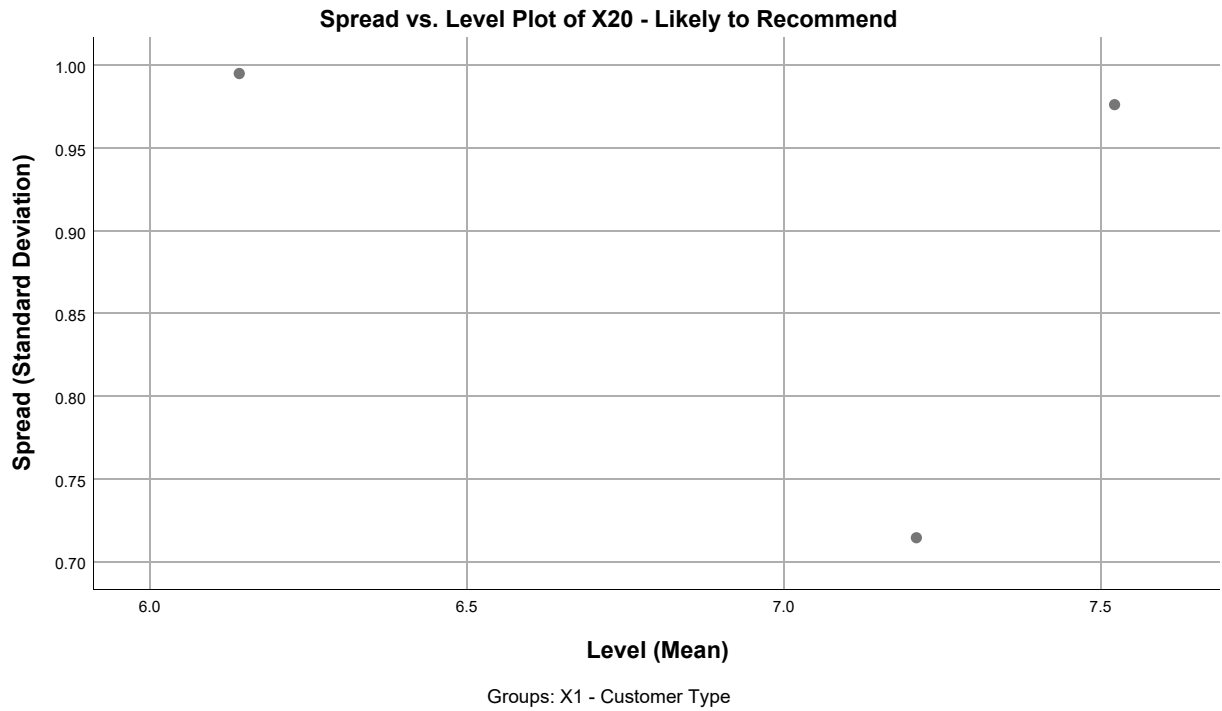
### Spread-versus-Level Plots

### Standard Deviations versus Means



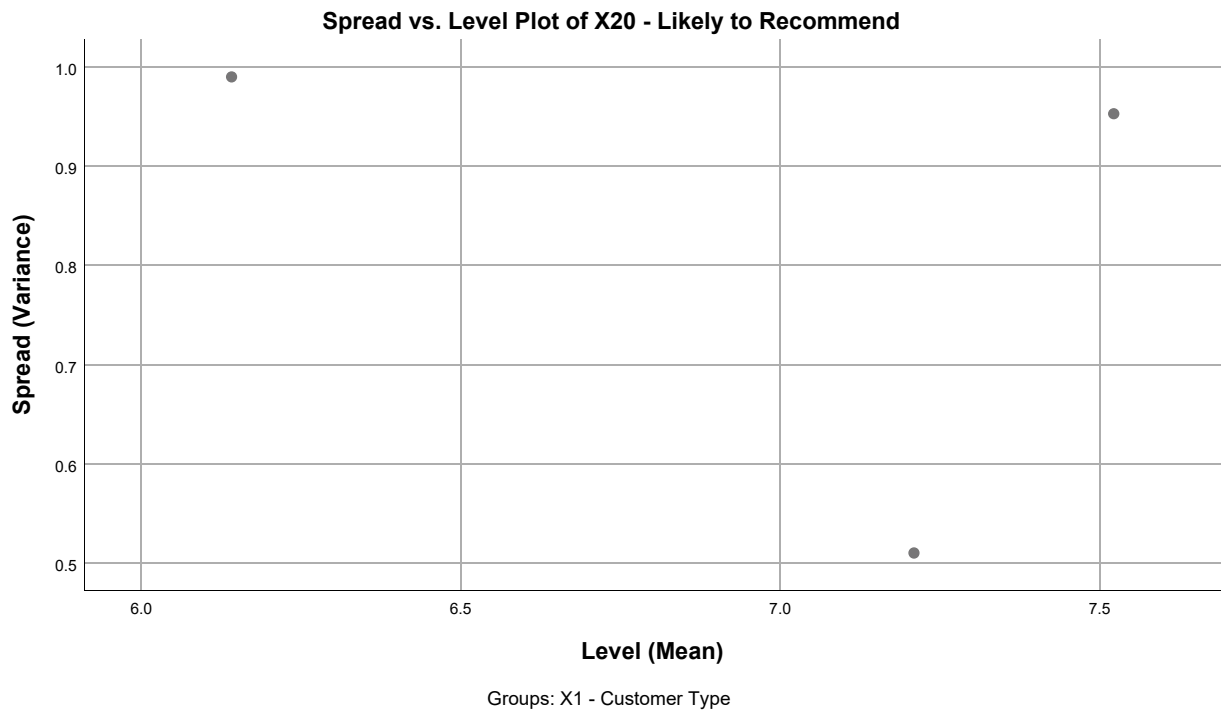
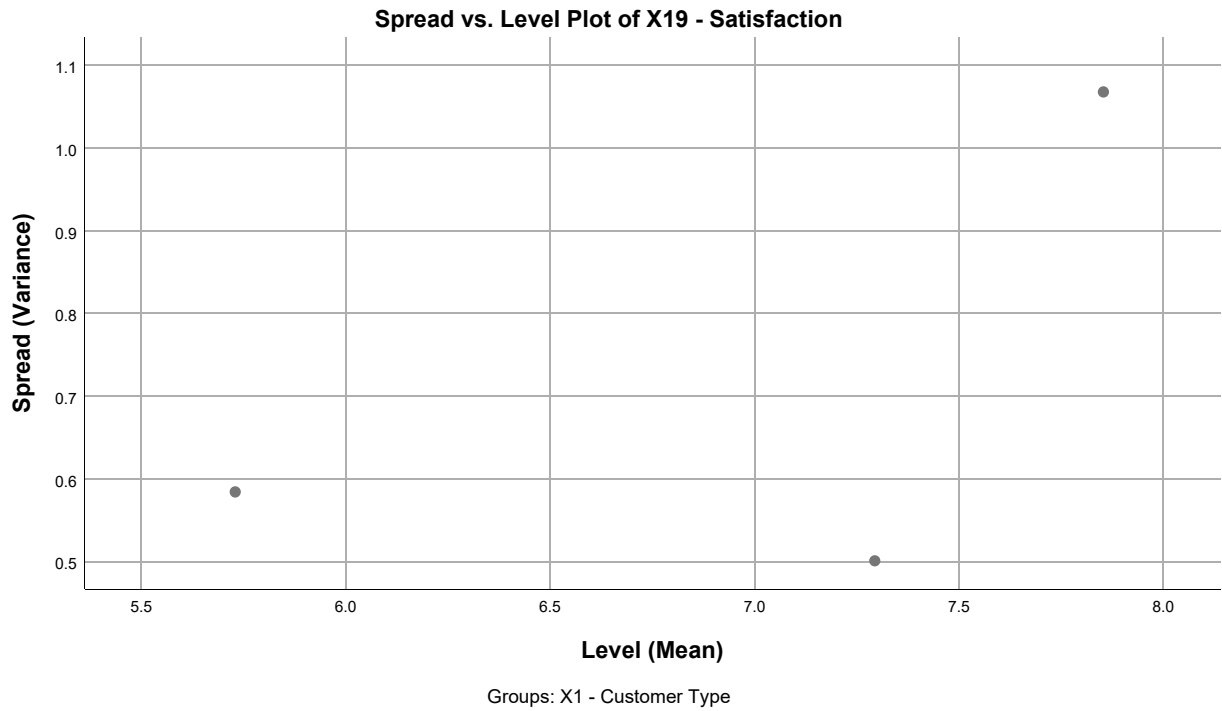


## **EXAMPLE 2 -- X1 BY X19 X20 X21**

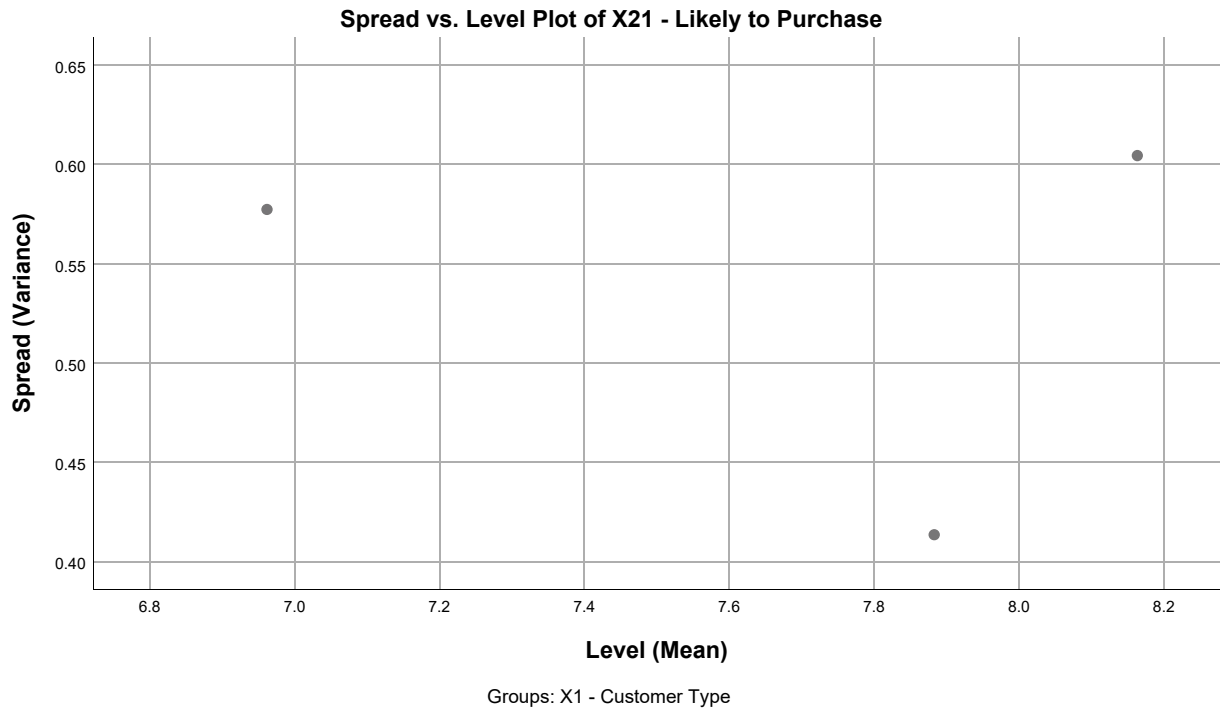


**Variances versus Means**

## **EXAMPLE 2 -- X1 BY X19 X20 X21**



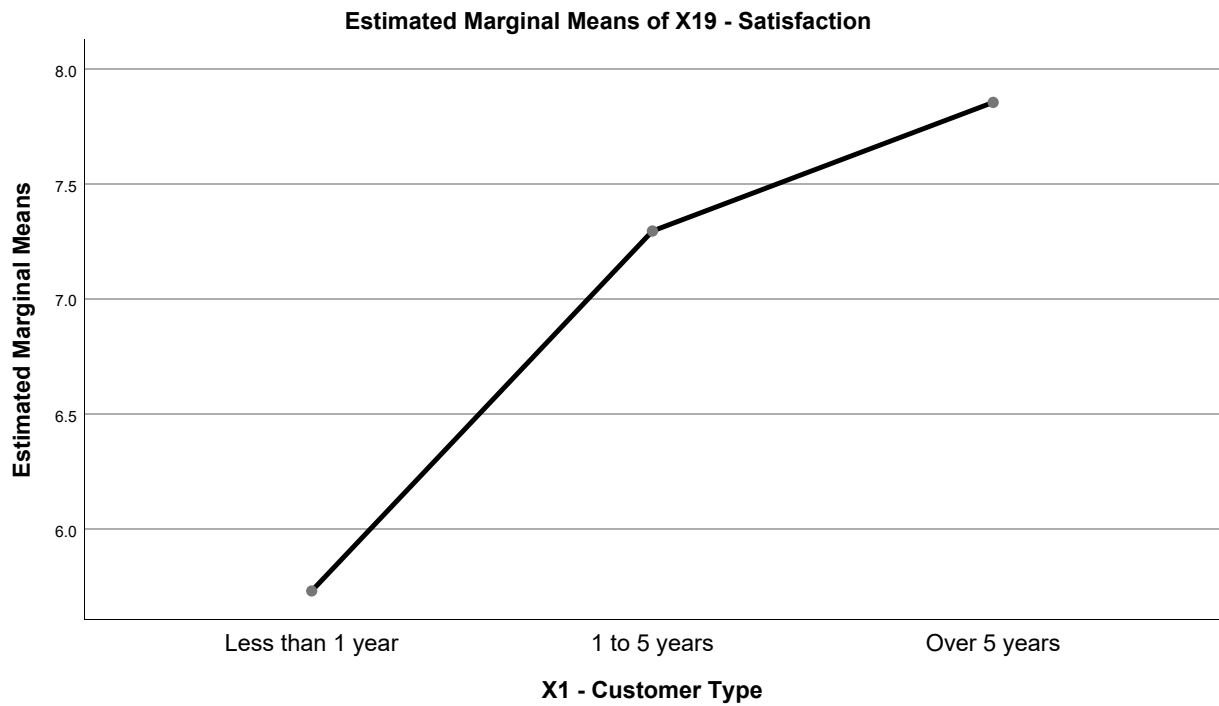
## **EXAMPLE 2 -- X1 BY X19 X20 X21**



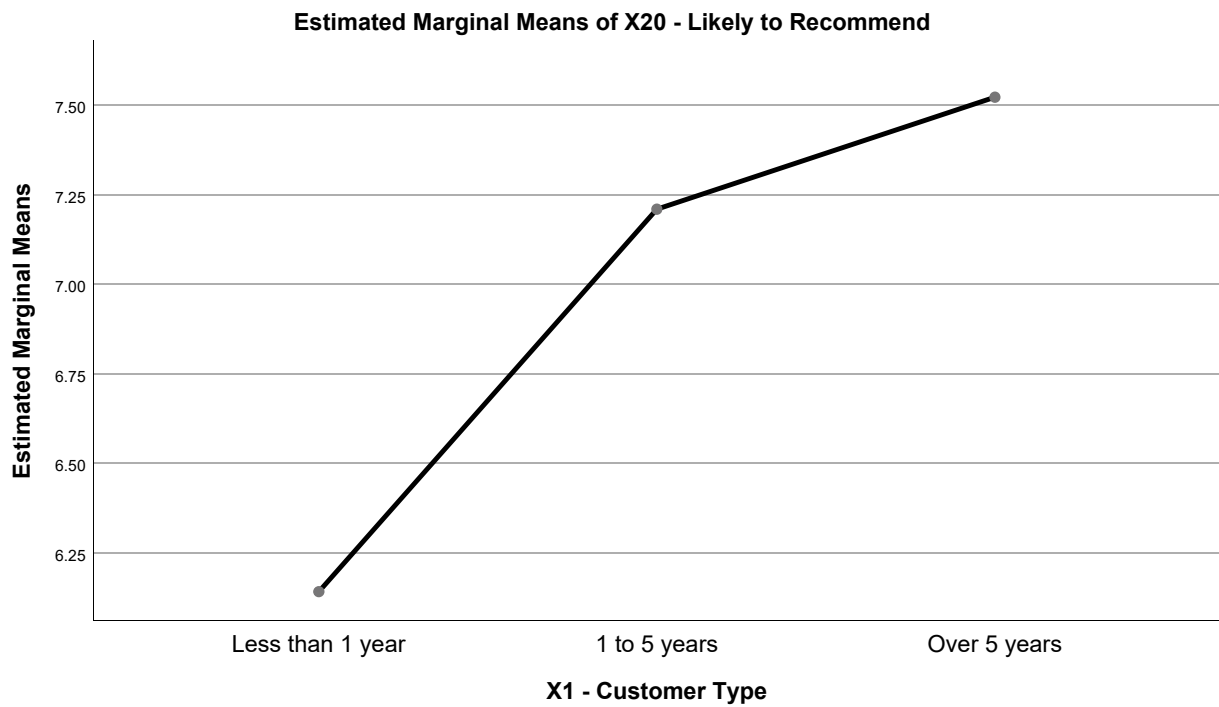
### **Profile Plots**

#### **X19 - Satisfaction**

## **EXAMPLE 2 -- X1 BY X19 X20 X21**

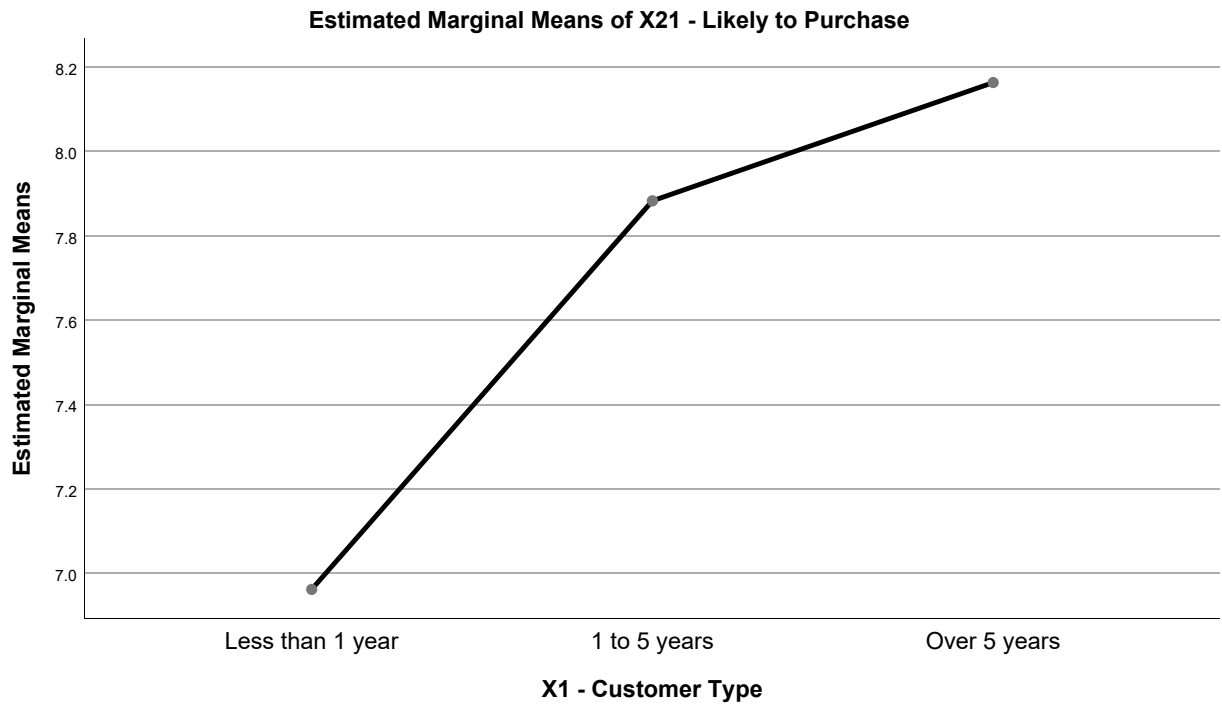


### **X20 - Likely to Recommend**



## **EXAMPLE 2 -- X1 BY X19 X20 X21**

### **X21 - Likely to Purchase**



## EXAMPLE 2 -- X1 BY X19 X20 X21

### EXAMPLE 2 -- STEPDOWN TESTS -- X19, X20, X21

#### **Manova**

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The default error term in MANOVA has been changed from WITHIN CELLS to  
WITHIN+RESIDUAL. Note that these are the same for all full factorial designs.

**EXAMPLE 2 -- X1 BY X19 X20 X21**  
**EXAMPLE 2 -- STEPDOWN TESTS -- X19, X20, X21**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e \* \*  
\* \* \* \* \*

200 cases accepted.

0 cases rejected because of out-of-range factor values.

0 cases rejected because of missing data.

3 non-empty cells.

1 design will be processed.

- - - - -  
- - - - -

## EXAMPLE 2 -- X1 BY X19 X20 X21

### EXAMPLE 2 -- STEPDOWN TESTS -- X19, X20, X21

\* \* \* \* \* A n a l y s i s o f V a r i a n c e -- D  
esign 1 \* \* \* \* \*

EFFECT .. x1

Multivariate Tests of Significance (S = 2, M = 0, N = 96 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error D
F Sig. of F				
Pillais	.54332	24.36832	6.00	392
.00	.000			
Hotellings	1.18429	38.29198	6.00	388
.00	.000			
Wilks	.45746	31.10309	6.00	390
.00	.000			
Roys	.54188			
Note.. F statistic for WILKS' Lambda is exact.				

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EFFECT .. x1 (Cont.)

Univariate F-tests with (2,197) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S F Sig. of F				
x19	164.31111	142.22809	82.15556	.7219
7 113.79359		.000		
x20	71.04276	162.31599	35.52138	.8239
4 43.11166		.000		
x21	53.54523	105.22977	26.77261	.5341
6 50.12085		.000		

-----  
-----



## EXAMPLE 2 -- X1 BY X19 X20 X21

### EXAMPLE 2 -- STEPDOWN TESTS -- X19, X20, X21

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x19	82.15556	.72197	113.79359	
2	197	.000		
x20	.06249	.49939	.12514	
2	196	.882		
x21	.45249	.35804	1.26380	
2	195	.285		

-----  
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EFFECT .. x1 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1
x19	1.09903
x20	-.08126
x21	.25454

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Standardized discriminant function coefficients

Function No.

Variable	1
x19	.93383
x20	-.07376
x21	.18604

-----  
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## EXAMPLE 2 -- X1 BY X19 X20 X21

### EXAMPLE 2 -- STEPDOWN TESTS -- X19, X20, X21

Estimates of effects for canonical variables

Canonical Variable

Parameter	1
2	-1.46477
3	.40212

-----  
-----

Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
x19	.98827
x20	.60789
x21	.65560

-----  
-----

## EXAMPLE 2 -- X1 BY X19 X20 X21

### EXAMPLE 2 -- STEPDOWN TESTS -- X21, X20, X19

#### **Manova**

-----  
-----  
The default error term in MANOVA has been changed from WITHIN CELLS to  
WITHIN+RESIDUAL. Note that these are the same for all full factorial designs.

**EXAMPLE 2 -- X1 BY X19 X20 X21**  
**EXAMPLE 2 -- STEPDOWN TESTS -- X21, X20, X19**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e \* \*  
\* \* \* \* \*

200 cases accepted.

0 cases rejected because of out-of-range factor values.

0 cases rejected because of missing data.

3 non-empty cells.

1 design will be processed.

- - - - -  
- - - - -

## EXAMPLE 2 -- X1 BY X19 X20 X21

### EXAMPLE 2 -- STEPDOWN TESTS -- X21, X20, X19

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e -- D  
esign   1 \* \* \* \* \*

EFFECT .. x1

Multivariate Tests of Significance (S = 2, M = 0, N = 96 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error D
F      Sig. of F				
Pillais	.54332	24.36832	6.00	392
.00      .000				
Hotellings	1.18429	38.29198	6.00	388
.00      .000				
Wilks	.45746	31.10309	6.00	390
.00      .000				
Roys	.54188			
Note.. F statistic for WILKS' Lambda is exact.				

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-----

EFFECT .. x1 (Cont.)

Univariate F-tests with (2,197) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S      F      Sig. of F				
x21	53.54523	105.22977	26.77261	.5341
6      50.12085		.000		
x20	71.04276	162.31599	35.52138	.8239
4      43.11166		.000		
x19	164.31111	142.22809	82.15556	.7219
7      113.79359		.000		

-----  
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## EXAMPLE 2 -- X1 BY X19 X20 X21

### EXAMPLE 2 -- STEPDOWN TESTS -- X21, X20, X19

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x21	26.77261	.53416	50.12085	
2	197	.000		
x20	4.96867	.61992	8.01496	
2	196	.000		
x19	12.89471	.38983	33.07741	
2	195	.000		

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EFFECT .. x1 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1
x21	-.25454
x20	.08126
x19	-1.09903

-----  
-----

Standardized discriminant function coefficients

Function No.

Variable	1
x21	-.18604
x20	.07376
x19	-.93383

-----  
-----

## EXAMPLE 2 -- X1 BY X19 X20 X21

### EXAMPLE 2 -- STEPDOWN TESTS -- X21, X20, X19

Estimates of effects for canonical variables

Canonical Variable

Parameter	1
2	1.46477
3	-.40212

-----  
-----

Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
x21	-.65560
x20	-.60789
x19	-.98827

-----  
-----

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### General Linear Model

#### Between-Subjects Factors

		Value Label	N
X5 - Distribution System	0	Indirect through broker	108
	1	Direct to customer	92
X1 - Customer Type	1	Less than 1 year	68
	2	1 to 5 years	64
	3	Over 5 years	68

#### Descriptive Statistics

	X5 - Distribution System	X1 - Customer Type	Mean	Std. Deviation
X19 - Satisfaction	Indirect through broker	Less than 1 year	5.462	.4995
		1 to 5 years	7.120	.5508
		Over 5 years	7.132	.8035
		Total	6.325	1.0328
	Direct to customer	Less than 1 year	6.600	.8390
		1 to 5 years	7.405	.7786
		Over 5 years	8.457	.7918
		Total	7.688	1.0488
	Total	Less than 1 year	5.729	.7643
		1 to 5 years	7.294	.7078
		Over 5 years	7.853	1.0332
		Total	6.952	1.2411
X20 - Likely to Recommend	Indirect through broker	Less than 1 year	5.883	.7728
		1 to 5 years	7.144	.8026
		Over 5 years	6.974	.8355
		Total	6.488	.9859
	Direct to customer	Less than 1 year	6.981	1.1862
		1 to 5 years	7.251	.6593
		Over 5 years	7.981	.8465
		Total	7.498	.9300



## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **Descriptive Statistics**

	X5 - Distribution System	X1 - Customer Type	N
X19 - Satisfaction	Indirect through broker	Less than 1 year	52
		1 to 5 years	25
		Over 5 years	31
		Total	108
	Direct to customer	Less than 1 year	16
		1 to 5 years	39
		Over 5 years	37
		Total	92
	Total	Less than 1 year	68
		1 to 5 years	64
		Over 5 years	68
		Total	200
X20 - Likely to Recommend	Indirect through broker	Less than 1 year	52
		1 to 5 years	25
		Over 5 years	31
		Total	108
	Direct to customer	Less than 1 year	16
		1 to 5 years	39
		Over 5 years	37
		Total	92

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### Descriptive Statistics

X5 - Distribution System		X1 - Customer Type	Mean	Std. Deviation
	Total	Less than 1 year	6.141	.9949
		1 to 5 years	7.209	.7144
		Over 5 years	7.522	.9761
		Total	6.953	1.0829
X21 - Likely to Purchase	Indirect through broker	Less than 1 year	6.763	.7021
		1 to 5 years	7.804	.7097
		Over 5 years	7.919	.6478
		Total	7.336	.8802
	Direct to customer	Less than 1 year	7.606	.5686
		1 to 5 years	7.933	.6006
		Over 5 years	8.368	.8253
		Total	8.051	.7449
	Total	Less than 1 year	6.962	.7598
		1 to 5 years	7.883	.6430
		Over 5 years	8.163	.7775
		Total	7.665	.8932

### **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

#### **Descriptive Statistics**

	X5 - Distribution System	X1 - Customer Type	N
	Total	Less than 1 year	68
		1 to 5 years	64
		Over 5 years	68
		Total	200
X21 - Likely to Purchase	Indirect through broker	Less than 1 year	52
		1 to 5 years	25
		Over 5 years	31
		Total	108
	Direct to customer	Less than 1 year	16
		1 to 5 years	39
		Over 5 years	37
		Total	92
	Total	Less than 1 year	68
		1 to 5 years	64
		Over 5 years	68
		Total	200

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### Box's Test of Equality of Covariance Matrices<sup>a</sup>

Box's M	39.721
F	1.263
df1	30
df2	33214.450
Sig.	.153

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + x5 + x1 + x5 \* x1

### Multivariate Tests<sup>a</sup>

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.993	9171.741 <sup>b</sup>	3.000	192.000	.000
	Wilks' Lambda	.007	9171.741 <sup>b</sup>	3.000	192.000	.000
	Hotelling's Trace	143.308	9171.741 <sup>b</sup>	3.000	192.000	.000
	Roy's Largest Root	143.308	9171.741 <sup>b</sup>	3.000	192.000	.000
x5	Pillai's Trace	.285	25.500 <sup>b</sup>	3.000	192.000	.000
	Wilks' Lambda	.715	25.500 <sup>b</sup>	3.000	192.000	.000
	Hotelling's Trace	.398	25.500 <sup>b</sup>	3.000	192.000	.000
	Roy's Largest Root	.398	25.500 <sup>b</sup>	3.000	192.000	.000
x1	Pillai's Trace	.488	20.770	6.000	386.000	.000
	Wilks' Lambda	.512	25.429 <sup>b</sup>	6.000	384.000	.000
	Hotelling's Trace	.952	30.306	6.000	382.000	.000
	Roy's Largest Root	.951	61.211 <sup>c</sup>	3.000	193.000	.000

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

**Multivariate Tests<sup>a</sup>**

Effect		Partial Eta Squared	Noncent. Parameter	Observed Power <sup>d</sup>
Intercept	Pillai's Trace	.993	27515.224	1.000
	Wilks' Lambda	.993	27515.224	1.000
	Hotelling's Trace	.993	27515.224	1.000
	Roy's Largest Root	.993	27515.224	1.000
x5	Pillai's Trace	.285	76.499	1.000
	Wilks' Lambda	.285	76.499	1.000
	Hotelling's Trace	.285	76.499	1.000
	Roy's Largest Root	.285	76.499	1.000
x1	Pillai's Trace	.244	124.618	1.000
	Wilks' Lambda	.284	152.574	1.000
	Hotelling's Trace	.322	181.834	1.000
	Roy's Largest Root	.488	183.633	1.000

**Multivariate Tests<sup>a</sup>**

Effect		Value	F	Hypothesis df	Error df	Sig.
x5 * x1	Pillai's Trace	.124	4.256	6.000	386.000	.000
	Wilks' Lambda	.878	4.291 <sup>b</sup>	6.000	384.000	.000
	Hotelling's Trace	.136	4.327	6.000	382.000	.000
	Roy's Largest Root	.112	7.194 <sup>c</sup>	3.000	193.000	.000

**Multivariate Tests<sup>a</sup>**

Effect		Partial Eta Squared	Noncent. Parameter	Observed Power <sup>d</sup>
x5 * x1	Pillai's Trace	.062	25.535	.980
	Wilks' Lambda	.063	25.749	.981
	Hotelling's Trace	.064	25.959	.982
	Roy's Largest Root	.101	21.582	.981

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

- a. Design: Intercept + x5 + x1 + x5 \* x1
- b. Exact statistic
- c. The statistic is an upper bound on F that yields a lower bound on the significance level.
- d. Computed using alpha = .05

### Levene's Test of Equality of Error Variances<sup>a</sup>

		Levene Statistic	df1	df2	Sig.
X19 - Satisfaction	Based on Mean	2.169	5	194	.059
	Based on Median	1.487	5	194	.196
	Based on Median and with adjusted df	1.487	5	147.923	.197
	Based on trimmed mean	2.120	5	194	.065
X20 - Likely to Recommend	Based on Mean	1.808	5	194	.113
	Based on Median	1.707	5	194	.135
	Based on Median and with adjusted df	1.707	5	176.034	.135
	Based on trimmed mean	1.764	5	194	.122
X21 - Likely to Purchase	Based on Mean	.990	5	194	.425
	Based on Median	.767	5	194	.575
	Based on Median and with adjusted df	.767	5	176.508	.575
	Based on trimmed mean	.985	5	194	.428

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

- a. Design: Intercept + x5 + x1 + x5 \* x1

## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F
Corrected Model	X19 - Satisfaction	210.999 <sup>a</sup>	5	42.200	85.689
	X20 - Likely to Recommend	103.085 <sup>b</sup>	5	20.617	30.702
	X21 - Likely to Purchase	65.879 <sup>c</sup>	5	13.176	27.516
Intercept	X19 - Satisfaction	8607.447	1	8607.447	17477.853
	X20 - Likely to Recommend	8623.298	1	8623.298	12841.553
	X21 - Likely to Purchase	10415.333	1	10415.333	21751.005
x5	X19 - Satisfaction	36.544	1	36.544	74.204
	X20 - Likely to Recommend	23.692	1	23.692	35.282
	X21 - Likely to Purchase	9.762	1	9.762	20.386
x1	X19 - Satisfaction	89.995	2	44.998	91.370
	X20 - Likely to Recommend	32.035	2	16.017	23.852
	X21 - Likely to Purchase	26.723	2	13.362	27.904
x5 * x1	X19 - Satisfaction	9.484	2	4.742	9.628
	X20 - Likely to Recommend	8.861	2	4.430	6.597
	X21 - Likely to Purchase	3.454	2	1.727	3.607
Error	X19 - Satisfaction	95.541	194	.492	
	X20 - Likely to Recommend	130.274	194	.672	
	X21 - Likely to Purchase	92.896	194	.479	
Total	X19 - Satisfaction	9972.600	200		
	X20 - Likely to Recommend	9900.810	200		
	X21 - Likely to Purchase	11909.220	200		
Corrected Total	X19 - Satisfaction	306.539	199		
	X20 - Likely to Recommend	233.359	199		
	X21 - Likely to Purchase	158.775	199		

## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Sig.	Partial Eta Squared	Noncent. Parameter
Corrected Model	X19 - Satisfaction	.000	.688	428.443
	X20 - Likely to Recommend	.000	.442	153.511
	X21 - Likely to Purchase	.000	.415	137.580
Intercept	X19 - Satisfaction	.000	.989	17477.853
	X20 - Likely to Recommend	.000	.985	12841.553
	X21 - Likely to Purchase	.000	.991	21751.005
x5	X19 - Satisfaction	.000	.277	74.204
	X20 - Likely to Recommend	.000	.154	35.282
	X21 - Likely to Purchase	.000	.095	20.386
x1	X19 - Satisfaction	.000	.485	182.740
	X20 - Likely to Recommend	.000	.197	47.705
	X21 - Likely to Purchase	.000	.223	55.808
x5 * x1	X19 - Satisfaction	.000	.090	19.257
	X20 - Likely to Recommend	.002	.064	13.195
	X21 - Likely to Purchase	.029	.036	7.213
Error	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			
Total	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			
Corrected Total	X19 - Satisfaction			
	X20 - Likely to Recommend			
	X21 - Likely to Purchase			



## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **Tests of Between-Subjects Effects**

Source	Dependent Variable	Observed Power <sup>d</sup>
Corrected Model	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
Intercept	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
x5	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	.994
x1	X19 - Satisfaction	1.000
	X20 - Likely to Recommend	1.000
	X21 - Likely to Purchase	1.000
x5 * x1	X19 - Satisfaction	.980
	X20 - Likely to Recommend	.908
	X21 - Likely to Purchase	.662
Error	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	
Total	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	
Corrected Total	X19 - Satisfaction	
	X20 - Likely to Recommend	
	X21 - Likely to Purchase	

a. R Squared = .688 (Adjusted R Squared = .680)

b. R Squared = .442 (Adjusted R Squared = .427)

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

c. R Squared = .415 (Adjusted R Squared = .400)

d. Computed using alpha = .05

### Parameter Estimates

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% ... Lower Bound
X19 - Satisfaction	Intercept	8.457	.115	73.301	.000	8.229
	[x5=0]	-1.324	.171	-7.751	.000	-1.662
	[x5=1]	0 <sup>a</sup>	.	.	.	.
	[x1=1]	-1.857	.210	-8.843	.000	-2.271
	[x1=2]	-1.052	.161	-6.530	.000	-1.369
	[x1=3]	0 <sup>a</sup>	.	.	.	.
	[x5=0] * [x1=1]	.186	.264	.706	.481	-.334
	[x5=0] * [x1=2]	1.039	.248	4.190	.000	.550
	[x5=0] * [x1=3]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=1]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=2]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=3]	0 <sup>a</sup>	.	.	.	.
X20 - Likely to Recommend	Intercept	7.981	.135	59.243	.000	7.715
	[x5=0]	-1.007	.200	-5.046	.000	-1.400
	[x5=1]	0 <sup>a</sup>	.	.	.	.
	[x1=1]	-1.000	.245	-4.078	.000	-1.483
	[x1=2]	-.730	.188	-3.881	.000	-1.101
	[x1=3]	0 <sup>a</sup>	.	.	.	.
	[x5=0] * [x1=1]	-.092	.308	-.298	.766	-.699
	[x5=0] * [x1=2]	.900	.290	3.106	.002	.328
	[x5=0] * [x1=3]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=1]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=2]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=3]	0 <sup>a</sup>	.	.	.	.
X21 - Likely to Purchase	Intercept	8.368	.114	73.553	.000	8.143
	[x5=0]	-.448	.168	-2.660	.008	-.781
	[x5=1]	0 <sup>a</sup>	.	.	.	.
	[x1=1]	-.761	.207	-3.677	.000	-1.170

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### Parameter Estimates

Dependent Variable	Parameter	95% Confidence Upper Bound	Partial Eta Squared	Noncent. Parameter
X19 - Satisfaction	Intercept	8.684	.965	73.301
	[x5=0]	-.987	.236	7.751
	[x5=1]	.	.	.
	[x1=1]	-1.443	.287	8.843
	[x1=2]	-.734	.180	6.530
	[x1=3]	.	.	.
	[x5=0] * [x1=1]	.706	.003	.706
	[x5=0] * [x1=2]	1.529	.083	4.190
	[x5=0] * [x1=3]	.	.	.
	[x5=1] * [x1=1]	.	.	.
	[x5=1] * [x1=2]	.	.	.
	[x5=1] * [x1=3]	.	.	.
X20 - Likely to Recommend	Intercept	8.247	.948	59.243
	[x5=0]	-.613	.116	5.046
	[x5=1]	.	.	.
	[x1=1]	-.516	.079	4.078
	[x1=2]	-.359	.072	3.881
	[x1=3]	.	.	.
	[x5=0] * [x1=1]	.515	.000	.298
	[x5=0] * [x1=2]	1.471	.047	3.106
	[x5=0] * [x1=3]	.	.	.
	[x5=1] * [x1=1]	.	.	.
	[x5=1] * [x1=2]	.	.	.
	[x5=1] * [x1=3]	.	.	.
X21 - Likely to Purchase	Intercept	8.592	.965	73.553
	[x5=0]	-.116	.035	2.660
	[x5=1]	.	.	.
	[x1=1]	-.353	.065	3.677

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### Parameter Estimates

Dependent Variable	Parameter	Observed Power <sup>b</sup>
X19 - Satisfaction	Intercept	1.000
	[x5=0]	1.000
	[x5=1]	.
	[x1=1]	1.000
	[x1=2]	1.000
	[x1=3]	.
	[x5=0] * [x1=1]	.108
	[x5=0] * [x1=2]	.986
	[x5=0] * [x1=3]	.
	[x5=1] * [x1=1]	.
	[x5=1] * [x1=2]	.
	[x5=1] * [x1=3]	.
X20 - Likely to Recommend	Intercept	1.000
	[x5=0]	.999
	[x5=1]	.
	[x1=1]	.982
	[x1=2]	.971
	[x1=3]	.
	[x5=0] * [x1=1]	.060
	[x5=0] * [x1=2]	.871
	[x5=0] * [x1=3]	.
	[x5=1] * [x1=1]	.
	[x5=1] * [x1=2]	.
	[x5=1] * [x1=3]	.
X21 - Likely to Purchase	Intercept	1.000
	[x5=0]	.754
	[x5=1]	.
	[x1=1]	.955

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

**Parameter Estimates**

Dependent Variable	Parameter	B	Std. Error	t	Sig.	95% ... Lower Bound
	[x1=2]	-.434	.159	-2.734	.007	-.747
	[x1=3]	0 <sup>a</sup>	.	.	.	.
	[x5=0] * [x1=1]	-.395	.260	-1.518	.131	-.907
	[x5=0] * [x1=2]	.319	.245	1.304	.194	-.164
	[x5=0] * [x1=3]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=1]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=2]	0 <sup>a</sup>	.	.	.	.
	[x5=1] * [x1=3]	0 <sup>a</sup>	.	.	.	.

**Parameter Estimates**

Dependent Variable	Parameter	95% Confidence ... Upper Bound	Partial Eta Squared	Noncent. Parameter
	[x1=2]	-.121	.037	2.734
	[x1=3]	.	.	.
	[x5=0] * [x1=1]	.118	.012	1.518
	[x5=0] * [x1=2]	.801	.009	1.304
	[x5=0] * [x1=3]	.	.	.
	[x5=1] * [x1=1]	.	.	.
	[x5=1] * [x1=2]	.	.	.
	[x5=1] * [x1=3]	.	.	.

## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **Parameter Estimates**

Dependent Variable	Parameter	Observed Power <sup>b</sup>
	[x1=2]	.777
	[x1=3]	.
	[x5=0] * [x1=1]	.327
	[x5=0] * [x1=2]	.254
	[x5=0] * [x1=3]	.
	[x5=1] * [x1=1]	.
	[x5=1] * [x1=2]	.
	[x5=1] * [x1=3]	.

a. This parameter is set to zero because it is redundant.

b. Computed using alpha = .05

### **Estimated Marginal Means**

#### **1. X5 - Distribution System**

Dependent Variable	X5 - Distribution System	Mean	Std. Error	95% ... Lower Bound
X19 - Satisfaction	Indirect through broker	6.571	.071	6.432
	Direct to customer	7.487	.079	7.331
X20 - Likely to Recommend	Indirect through broker	6.667	.083	6.504
	Direct to customer	7.405	.093	7.222
X21 - Likely to Purchase	Indirect through broker	7.496	.070	7.358
	Direct to customer	7.969	.078	7.815

## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **1. X5 - Distribution System**

Dependent Variable	X5 - Distribution System	95% Confidence .
		Upper Bound
X19 - Satisfaction	Indirect through broker	6.711
	Direct to customer	7.644
X20 - Likely to Recommend	Indirect through broker	6.830
	Direct to customer	7.587
X21 - Likely to Purchase	Indirect through broker	7.633
	Direct to customer	8.123

### **2. X1 - Customer Type**

Dependent Variable	X1 - Customer Type	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
X19 - Satisfaction	Less than 1 year	6.031	.100	5.833	6.229
	1 to 5 years	7.263	.090	7.085	7.440
	Over 5 years	7.795	.085	7.626	7.963
X20 - Likely to Recommend	Less than 1 year	6.432	.117	6.201	6.663
	1 to 5 years	7.198	.105	6.991	7.405
	Over 5 years	7.478	.100	7.281	7.674
X21 - Likely to Purchase	Less than 1 year	7.185	.099	6.990	7.380
	1 to 5 years	7.869	.089	7.694	8.043
	Over 5 years	8.143	.084	7.977	8.310

## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **3. X5 - Distribution System \* X1 - Customer Type**

Dependent Variable	X5 - Distribution System	X1 - Customer Type	Mean	Std. Error
X19 - Satisfaction	Indirect through broker	Less than 1 year	5.462	.097
		1 to 5 years	7.120	.140
		Over 5 years	7.132	.126
	Direct to customer	Less than 1 year	6.600	.175
		1 to 5 years	7.405	.112
		Over 5 years	8.457	.115
X20 - Likely to Recommend	Indirect through broker	Less than 1 year	5.883	.114
		1 to 5 years	7.144	.164
		Over 5 years	6.974	.147
	Direct to customer	Less than 1 year	6.981	.205
		1 to 5 years	7.251	.131
		Over 5 years	7.981	.135
X21 - Likely to Purchase	Indirect through broker	Less than 1 year	6.763	.096
		1 to 5 years	7.804	.138
		Over 5 years	7.919	.124
	Direct to customer	Less than 1 year	7.606	.173
		1 to 5 years	7.933	.111
		Over 5 years	8.368	.114



## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **3. X5 - Distribution System \* X1 - Customer Type**

Dependent Variable	X5 - Distribution System	X1 - Customer Type	95% ... Lower Bound
X19 - Satisfaction	Indirect through broker	Less than 1 year	5.270
		1 to 5 years	6.843
		Over 5 years	6.884
	Direct to customer	Less than 1 year	6.254
		1 to 5 years	7.183
		Over 5 years	8.229
X20 - Likely to Recommend	Indirect through broker	Less than 1 year	5.659
		1 to 5 years	6.821
		Over 5 years	6.684
	Direct to customer	Less than 1 year	6.577
		1 to 5 years	6.992
		Over 5 years	7.715
X21 - Likely to Purchase	Indirect through broker	Less than 1 year	6.574
		1 to 5 years	7.531
		Over 5 years	7.674
	Direct to customer	Less than 1 year	7.265
		1 to 5 years	7.715
		Over 5 years	8.143

## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

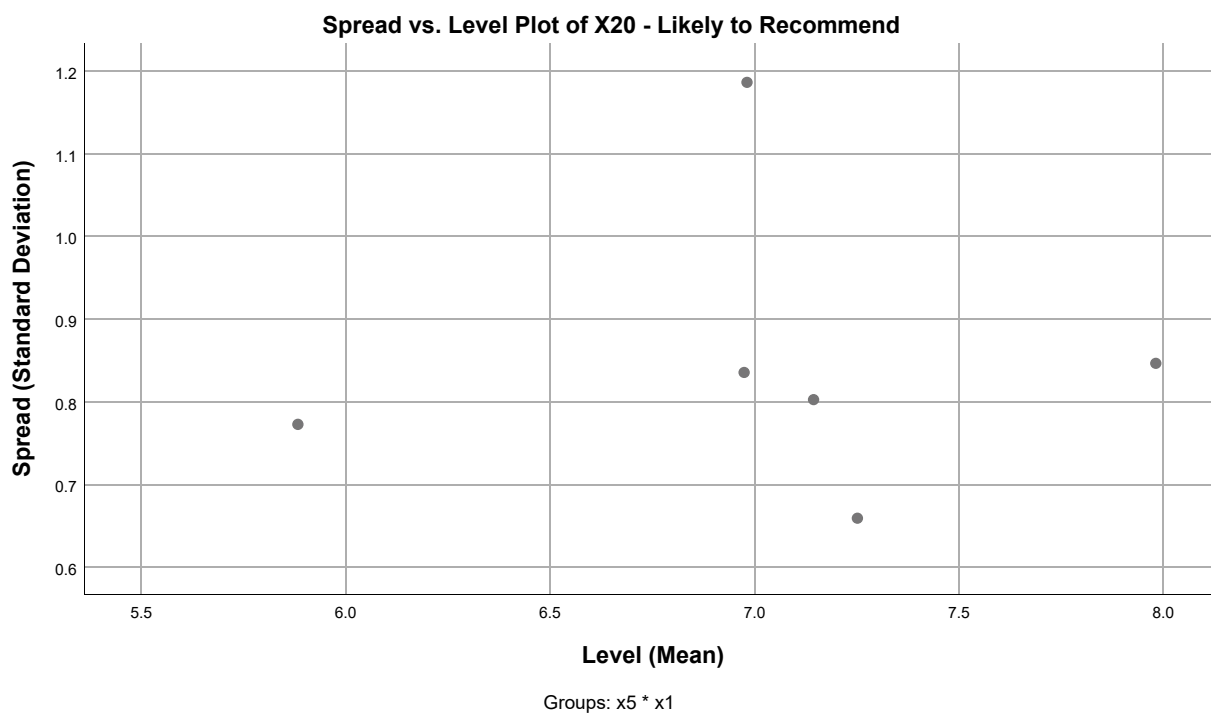
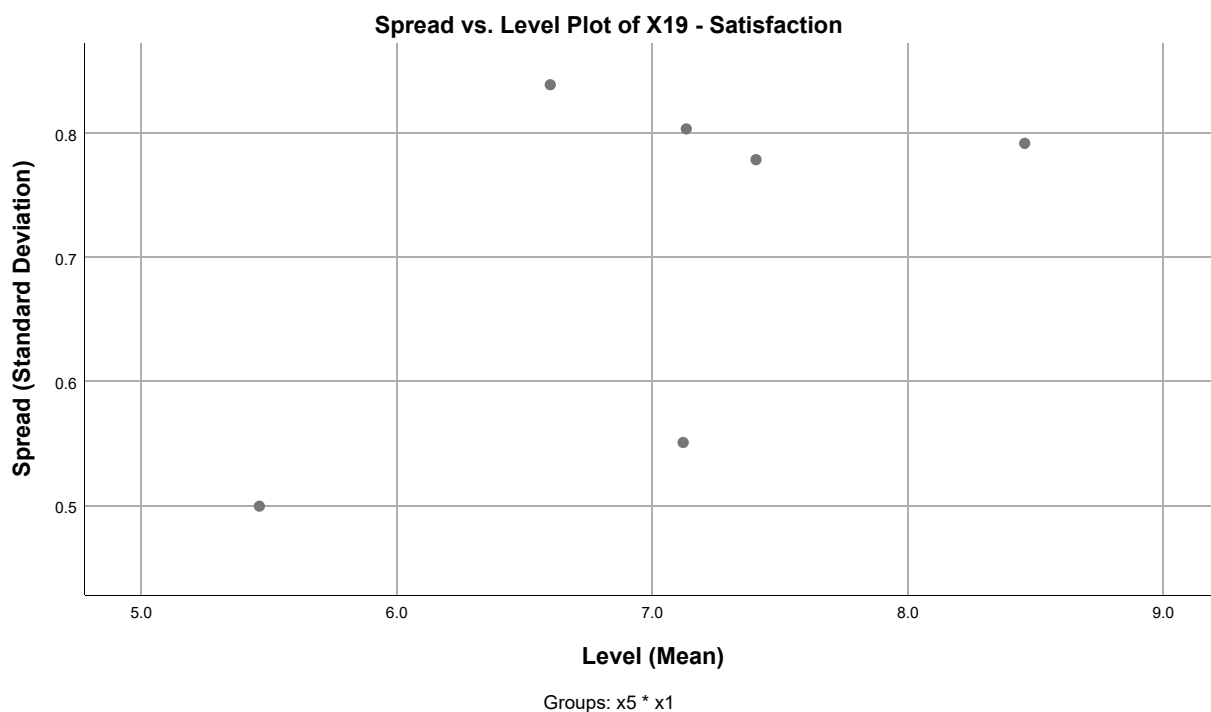
### **3. X5 - Distribution System \* X1 - Customer Type**

Dependent Variable	X5 - Distribution System	X1 - Customer Type	95% Confidence .
			Upper Bound
X19 - Satisfaction	Indirect through broker	Less than 1 year	5.653
		1 to 5 years	7.397
		Over 5 years	7.381
	Direct to customer	Less than 1 year	6.946
		1 to 5 years	7.627
		Over 5 years	8.684
X20 - Likely to Recommend	Indirect through broker	Less than 1 year	6.107
		1 to 5 years	7.467
		Over 5 years	7.264
	Direct to customer	Less than 1 year	7.385
		1 to 5 years	7.510
		Over 5 years	8.247
X21 - Likely to Purchase	Indirect through broker	Less than 1 year	6.953
		1 to 5 years	8.077
		Over 5 years	8.164
	Direct to customer	Less than 1 year	7.947
		1 to 5 years	8.152
		Over 5 years	8.592

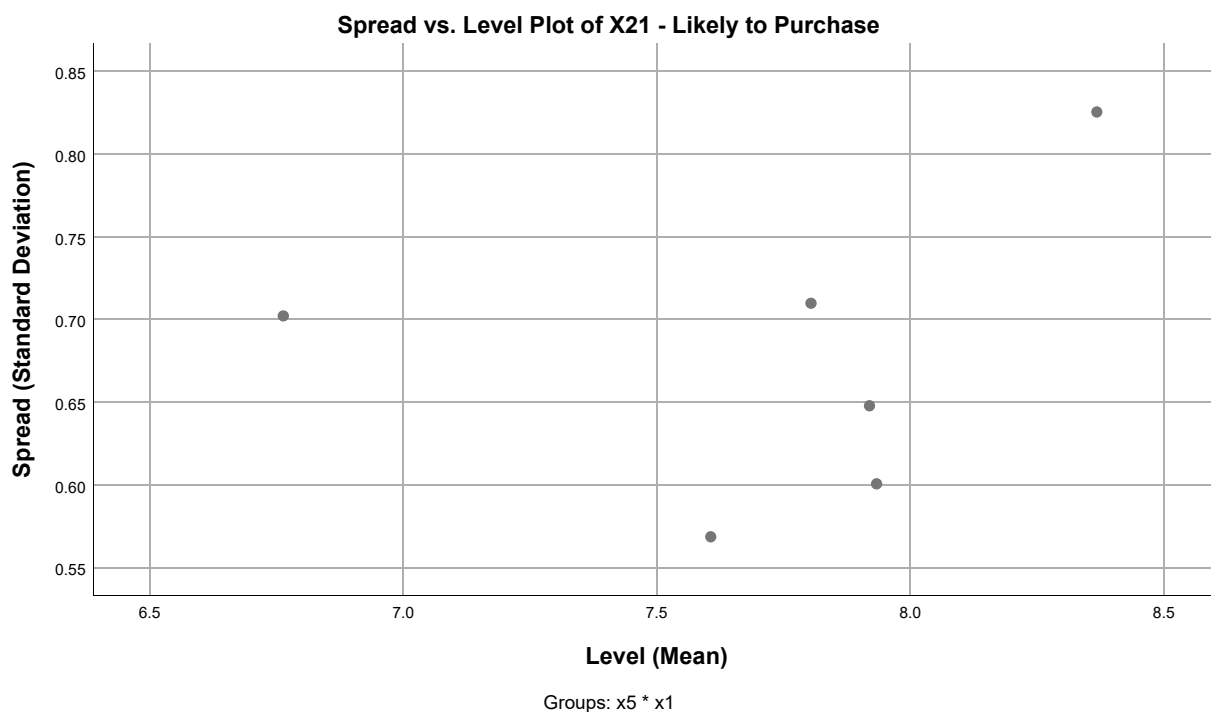
**Spread-versus-Level Plots**

**Standard Deviations versus Means**

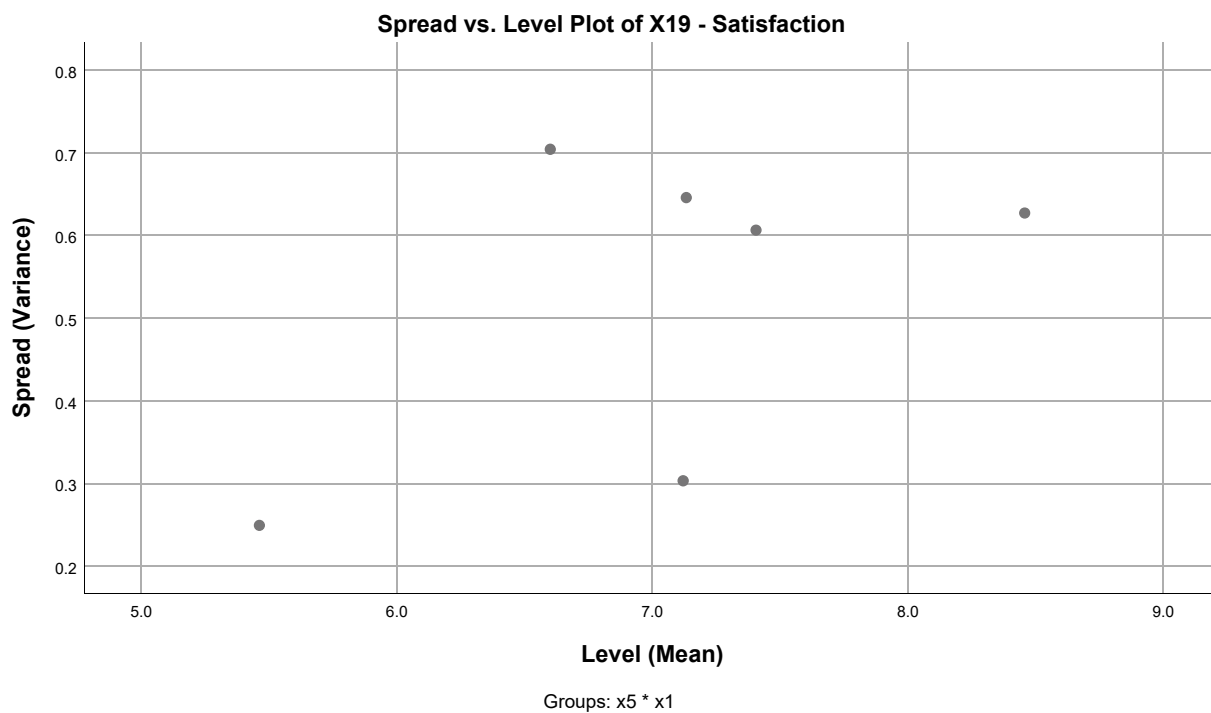
## EXAMPLE 3 -- X1 X5 BY X19 X20 X21



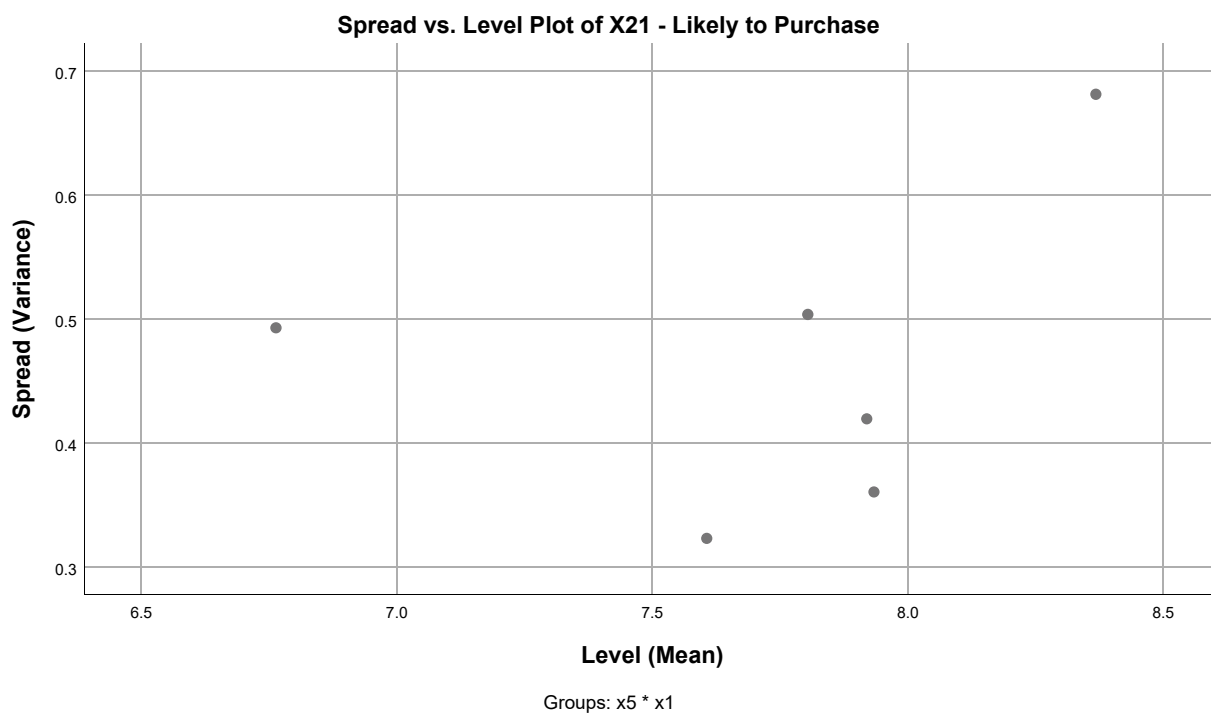
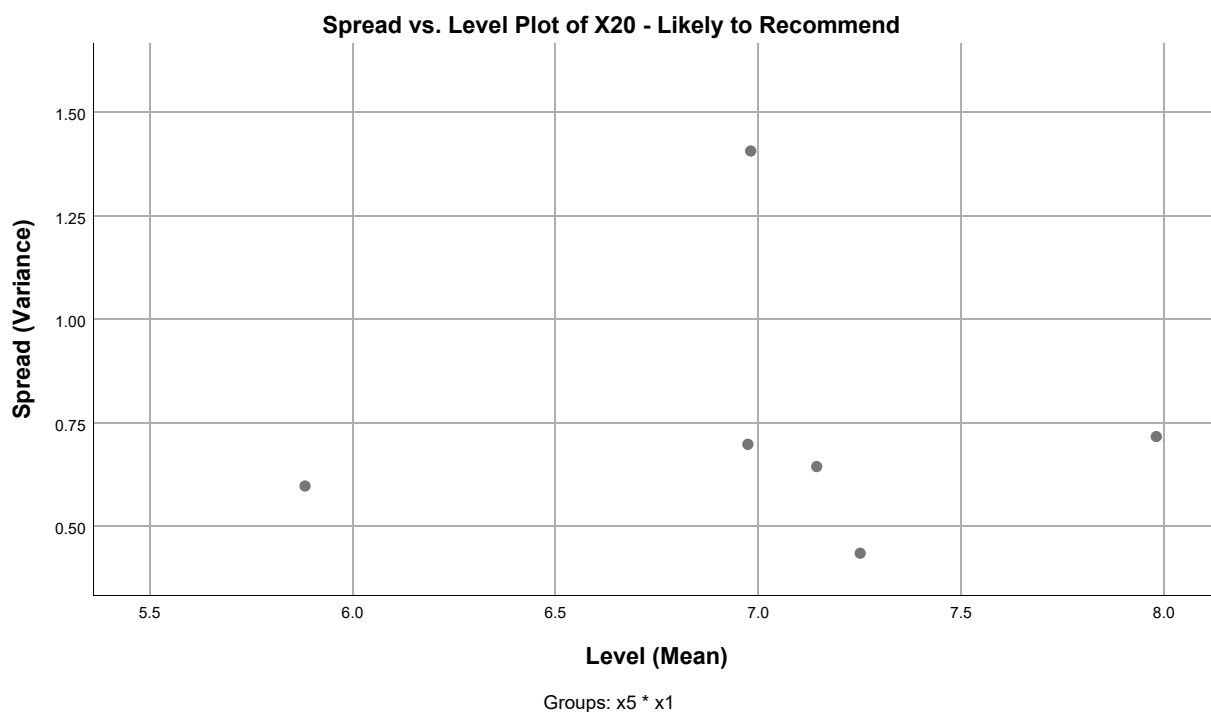
## EXAMPLE 3 -- X1 X5 BY X19 X20 X21



### Variances versus Means



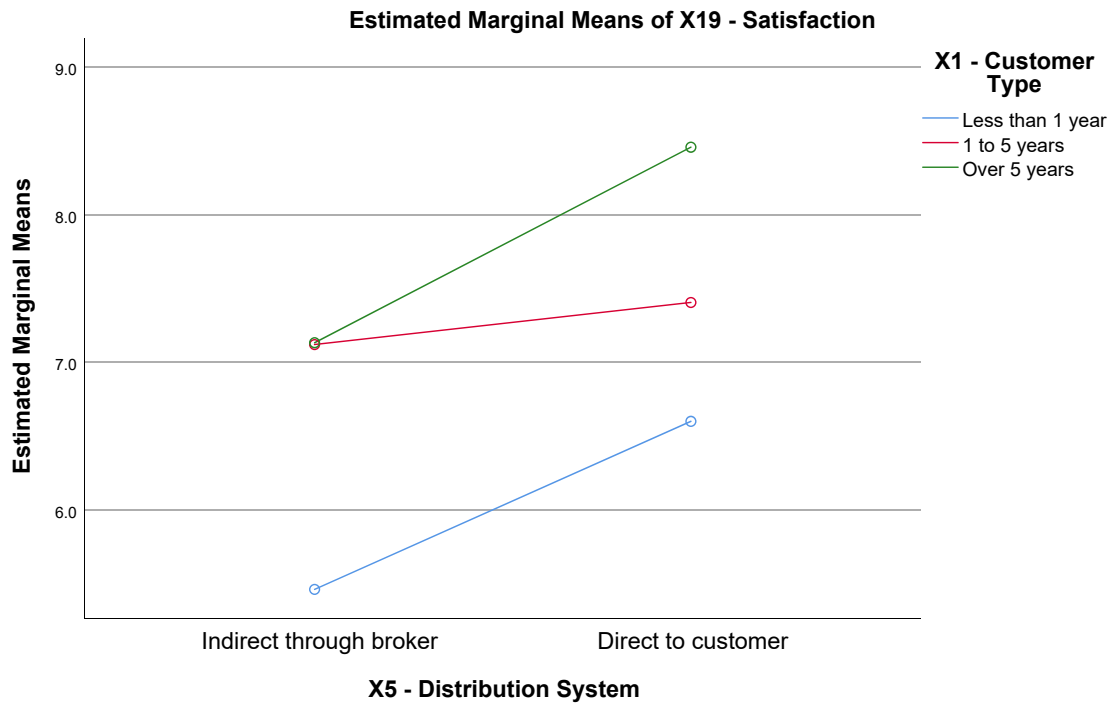
## EXAMPLE 3 -- X1 X5 BY X19 X20 X21



## Profile Plots

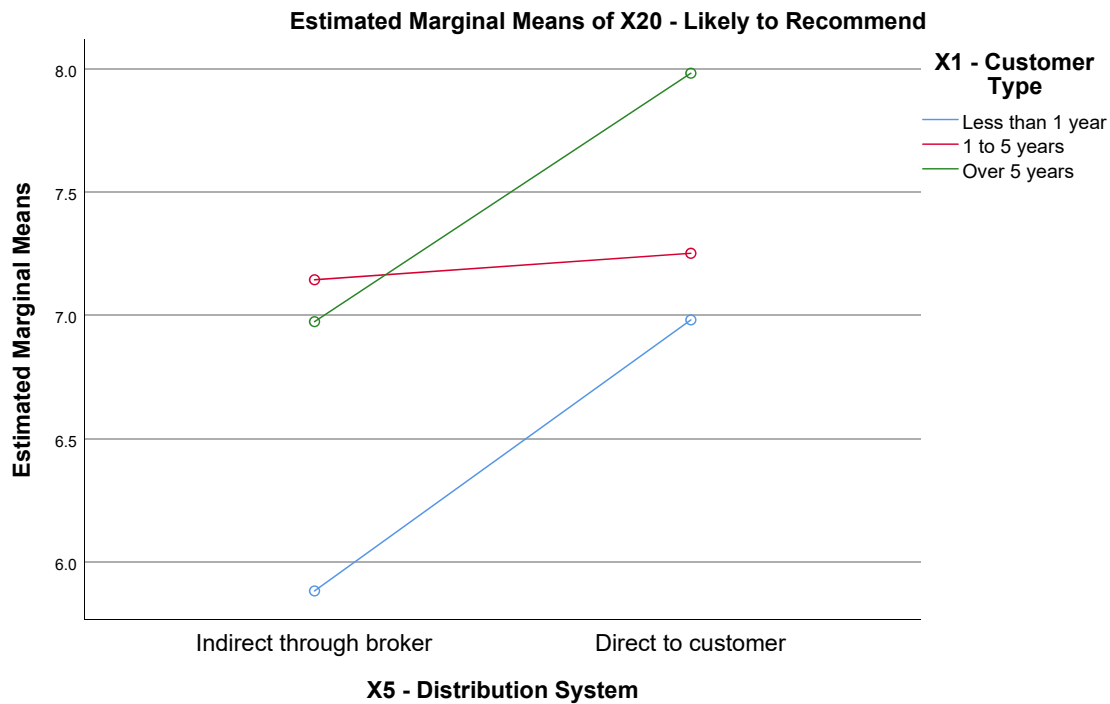
## **EXAMPLE 3 -- X1 X5 BY X19 X20 X21**

### **X19 - Satisfaction**

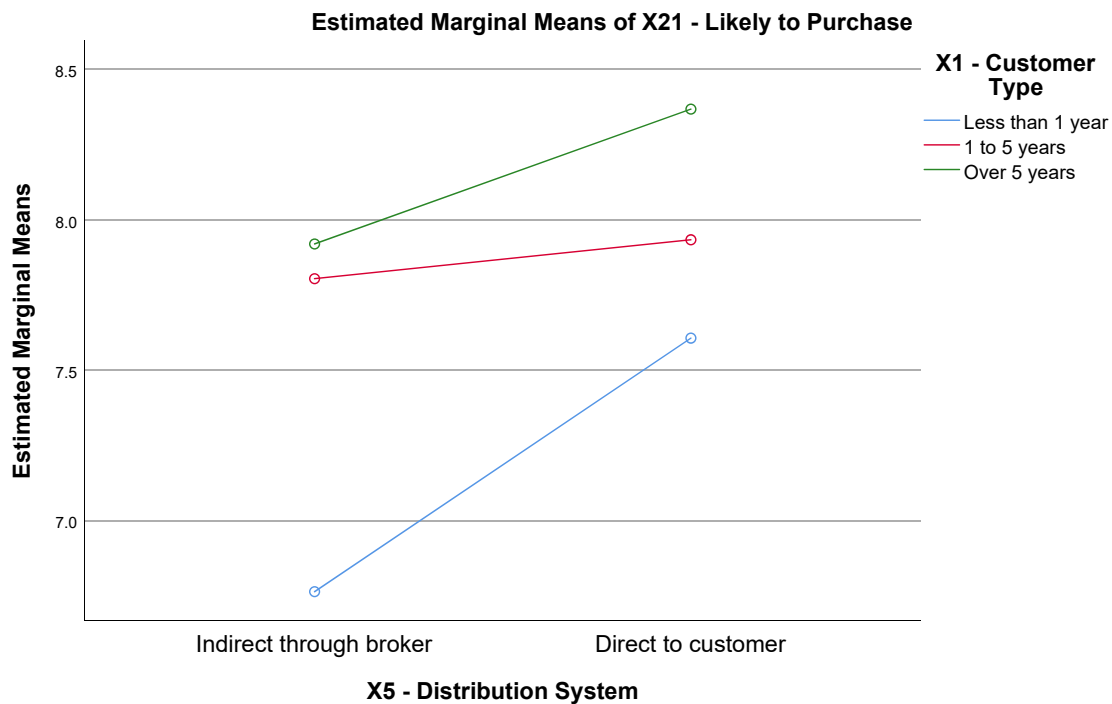


### **X20 - Likely to Recommend**

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21



### X21 - Likely to Purchase



### EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21

#### **Manova**

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The default error term in MANOVA has been changed from WITHIN CELLS to  
WITHIN+RESIDUAL. Note that these are the same for all full factorial designs.



**EXAMPLE 3 -- X1 X5 BY X19 X20 X21**  
**EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e \* \*  
\* \* \* \* \*

200 cases accepted.

0 cases rejected because of out-of-range factor values.

0 cases rejected because of missing data.

6 non-empty cells.

1 design will be processed.

- - - - -  
- - - - -

# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e -- D  
 esign   1 \* \* \* \* \*

EFFECT .. x1 BY x5

Multivariate Tests of Significance (S = 2, M = 0, N = 95 )

Test Name	Value	Approx. F	Hypoth. DF	Error D
F      Sig. of F				
Pillais	.12410	4.25589	6.00	386
.00      .000				
Hotellings	.13591	4.32650	6.00	382
.00      .000				
Wilks	.87827	4.29147	6.00	384
.00      .000				
Roys	.10058			
Note.. F statistic for WILKS' Lambda is exact.				

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 -----  
 EFFECT .. x1 BY x5 (Cont.)

Univariate F-tests with (2,194) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S      F      Sig. of F				
x19	9.48351	95.54060	4.74175	.4924
8      9.62837      .000				
x20	8.86059	130.27395	4.43030	.6715
2      6.59746      .002				
x21	3.45399	92.89569	1.72699	.4788
4      3.60659      .029				

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x19	4.74175	.49248	9.62837	
2	194	.000		
x20	.74643	.49589	1.50525	
2	193	.225		
x21	.68053	.35655	1.90868	
2	192	.151		

-----  
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EFFECT .. x1 BY x5 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1	2
x19	1.11601	.98633
x20	.49326	-.32882
x21	-.15381	-1.49915

-----  
-----

Standardized discriminant function coefficients

Function No.

Variable	1	2
x19	.78318	.69218
x20	.40421	-.26946
x21	-.10643	-1.03739

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### EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21

Estimates of effects for canonical variables

Canonical Variable

Parameter	1	2
5	-.18474	.22650
6	.48103	-.05043

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Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1	2
x19	.94163	.06835
x20	.76277	-.35028
x21	.43016	-.82737

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# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21**

\* \* \* \* \* A n a l y s i s o f V a r i a n c e -- D  
 esign 1 \* \* \* \* \*

EFFECT .. x5

Multivariate Tests of Significance (S = 1, M = 1/2, N = 95 )

Test Name	Value	Exact F	Hypoth. DF	Error D
F Sig. of F				
Pillais	.28491	25.49954	3.00	192
.00 .000				
Hotellings	.39843	25.49954	3.00	192
.00 .000				
Wilks	.71509	25.49954	3.00	192
.00 .000				
Roys	.28491			
Note.. F statistics are exact.				

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 -----  
 EFFECT .. x5 (Cont.)

Univariate F-tests with (1,194) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S F Sig. of F				
x19	36.54362	95.54060	36.54362	.4924
8 74.20365	.000			
x20	23.69223	130.27395	23.69223	.6715
2 35.28175	.000			
x21	9.76183	92.89569	9.76183	.4788
4 20.38626	.000			

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x19	36.54362	.49248	74.20365	
1	194	.000		
x20	1.09656	.49589	2.21133	
1	193	.139		
x21	.00476	.35655	.01335	
1	192	.908		

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EFFECT .. x5 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1
x19	-1.21659
x20	-.27842
x21	-.02630

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Standardized discriminant function coefficients

Function No.

Variable	1
x19	-.85376
x20	-.22815
x21	-.01820

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# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21**

Estimates of effects for canonical variables

Canonical Variable

Parameter	1
4	.66612

- - - - -  
- - - - -

Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
x19	-.97980
x20	-.67561
x21	-.51356

- - - - -  
- - - - -

# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e -- D  
 esign   1 \* \* \* \* \*

EFFECT .. x1

Multivariate Tests of Significance (S = 2, M = 0, N = 95 )

Test Name	Value	Approx. F	Hypoth. DF	Error D
F      Sig. of F				
Pillais	.48811	20.76961	6.00	386
.00      .000				
Hotellings	.95201	30.30562	6.00	382
.00      .000				
Wilks	.51216	25.42894	6.00	384
.00      .000				
Roys	.48757			
Note.. F statistic for WILKS' Lambda is exact.				

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 -----  
 EFFECT .. x1 (Cont.)

Univariate F-tests with (2,194) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S      F      Sig. of F				
x19	89.99548	95.54060	44.99774	.4924
8      91.37017		.000		
x20	32.03454	130.27395	16.01727	.6715
2      23.85243		.000		
x21	26.72342	92.89569	13.36171	.4788
4      27.90411		.000		



# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21**

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x19	44.99774	.49248	91.37017	
2	194	.000		
x20	.02520	.49589	.05082	
2	193	.950		
x21	.16806	.35655	.47136	
2	192	.625		

-----  
-----

EFFECT .. x1 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1
x19	1.36591
x20	-.04247
x21	.16805

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-----

Standardized discriminant function coefficients

Function No.

Variable	1
x19	.95855
x20	-.03480
x21	.11629

-----  
-----

# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X19, X20, X21**

Estimates of effects for canonical variables

Canonical Variable

Parameter	1
2	-1.43023
3	.33468

- - - - -  
- - - - -

Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
x19	.99499
x20	.50799
x21	.54978

- - - - -  
- - - - -

### EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19

#### **Manova**

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The default error term in MANOVA has been changed from WITHIN CELLS to  
WITHIN+RESIDUAL. Note that these are the same for all full factorial designs.

**EXAMPLE 3 -- X1 X5 BY X19 X20 X21**  
**EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19**

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e \* \*  
\* \* \* \* \*

200 cases accepted.

0 cases rejected because of out-of-range factor values.

0 cases rejected because of missing data.

6 non-empty cells.

1 design will be processed.

- - - - -  
- - - - -

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19

\* \* \* \* \* A n a l y s i s   o f   V a r i a n c e -- D  
esign   1 \* \* \* \* \*

EFFECT .. x1 BY x5

Multivariate Tests of Significance (S = 2, M = 0, N = 95 )

Test Name	Value	Approx. F	Hypoth. DF	Error D
F      Sig. of F				
Pillais	.12410	4.25589	6.00	386
.00      .000				
Hotellings	.13591	4.32650	6.00	382
.00      .000				
Wilks	.87827	4.29147	6.00	384
.00      .000				
Roys	.10058			
Note.. F statistic for WILKS' Lambda is exact.				

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-----  
EFFECT .. x1 BY x5 (Cont.)

Univariate F-tests with (2,194) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S      F      Sig. of F				
x21	3.45399	92.89569	1.72699	.4788
4      3.60659      .029				
x20	8.86059	130.27395	4.43030	.6715
2      6.59746      .002				
x19	9.48351	95.54060	4.74175	.4924
8      9.62837      .000				

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x21	1.72699	.47884	3.60659	
2	194	.029		
x20	2.41294	.55501	4.34756	
2	193	.014		
x19	1.58716	.32763	4.84433	
2	192	.009		

-----  
-----

EFFECT .. x1 BY x5 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1	2
x21	.15381	1.49915
x20	-.49326	.32882
x19	-1.11601	-.98633

-----  
-----

Standardized discriminant function coefficients

Function No.

Variable	1	2
x21	.10643	1.03739
x20	-.40421	.26946
x19	-.78318	-.69218

-----  
-----

# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19**

Estimates of effects for canonical variables

Canonical Variable

Parameter	1	2
5	.18474	-.22650
6	-.48103	.05043

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-----

Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1	2
x21	-.43016	.82737
x20	-.76277	.35028
x19	-.94163	-.06835

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-----

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19

\* \* \* \* \* A n a l y s i s o f V a r i a n c e -- D  
esign 1 \* \* \* \* \*

EFFECT .. x5

Multivariate Tests of Significance (S = 1, M = 1/2, N = 95 )

Test Name	Value	Exact F	Hypoth. DF	Error D
F Sig. of F				
Pillais	.28491	25.49954	3.00	192
.00 .000				
Hotellings	.39843	25.49954	3.00	192
.00 .000				
Wilks	.71509	25.49954	3.00	192
.00 .000				
Roys	.28491			
Note.. F statistics are exact.				

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-----  
EFFECT .. x5 (Cont.)

Univariate F-tests with (1,194) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S F Sig. of F				
x21	9.76183	92.89569	9.76183	.4788
4 20.38626	.000			
x20	23.69223	130.27395	23.69223	.6715
2 35.28175	.000			
x19	36.54362	95.54060	36.54362	.4924
8 74.20365	.000			



## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x21		9.76183	.47884	20.38626
1	194	.000		
x20		9.89947	.55501	17.83652
1	193	.000		
x19		9.96400	.32763	30.41205
1	192	.000		

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-----

EFFECT .. x5 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1
x21	-.02630
x20	-.27842
x19	-1.21659

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-----

Standardized discriminant function coefficients

Function No.

Variable	1
x21	-.01820
x20	-.22815
x19	-.85376

-----  
-----

# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19**

Estimates of effects for canonical variables

Canonical Variable

Parameter	1
4	.66612

- - - - -  
- - - - -

Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
x21	-.51356
x20	-.67561
x19	-.97980

- - - - -  
- - - - -

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19

\* \* \* \* \* A n a l y s i s o f V a r i a n c e -- D  
esign 1 \* \* \* \* \*

EFFECT .. x1

Multivariate Tests of Significance (S = 2, M = 0, N = 95 )

Test Name	Value	Approx. F	Hypoth. DF	Error D
F Sig. of F				
Pillais	.48811	20.76961	6.00	386
.00 .000				
Hotellings	.95201	30.30562	6.00	382
.00 .000				
Wilks	.51216	25.42894	6.00	384
.00 .000				
Roys	.48757			
Note.. F statistic for WILKS' Lambda is exact.				

-----  
-----  
EFFECT .. x1 (Cont.)

Univariate F-tests with (2,194) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error M
S F Sig. of F				
x21	26.72342	92.89569	13.36171	.4788
4 27.90411		.000		
x20	32.03454	130.27395	16.01727	.6715
2 23.85243		.000		
x19	89.99548	95.54060	44.99774	.4924
8 91.37017		.000		

## EXAMPLE 3 -- X1 X5 BY X19 X20 X21

### EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19

Roy-Bargman Stepdown F - tests

Variable	Hypoth. MS	Error MS	StepDown F	Hypoth. D
F	Error DF	Sig. of F		
x21	13.36171	.47884	27.90411	
2	194	.000		
x20	3.68533	.55501	6.64011	
2	193	.002		
x19	13.16932	.32763	40.19533	
2	192	.000		

-----  
-----

EFFECT .. x1 (Cont.)

Raw discriminant function coefficients

Function No.

Variable	1
x21	.16805
x20	-.04247
x19	1.36591

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-----

Standardized discriminant function coefficients

Function No.

Variable	1
x21	.11629
x20	-.03480
x19	.95855

-----  
-----

# **EXAMPLE 3 -- X1 X5 BY X19 X20 X21** **EXAMPLE 3 -- STEPDOWN TESTS -- X21, X20, X19**

Estimates of effects for canonical variables

Canonical Variable

Parameter	1
2	-1.43023
3	.33468

-----  
 -----

Correlations between DEPENDENT and canonical variables

Canonical Variable

Variable	1
x21	.54978
x20	.50799
x19	.99499

-----  
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## MODERATION -- X19 BY X5, MODERATED BY X3

### Matrix

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Release 2.16.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D.

[www.afhayes.com](http://www.afhayes.com)

\*\*\*\*\*

Model = 1

Y = x19

X = x5

M = x3

Sample size

200

\*\*\*\*\*

Outcome: x19

Model Summary

R	R-sq	MSE	F	df1	df2	p
.6574	.4322	.8881	59.8045	3.0000	196.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	6.2111	.1679	36.9835	.0000	5.8799	6.5423
x3	.1952	.2084	.9368	.3500	-.2158	.6062
x5	.9172	.2066	4.4395	.0000	.5098	1.3246
int_1	1.1252	.2702	4.1647	.0000	.5924	1.6580

Product terms key:

int\_1      x5                      X                      x3

R-square increase due to interaction(s):

	R2-chng	F	df1	df2	p
int_1	.0500	17.3447	1.0000	196.0000	.0000

## MODERATION -- X19 BY X5, MODERATED BY X3

\*\*\*\*\*

Conditional effect of X on Y at values of the moderator(s):

x3	Effect	se	t	p	LLCI	ULCI
.0000	.9172	.2066	4.4395	.0000	.5098	1.3246
1.0000	2.0424	.1741	11.7312	.0000	1.6990	2.3857

\*\*\*\*\* ANALYSIS NOTES AND WARNINGS \*\*\*\*\*

Level of confidence for all confidence intervals in output:

95.00

NOTE: All standard errors for continuous outcome models are based on the HC3 estimator

----- END MATRIX -----



## MODERATION -- X20 BY X5, MODERATED BY X3

### Matrix

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Release 2.16.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D.

[www.afhayes.com](http://www.afhayes.com)

\*\*\*\*\*

Model = 1

Y = x20

X = x5

M = x3

Sample size

200

\*\*\*\*\*

Outcome: x20

Model Summary

R	R-sq	MSE	F	df1	df2	p
.6025	.3630	.7584	36.0762	3.0000	196.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	6.0911	.1475	41.2877	.0000	5.8002	6.3821
x3	.6803	.1863	3.6523	.0003	.3130	1.0477
x5	.9881	.1832	5.3935	.0000	.6268	1.3494
int_1	.3071	.2524	1.2165	.2253	-.1908	.8050

Product terms key:

int\_1      x5                      X                      x3

R-square increase due to interaction(s):

	R2-chng	F	df1	df2	p
int_1	.0049	1.4799	1.0000	196.0000	.2253

## MODERATION -- X20 BY X5, MODERATED BY X3

\*\*\*\*\*

Conditional effect of X on Y at values of the moderator(s):

x3	Effect	se	t	p	LLCI	ULCI
.0000	.9881	.1832	5.3935	.0000	.6268	1.3494
1.0000	1.2952	.1737	7.4575	.0000	.9527	1.6378

\*\*\*\*\* ANALYSIS NOTES AND WARNINGS \*\*\*\*\*

Level of confidence for all confidence intervals in output:

95.00

NOTE: All standard errors for continuous outcome models are based on the HC3 estimator

----- END MATRIX -----

## MODERATION -- X21 BY X5, MODERATED BY X3

### Matrix

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Release 2.16.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D.

[www.afhayes.com](http://www.afhayes.com)

\*\*\*\*\*

Model = 1

Y = x21

X = x5

M = x3

Sample size

200

\*\*\*\*\*

Outcome: x21

Model Summary

R	R-sq	MSE	F	df1	df2	p
.5410	.2927	.5730	27.6736	3.0000	196.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	7.1422	.1499	47.6313	.0000	6.8465	7.4379
x3	.3324	.1788	1.8590	.0645	-.0202	.6850
x5	.5276	.1679	3.1418	.0019	.1964	.8588
int_1	.5670	.2222	2.5522	.0115	.1289	1.0052

Product terms key:

int\_1      x5                      X                      x3

R-square increase due to interaction(s):

	R2-chng	F	df1	df2	p
int_1	.0245	6.5138	1.0000	196.0000	.0115

## MODERATION -- X21 BY X5, MODERATED BY X3

\*\*\*\*\*

Conditional effect of X on Y at values of the moderator(s):

x3	Effect	se	t	p	LLCI	ULCI
.0000	.5276	.1679	3.1418	.0019	.1964	.8588
1.0000	1.0946	.1455	7.5245	.0000	.8077	1.3815

\*\*\*\*\* ANALYSIS NOTES AND WARNINGS \*\*\*\*\*

Level of confidence for all confidence intervals in output:

95.00

NOTE: All standard errors for continuous outcome models are based on the HC3 estimator

----- END MATRIX -----

## MEDIATION -- X19 BY X5, MEDIATED BY X22

### Matrix

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Release 2.16.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D.

[www.afhayes.com](http://www.afhayes.com)

\*\*\*\*\*

Model = 4

Y = x19

X = x5

M = x22

Sample size

200

\*\*\*\*\*

Outcome: x22

Model Summary

R	R-sq	MSE	F	df1	df2	p
.2746	.0754	74.7058	15.7278	1.0000	198.0000	.0001

Model

	coeff	se	t	p	LLCI	ULCI
constant	55.9333	.7960	70.2645	.0000	54.3635	57.5031
x5	4.9275	1.2425	3.9658	.0001	2.4773	7.3778

\*\*\*\*\*

Outcome: x19

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7992	.6387	.5622	218.8394	2.0000	197.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	1.6463	.2948	5.5838	.0000	1.0649	2.2278

## MEDIATION -- X19 BY X5, MEDIATED BY X22

x22	.0836	.0055	15.1855	.0000	.0728	.0945
x5	.9509	.1124	8.4595	.0000	.7292	1.1725

\*\*\*\*\* TOTAL EFFECT MODEL \*\*\*\*\*

Outcome: x19

### Model Summary

R	R-sq	MSE	F	df1	df2	p
.5487	.3011	1.0820	84.2305	1.0000	198.0000	.0000

### Model

	coeff	se	t	p	LLCI	ULCI
constant	6.3250	.0998	63.3462	.0000	6.1281	6.5219
x5	1.3630	.1485	9.1777	.0000	1.0702	1.6559

\*\*\*\*\* TOTAL, DIRECT, AND INDIRECT EFFECTS \*\*\*\*\*

### Total effect of X on Y

Effect	SE	t	p	LLCI	ULCI
1.3630	.1485	9.1777	.0000	1.0702	1.6559

### Direct effect of X on Y

Effect	SE	t	p	LLCI	ULCI
.9509	.1124	8.4595	.0000	.7292	1.1725

### Indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.4122	.1086	.2092	.6339

### Partially standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.3321	.0804	.1747	.4889

### Completely standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.1659	.0401	.0877	.2447

### Ratio of indirect to total effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
--	--------	---------	----------	----------

## MEDIATION -- X19 BY X5, MEDIATED BY X22

x22	.3024	.0644	.1750	.4291
-----	-------	-------	-------	-------

Ratio of indirect to direct effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.4335	.1361	.2121	.7517

R-squared mediation effect size (R-sq\_med)

	Effect	Boot SE	BootLLCI	BootULCI
x22	.1656	.0454	.0808	.2569

Normal theory tests for indirect effect

Effect	se	Z	p
.4122	.1076	3.8294	.0001

\*\*\*\*\* ANALYSIS NOTES AND WARNINGS \*\*\*\*\*

Number of bootstrap samples for bias corrected bootstrap confidence intervals:  
5000

Level of confidence for all confidence intervals in output:  
95.00

NOTE: All standard errors for continuous outcome models are based on the HC3 estimator

NOTE: Kappa-squared is disabled from output as of version 2.16.

----- END MATRIX -----

## MEDIATION -- X20 BY X5, MEDIATED BY X22

### Matrix

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Release 2.16.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D.

[www.afhayes.com](http://www.afhayes.com)

\*\*\*\*\*

Model = 4

Y = x20

X = x5

M = x22

Sample size

200

\*\*\*\*\*

Outcome: x22

Model Summary

R	R-sq	MSE	F	df1	df2	p
.2746	.0754	74.7058	15.7278	1.0000	198.0000	.0001

Model

	coeff	se	t	p	LLCI	ULCI
constant	55.9333	.7960	70.2645	.0000	54.3635	57.5031
x5	4.9275	1.2425	3.9658	.0001	2.4773	7.3778

\*\*\*\*\*

Outcome: x20

Model Summary

R	R-sq	MSE	F	df1	df2	p
.6370	.4058	.7039	64.7239	2.0000	197.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	3.4362	.4077	8.4275	.0000	2.6321	4.2403



## MEDIATION -- X20 BY X5, MEDIATED BY X22

x22	.0546	.0071	7.6345	.0000	.0405	.0687
x5	.7410	.1246	5.9468	.0000	.4953	.9868

\*\*\*\*\* TOTAL EFFECT MODEL \*\*\*\*\*

Outcome: x20

### Model Summary

R	R-sq	MSE	F	df1	df2	p
.4660	.2171	.9227	54.8679	1.0000	198.0000	.0000

### Model

	coeff	se	t	p	LLCI	ULCI
constant	6.4880	.0953	68.0749	.0000	6.3000	6.6759
x5	1.0099	.1363	7.4073	.0000	.7410	1.2787

\*\*\*\*\* TOTAL, DIRECT, AND INDIRECT EFFECTS \*\*\*\*\*

### Total effect of X on Y

Effect	SE	t	p	LLCI	ULCI
1.0099	.1363	7.4073	.0000	.7410	1.2787

### Direct effect of X on Y

Effect	SE	t	p	LLCI	ULCI
.7410	.1246	5.9468	.0000	.4953	.9868

### Indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.2688	.0755	.1389	.4403

### Partially standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.2483	.0653	.1309	.3906

### Completely standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.1240	.0326	.0658	.1945

### Ratio of indirect to total effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
--	--------	---------	----------	----------

## MEDIATION -- X20 BY X5, MEDIATED BY X22

x22	.2662	.0683	.1503	.4232
-----	-------	-------	-------	-------

Ratio of indirect to direct effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.3628	.1366	.1769	.7338

R-squared mediation effect size (R-sq\_med)

	Effect	Boot SE	BootLLCI	BootULCI
x22	.1090	.0330	.0520	.1816

Normal theory tests for indirect effect

Effect	se	Z	p
.2688	.0769	3.4958	.0005

\*\*\*\*\* ANALYSIS NOTES AND WARNINGS \*\*\*\*\*

Number of bootstrap samples for bias corrected bootstrap confidence intervals:  
5000

Level of confidence for all confidence intervals in output:  
95.00

NOTE: All standard errors for continuous outcome models are based on the HC3 estimator

NOTE: Kappa-squared is disabled from output as of version 2.16.

----- END MATRIX -----

## MEDIATION-- X21 BY X5, MEDIATEDBY X22

### Matrix

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Release 2.16.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D.

[www.afhayes.com](http://www.afhayes.com)

\*\*\*\*\*

Model = 4

Y = x21

X = x5

M = x22

Sample size

200

\*\*\*\*\*

Outcome: x22

Model Summary

R	R-sq	MSE	F	df1	df2	p
.2746	.0754	74.7058	15.7278	1.0000	198.0000	.0001

Model

	coeff	se	t	p	LLCI	ULCI
constant	55.9333	.7960	70.2645	.0000	54.3635	57.5031
x5	4.9275	1.2425	3.9658	.0001	2.4773	7.3778

\*\*\*\*\*

Outcome: x21

Model Summary

R	R-sq	MSE	F	df1	df2	p
.5803	.3368	.5345	45.3891	2.0000	197.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	4.8991	.3249	15.0804	.0000	4.2584	5.5398
x22	.0436	.0057	7.6784	.0000	.0324	.0548

# MEDIATION-- X21 BY X5, MEDIATEDBY X22

x5	.5003	.1018	4.9163	.0000	.2996	.7010
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\*\*\*\*\* TOTAL EFFECT MODEL \*\*\*\*\*

Outcome: x21

## Model Summary

R	R-sq	MSE	F	df1	df2	p
.3999	.1599	.6736	38.3289	1.0000	198.0000	.0000

## Model

	coeff	se	t	p	LLCI	ULCI
constant	7.3361	.0851	86.2186	.0000	7.1683	7.5039
x5	.7150	.1155	6.1910	.0000	.4872	.9427

\*\*\*\*\* TOTAL, DIRECT, AND INDIRECT EFFECTS \*\*\*\*\*

## Total effect of X on Y

Effect	SE	t	p	LLCI	ULCI
.7150	.1155	6.1910	.0000	.4872	.9427

## Direct effect of X on Y

Effect	SE	t	p	LLCI	ULCI
.5003	.1018	4.9163	.0000	.2996	.7010

## Indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.2147	.0595	.1098	.3441

## Partially standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.2404	.0619	.1257	.3679

## Completely standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.1201	.0308	.0630	.1844

## Ratio of indirect to total effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.3003	.0771	.1666	.4783

# MEDIATION-- X21 BY X5, MEDIATEDBY X22

Ratio of indirect to direct effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.4291	.1774	.1999	.9170

R-squared mediation effect size (R-sq\_med)

	Effect	Boot SE	BootLLCI	BootULCI
x22	.0875	.0275	.0396	.1492

Normal theory tests for indirect effect

Effect	se	Z	p
.2147	.0613	3.5002	.0005

\*\*\*\*\* ANALYSIS NOTES AND WARNINGS \*\*\*\*\*

Number of bootstrap samples for bias corrected bootstrap confidence intervals:  
5000

Level of confidence for all confidence intervals in output:  
95.00

NOTE: All standard errors for continuous outcome models are based on the HC3 estimator

NOTE: Kappa-squared is disabled from output as of version 2.16.

----- END MATRIX -----

# MEDIATION -- PRINCIPAL COMPONENT BY X5, MEDIATED BY X22

## Matrix

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Release 2.16.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D. [www.afhayes.com](http://www.afhayes.com)

\*\*\*\*\*

Model = 4

Y = FAC1\_1

X = x5

M = x22

Sample size

200

\*\*\*\*\*

Outcome: x22

Model Summary

R	R-sq	MSE	F	df1	df2	p
.2746	.0754	74.7058	15.7278	1.0000	198.0000	.0001

Model

	coeff	se	t	p	LLCI	ULCI
constant	55.9333	.7960	70.2645	.0000	54.3635	57.5031
x5	4.9275	1.2425	3.9658	.0001	2.4773	7.3778

\*\*\*\*\*

Outcome: FAC1\_1

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7479	.5594	.4451	127.0151	2.0000	197.0000	.0000

## MEDIATION -- PRINCIPAL COMPONENT BY X5, MEDIATED BY X22

Model

	coeff	se	t	p	LLCI	ULCI
constant	-3.9404	.2862	-13.7663	.0000	-4.5049	-3.3759
x22	.0618	.0051	12.0889	.0000	.0517	.0719
x5	.7458	.0958	7.7847	.0000	.5569	.9347

\*\*\*\*\* TOTAL EFFECT MODEL \*\*\*\*\*

Outcome: FAC1\_1

Model Summary

R	R-sq	MSE	F	df1	df2	p
.5248	.2754	.7282	75.7803	1.0000	198.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-.4832	.0864	-5.5944	.0000	-.6535	-.3129
x5	1.0504	.1207	8.7052	.0000	.8124	1.2883

\*\*\*\*\* TOTAL, DIRECT, AND INDIRECT EFFECTS \*\*\*\*\*

Total effect of X on Y

Effect	SE	t	p	LLCI	ULCI
1.0504	.1207	8.7052	.0000	.8124	1.2883

Direct effect of X on Y

Effect	SE	t	p	LLCI	ULCI
.7458	.0958	7.7847	.0000	.5569	.9347

Indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.3046	.0796	.1561	.4721

Partially standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.3046	.0732	.1586	.4490

Completely standardized indirect effect of X on Y

## **MEDIATION -- PRINCIPAL COMPONENT BY X5, MEDIATED BY X22**

	Effect	Boot SE	BootLLCI	BootULCI
x22	.1522	.0365	.0793	.2242

Ratio of indirect to total effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.2900	.0629	.1658	.4162

Ratio of indirect to direct effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
x22	.4084	.1293	.1988	.7130

R-squared mediation effect size (R-sq\_med)

	Effect	Boot SE	BootLLCI	BootULCI
x22	.1470	.0401	.0723	.2336

Normal theory tests for indirect effect

Effect	se	Z	p
.3046	.0811	3.7567	.0002

\*\*\*\*\* ANALYSIS NOTES AND WARNINGS \*\*\*\*\*

Number of bootstrap samples for bias corrected bootstrap confidence intervals:  
5000

Level of confidence for all confidence intervals in output:  
95.00

NOTE: All standard errors for continuous outcome models are based on the HC3 estimator

NOTE: Kappa-squared is disabled from output as of version 2.16.

----- END MATRIX -----