University of Groningen - Faculty of Economics and Business

Statistics II for IB (EBB682B05) Final Exam. Jan. 30th 2014, 14:00 – 17:00

Student Name:_____ Student Number: _____

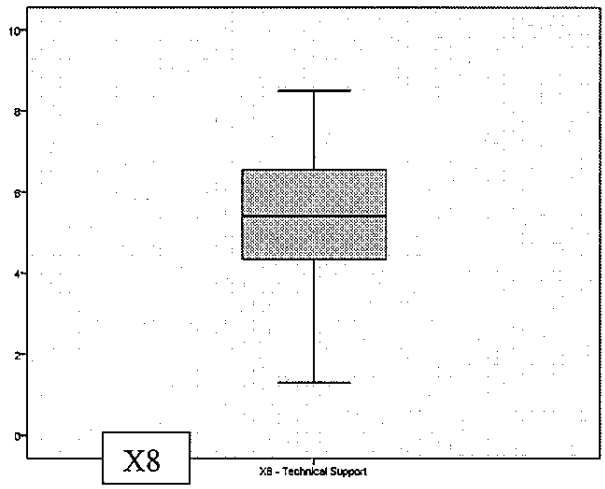
Appendix on PART 2 - Problem on Multivariate Regression Analysis

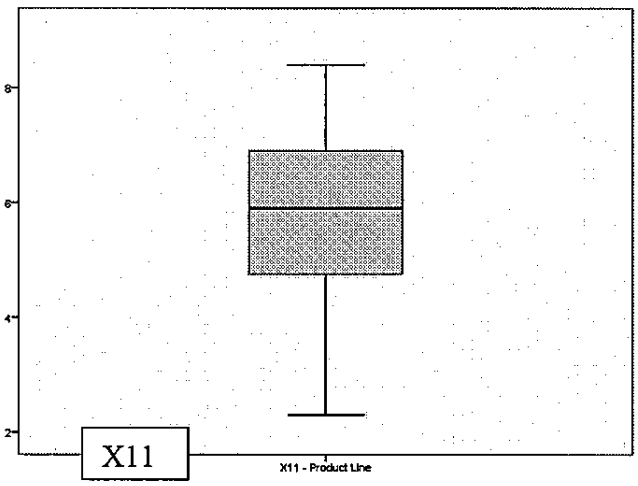
Descriptive Statistics

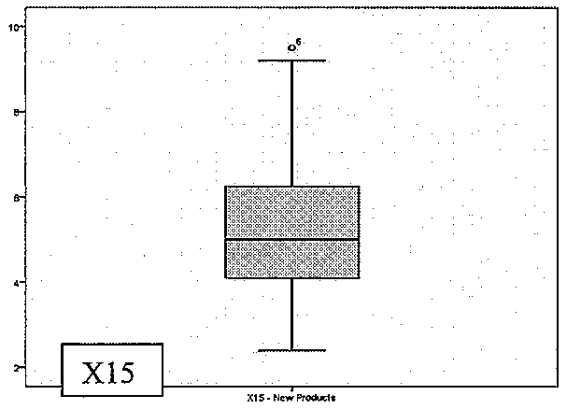
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
X8 - Technical Support	92	1.3	8.5	5.333	1.5052	-.241	.251	-.410	.498
X11 - Product Line	92	2.3	8.4	5.871	1.3187	-.113	.251	-.607	.498
X15 - New Products	92	2.4	9.5	5.173	1.4767	.411	.251	.015	.498
X19 – Satisfaction	92	4.7	9.9	6.892	1.2026	.158	.251	-.776	.498
Valid N (listwise)	92								

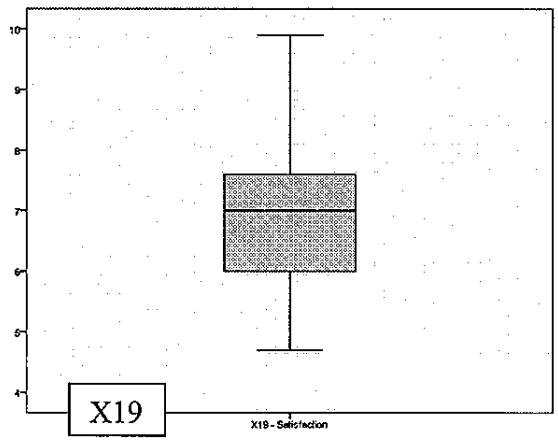
Case Processing Summary

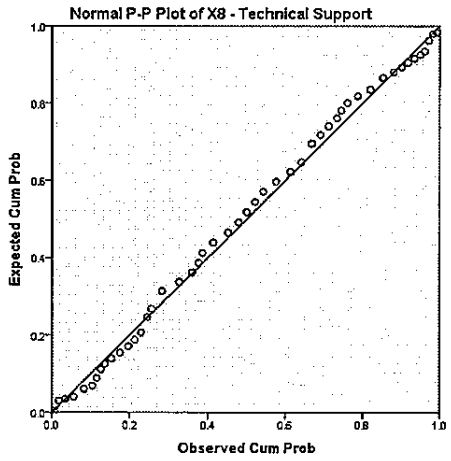
	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
X8 - Technical Support	92	100.0%	0	0.0%	92	100.0%
X11 - Product Line	92	100.0%	0	0.0%	92	100.0%
X15 - New Products	92	100.0%	0	0.0%	92	100.0%
X19 - Satisfaction	92	100.0%	0	0.0%	92	100.0%

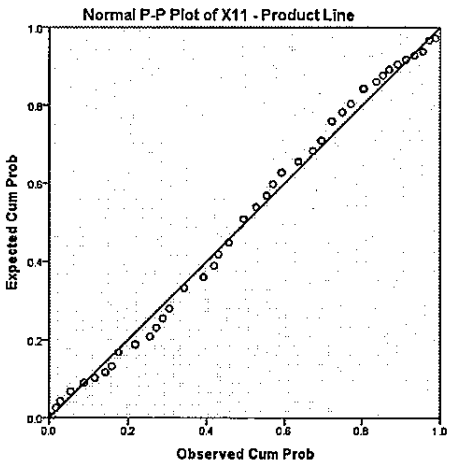


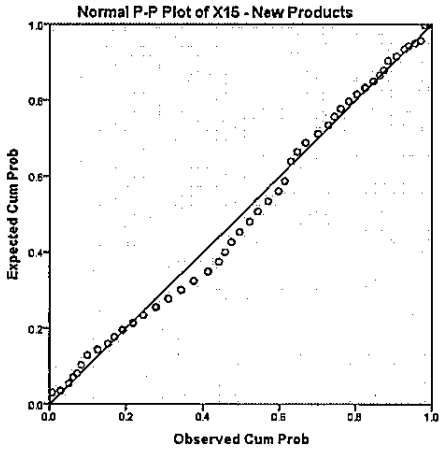


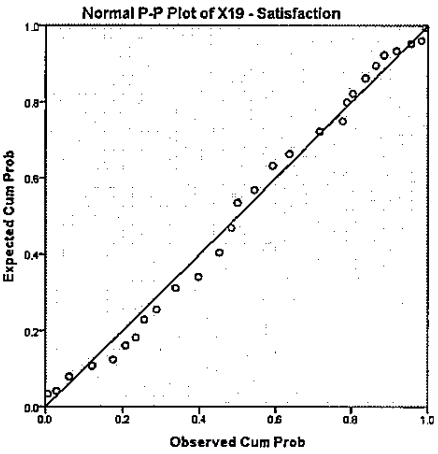


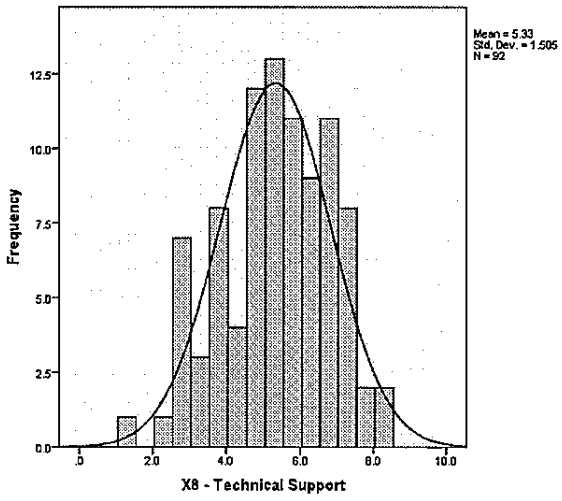


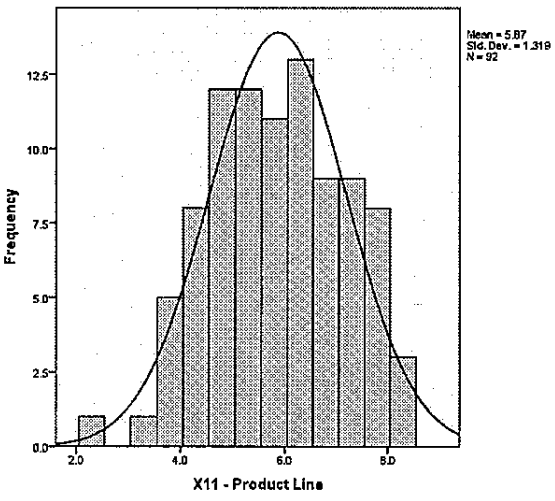

Normal P-P Plot of X8 - Technical Support
Expected Cum Prob
Observed Cum Prob

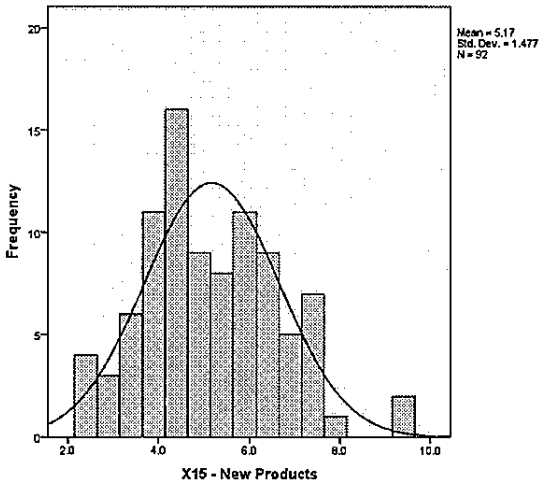

Normal P-P Plot of X11 - Product Line
Expected Cum Prob
Observed Cum Prob

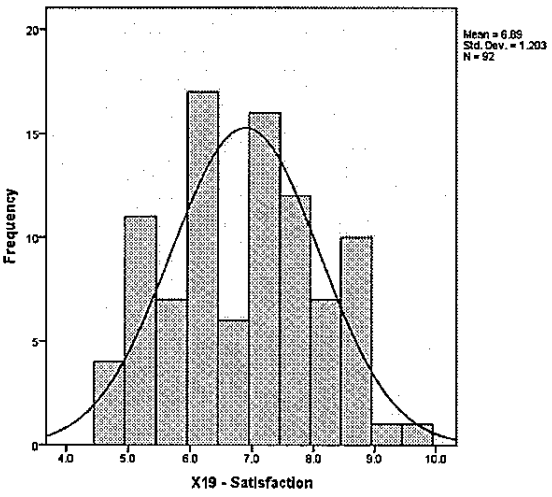

Normal P-P Plot of X15 - New Products
Expected Cum Prob
Observed Cum Prob

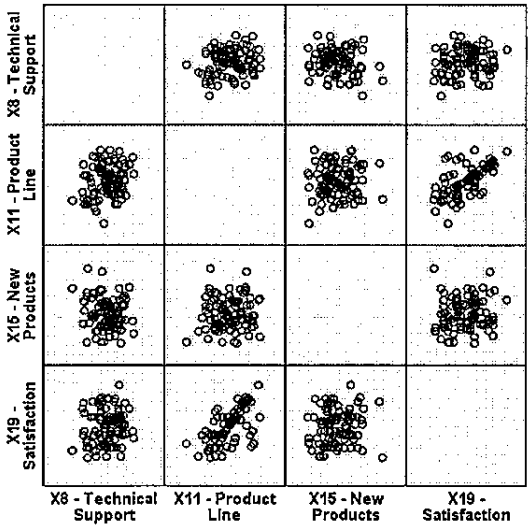

Normal P-P Plot of X19 - Satisfaction
Expected Cum Prob
Observed Cum Prob


Mean = 5.33
Std. Dev. = 1.505
N = 92
Frequency
X8 - Technical Support


Mean = 5.87
Std. Dev. = 1.319
N = 92
Frequency
X11 - Product Line


Mean = 5.17
Std. Dev. = 1.477
N = 92
Frequency
X15 - New Products


Mean = 6.89
Std. Dev. = 1.203
N = 92
Frequency
X19 - Satisfaction



Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
X8 - Technical Support	.052	92	.200*	.987	92	.503
X11 - Product Line	.063	92	.200*	.983	92	.290
X15 - New Products	.086	92	.092	.979	92	.151
X19 - Satisfaction	.083	92	.148	.973	92	.050

*. This is a lower bound of the true significance. a. Lilliefors Significance Correction

With X19 as factor)

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
X8 - Technical Support	1.564	19	64	.094
X11 - Product Line	4.541	19	64	.000
X15 - New Products	1.858	19	64	.034

With X15 as factor)

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
X8 - Technical Support	5.317	28	44	.000
X11 - Product Line	1.903	28	44	.027
X19 – Satisfaction	2.784	28	44	.001

With X11 as factor)

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
X8 - Technical Support	3.001	28	52	.000
X15 - New Products	2.594	28	52	.001
X19 – Satisfaction	3.191	28	52	.000

With X8 as factor)

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
X11 - Product Line	2.391	27	44	.005
X15 - New Products	1.627	27	44	.074
X19 - Satisfaction	5.506	27	44	.000

Tables and graphs for MODEL 1 in PART 2

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	X15 - New Products, X11 - Product Line, X8 - Technical Support[b]	.	Enter

a. Dependent Variable: X19 – Satisfaction

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.570[a]	.325	.302	1.0049	.325	14.108	3	88	.000

a. Predictors: (Constant), X15 - New Products, X11 - Product Line, X8 - Technical Support

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	42.740	3	14.247	14.108	.000[b]
	Residual	88.865	88	1.010		
	Total	131.605	91			

a. Dependent Variable: X19 – Satisfaction

b. Predictors: (Constant), X15 - New Products, X11 - Product Line, X8 - Technical Support

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.455	.688		5.020	.000		
	X8 - Technical Support	.017	.073	.021	.233	.816	.921	1.086
	X11 - Product Line	.506	.082	.555	6.162	.000	.946	1.057
	X15 - New Products	.073	.073	.089	1.001	.320	.967	1.034

a. Dependent Variable: X19 - Satisfaction

Tables and graphs for MODEL 2 in PART 2

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	X11 - Product Line	.	Forward (Criterion: Probability-of-F-to-enter <= .050)

a. Dependent Variable: X19 - Satisfaction

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.563[a]	.317	.309	.9993	.317	41.782	1	90	.000

a. Predictors: (Constant), X11 - Product Line

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3566,685	1	3566,685	83,098	,000[b]
	Residual	4206,315	98	42,922		
	Total	7773,000	99			
2	Regression	5918,657	2	2959,329	154,801	,000[c]
	Residual	1854,343	97	19,117		
	Total	7773,000	99			

a. Dependent Variable: X22 - Purchase Level

b. Predictors: (Constant), X18 - Delivery Speed

c. Predictors: (Constant), X18 - Delivery Speed, X6 - Product Quality

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	26,641	3,545		7,515	,000
	X18 - Delivery Speed	8,173	,897	,677	9,116	,000
2	(Constant)	,083	3,366		,025	,980
	X18 - Delivery Speed	7,989	,599	,662	13,346	,000
	X6 - Product Quality	3,492	,315	,550	11,092	,000

a. Dependent Variable: X22 - Purchase Level

Excluded Variables[a]

Model		Beta In	T	Sig.	Partial Correlation	Collinearity Statistics		
						Tolerance	VIF	Minimum Tolerance
1	X15 - New Products	.085[b]	.980	.330	.103	.999	1.001	.999
	X8 - Technical Support	.005[b]	.056	.956	.006	.951	1.051	.951

a. Dependent Variable: X19 - Satisfaction

b. Predictors in the Model: (Constant), X11 - Product Line

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions	
				(Constant)	X11 - Product Line
1	1	1.976	1.000	.01	.01
	2	.024	9.063	.99	.99

a. Dependent Variable: X19 - Satisfaction

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3.878	.478		8.115	.000					
	X11 - Product Line	.513	.079	.563	6.464	.000	.563	.563	.563	1.000	1.000

a. Dependent Variable: X19 - Satisfaction

APPENDIX on PART 3 - Problem on Factor Analysis

First set of tables and graphs for PART 3

Communalities

	Initial	Extraction
X6 - Product Quality	1.000	.696
X7 - E-Commerce Activities	1.000	.789
X8 - Technical Support	1.000	.494
X9 - Complaint Resolution	1.000	.885
X10 – Advertising	1.000	.534
X11 - Product Line	1.000	.840
X12 - Salesforce Image	1.000	.855
X13 - Competitive Pricing	1.000	.603
X15 - New Products	1.000	.748
X16 - Order & Billing	1.000	.744
X17 - Price Flexibility	1.000	.877
X18 - Delivery Speed	1.000	.925

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.487	29.062	29.062	3.487	29.062	29.062
2	2.931	24.427	53.489	2.931	24.427	53.489
3	1.474	12.286	65.774	1.474	12.286	65.774
4	1.098	9.150	74.924	1.098	9.150	74.924
5	.782	6.515	81.440			
6	.650	5.420	86.859			
7	.509	4.242	91.101			
8	.433	3.608	94.709			
9	.282	2.352	97.061			
10	.204	1.696	98.757			
11	.140	1.168	99.925			
12	.009	.075	100.000			

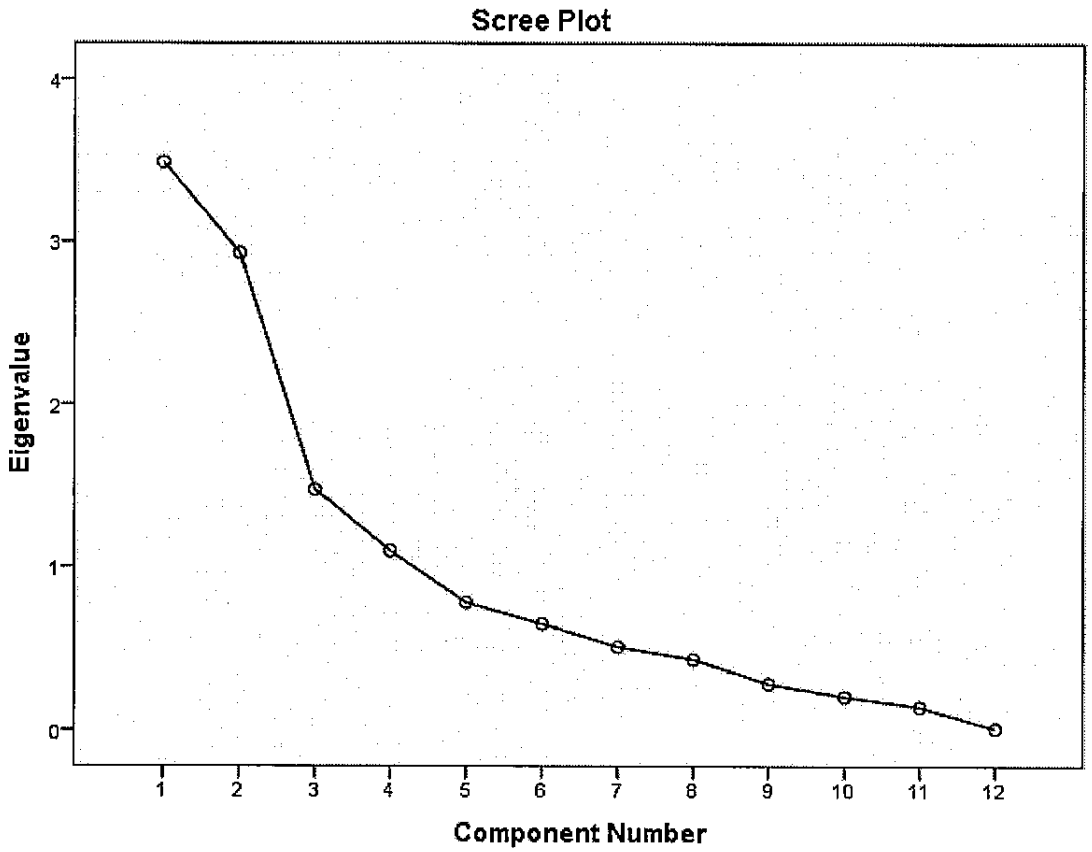
Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component			
	1	2	3	4
X6 - Product Quality	-.042	.659	.379	.340
X7 - E-Commerce Activities	.479	-.410	.626	.000
X8 - Technical Support	-.032	.366	.364	-.476
X9 - Complaint Resolution	.828	.385	-.194	-.114
X10 – Advertising	.525	-.325	.346	.183
X11 - Product Line	.357	.836	.092	.073
X12 - Salesforce Image	.599	-.412	.569	.044
X13 - Competitive Pricing	.156	-.743	-.157	-.042
X15 - New Products	.187	-.053	-.197	.819
X16 - Order & Billing	.771	.315	-.200	-.101
X17 - Price Flexibility	.617	-.569	-.396	-.124
X18 - Delivery Speed	.879	.307	-.235	-.053

Extraction Method: Principal Component Analysis.

a. 4 components extracted.



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.622
Bartlett's Test of Sphericity	Approx. Chi-Square	768.327
	df	66
	Sig.	.000

Anti-image Matrices

		X6 -	X7 - E-	X8 -	X9 -	X10 -	X11 -	X12 -	X13 -	X15 -	X16	X17 -	X18 -
Anti-image Covariance	X6 -	.591	-.010	.005	-.032	-.072	-.003	.002	.060	-.090	-.059	.016	.001
	X7 - E-	-.010	.376	.034	.023	.008	-.017	-.238	-.024	.081	-.030	-.016	.015
	X8 -	.005	.034	.877	-.008	-.004	.001	-.045	.060	.132	-.040	.009	-.002
	X9 -	-.032	.023	-.008	.204	.013	-.006	-.024	.010	.059	-.084	-.005	-.012
	X10 -	-.072	.008	-.004	.013	.642	-.020	-.147	.063	-.032	.020	-.031	.017
	X11 -	-.003	-.017	.001	-.006	-.020	.026	.027	-.012	-.015	-.001	.027	-.023
	X12 -	.002	-.238	-.045	-.024	-.147	.027	.292	-.056	-.055	.013	.027	-.024
	X13 -	.060	-.024	.060	.010	.063	-.012	-.056	.574	-.026	.047	-.028	.015
	X15 -	-.090	.081	.132	.059	-.032	-.015	-.055	-.026	.893	-.014	-.018	.007
	X16 -	-.059	-.030	-.040	-.084	.020	-.001	.013	.047	-.014	.406	-.006	-.006
	X17 -	.016	-.016	.009	-.005	-.031	.027	.027	-.028	-.018	-.006	.030	-.024
	X18 -	.001	.015	-.002	-.012	.017	-.023	-.024	.015	.007	-.006	-.024	.023
Anti-image Correlation	X6 -	.907[a]	-.020	.006	-.092	-.117	-.026	.005	.103	-.124	-.120	.122	.012
	X7 - E-	-.020	.605[a]	.059	.082	.017	-.168	-.718	-.053	.140	-.076	-.153	.159
	X8 -	.006	.059	.825[a]	-.020	-.005	.008	-.089	.085	.149	-.066	.057	-.012
	X9 -	-.092	.082	-.020	.919[a]	.036	-.076	-.098	.030	.139	-.291	-.064	-.170
	X10 -	-.117	.017	-.005	.036	.767[a]	-.152	-.340	.104	-.042	.038	-.220	.139
	X11 -	-.026	-.168	.008	-.076	-.152	.447[a]	.306	-.094	-.100	-.007	.954	-.939
	X12 -	.005	-.718	-.089	-.098	-.340	.306	.574[a]	-.138	-.107	.039	.287	-.298
	X13 -	.103	-.053	.085	.030	.104	-.094	-.138	.876[a]	-.036	.097	-.215	.132
	X15 -	-.124	.140	.149	.139	-.042	-.100	-.107	-.036	.489[a]	-.024	-.109	.047
	X16 -	-.120	-.076	-.066	-.291	.038	-.007	.039	.097	-.024	.922[a]	-.059	-.059
	X17 -	.122	-.153	.057	-.064	-.220	.954	.287	-.215	-.109	-.059	.440[a]	-.925
	X18 -	.012	.159	-.012	-.170	.139	-.939	-.298	.132	.047	-.059	-.925	.519[a]

a. Measures of Sampling Adequacy(MSA)

Notice that in this table the entire names of the variables are not reported

Second set of tables and graphs for PART 3

Communalities

	Initial	Extraction
X6 - Product Quality	1.000	.698
X7 - E-Commerce Activities	1.000	.812
X9 - Complaint Resolution	1.000	.887
X10 – Advertising	1.000	.541
X11 - Product Line	1.000	.851
X12 - Salesforce Image	1.000	.854
X13 - Competitive Pricing	1.000	.611
X15 - New Products	1.000	.952
X16 - Order & Billing	1.000	.743
X17 - Price Flexibility	1.000	.887
X18 - Delivery Speed	1.000	.925

Extraction Method: Principal Component Analysis.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.487	31.698	31.698	3.487	31.698	31.698
2	2.840	25.819	57.518	2.840	25.819	57.518
3	1.419	12.901	70.419	1.419	12.901	70.419
4	1.016	9.238	79.656	1.016	9.238	79.656
5	.653	5.941	85.597			
6	.512	4.650	90.247			
7	.433	3.936	94.183			
8	.284	2.579	96.762			
9	.207	1.881	98.644			
10	.140	1.275	99.918			
11	.009	.082	100.000			

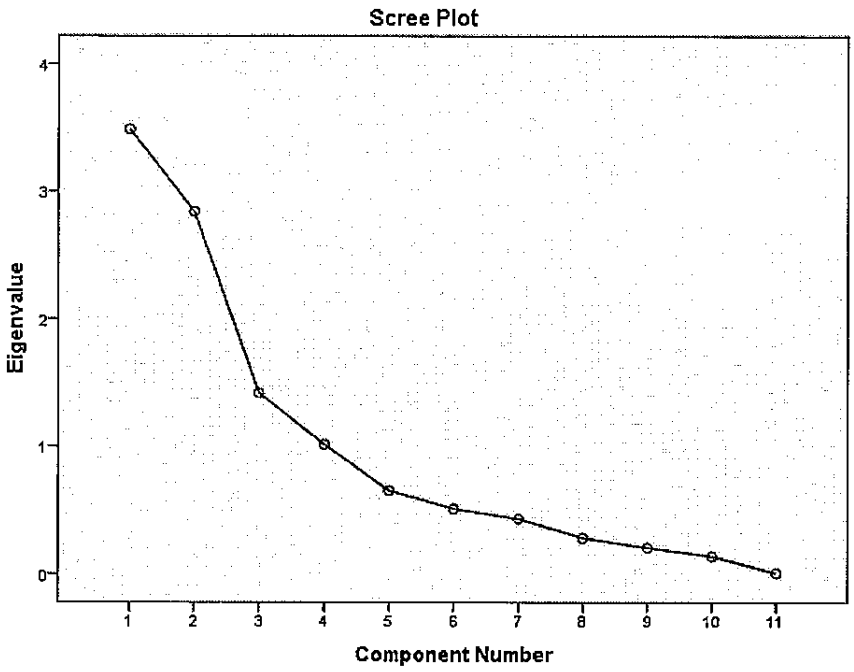
Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component			
	1	2	3	4
X6 - Product Quality	-.034	-.659	.475	.193
X7 - E-Commerce Activities	.475	.441	.612	-.136
X9 - Complaint Resolution	.833	-.381	-.192	-.110
X10 - Advertising	.522	.345	.347	.172
X11 - Product Line	.368	-.832	.150	-.018
X12 - Salesforce Image	.596	.447	.547	-.031
X13 - Competitive Pricing	.147	.740	-.202	.036
X15 - New Products	.184	.025	-.088	.954
X16 - Order & Billing	.774	-.310	-.205	-.072
X17 - Price Flexibility	.609	.563	-.446	.002
X18 - Delivery Speed	.882	-.307	-.227	-.033

Extraction Method: Principal Component Analysis.

a. 4 components extracted



KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.615
Bartlett's Test of Sphericity	Approx. Chi-Square	759.968
	df	55
	Sig.	.000

Anti-image Matrices

		X6 -	X7 - E-	X9 -	X10 -	X11 -	X12 -	X13 -	X15 -	X16 -	X17 -	X18 -
Anti-image Covariance	X6 -	.591	-.010	-.032	-.072	-.003	.002	.060	-.093	-.059	.016	.001
	X7 - E-	-.010	.377	.023	.008	-.017	-.239	-.027	.078	-.028	-.017	.015
	X9 -	-.032	.023	.205	.013	-.006	-.025	.011	.062	-.085	-.005	-.012
	X10 -	-.072	.008	.013	.642	-.020	-.148	.064	-.032	.019	-.031	.017
	X11 -	-.003	-.017	-.006	-.020	.026	.027	-.012	-.016	-.001	.027	-.023
	X12 -	.002	-.239	-.025	-.148	.027	.294	-.054	-.049	.012	.028	-.024
	X13 -	.060	-.027	.011	.064	-.012	-.054	.578	-.036	.050	-.029	.015
	X15 - New	-.093	.078	.062	-.032	-.016	-.049	-.036	.913	-.009	-.020	.007
	X16 -	-.059	-.028	-.085	.019	-.001	.012	.050	-.009	.407	-.006	-.006
	X17 - Price	.016	-.017	-.005	-.031	.027	.028	-.029	-.020	-.006	.030	-.024
	X18 -	.001	.015	-.012	.017	-.023	-.024	.015	.007	-.006	-.024	.023
Anti-image Correlation	X6 -	.903[a]	-.021	-.092	-.117	-.026	.006	.103	-.126	-.120	.122	.013
	X7 - E-	-.021	.607[a]	.084	.017	-.169	-.717	-.058	.133	-.072	-.157	.160
	X9 -	-.092	.084	.917[a]	.036	-.076	-.100	.031	.144	-.293	-.063	-.170
	X10 -	-.117	.017	.036	.766[a]	-.152	-.341	.105	-.042	.038	-.220	.139
	X11 -	-.026	-.169	-.076	-.152	.439[a]	.308	-.095	-.102	-.006	.955	-.939
	X12 -	.006	-.717	-.100	-.341	.308	.575[a]	-.131	-.095	.033	.293	-.301
	X13 -	.103	-.058	.031	.105	-.095	-.131	.871[a]	-.049	.103	-.221	.133
	X15 - New	-.126	.133	.144	-.042	-.102	-.095	-.049	.468[a]	-.014	-.119	.050
	X16 -	-.120	-.072	-.293	.038	-.006	.033	.103	-.014	.924[a]	-.055	-.060
	X17 - Price	.122	-.157	-.063	-.220	.955	.293	-.221	-.119	-.055	.430[a]	-.926
	X18 -	.013	.160	-.170	.139	-.939	-.301	.133	.050	-.060	-.926	.519[a]

a. Measures of Sampling Adequacy(MSA)

Notice that in this table the entire names of the variables are not reported

Third set of tables and graphs for PART 3

Rotated Component Matrix[a]	Component			
	1	2	3	4
X6 - Product Quality	.055	-.823	.039	.125
X7 - E-Commerce Activities	.030	.076	.889	-.121
X9 - Complaint Resolution	.933	-.067	.114	-.002
X10 – Advertising	.160	.131	.674	.210
X11 - Product Line	.599	-.698	-.073	-.010
X12 - Salesforce Image	.139	.126	.905	.003
X13 - Competitive Pricing	-.113	.724	.255	.092
X15 - New Products	.058	.009	.035	.973
X16 - Order & Billing	.855	-.014	.106	.032
X17 - Price Flexibility	.434	.792	.233	.130
X18 - Delivery Speed	.947	.012	.146	.086

Extraction Method: Principal Component Analysis.Rotation Method: Varimax with Kaiser Normalization.

Pattern Matrix[a]	Component			
	1	2	3	4
X6 - Product Quality	-.003	-.854	.127	.132
X7 - E-Commerce Activities	-.058	-.043	.928	-.151
X9 - Complaint Resolution	.938	-.023	.029	-.039
X10 - Advertising	.074	.037	.656	.187
X11 - Product Line	.586	-.666	-.052	-.023
X12 - Salesforce Image	.043	.008	.917	-.030
X13 - Competitive Pricing	-.116	.695	.182	.083
X15 - New Products	-.028	-.041	-.047	.986
X16 - Order & Billing	.859	.025	.019	-.002
X17 - Price Flexibility	.448	.802	.089	.103
X18 - Delivery Speed	.946	.050	.044	.048

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization

Structure Matrix	Component			
	1	2	3	4
X6 - Product Quality	.102	-.813	-.062	.087
X7 - E-Commerce Activities	.109	.175	.885	-.033
X9 - Complaint Resolution	.941	-.088	.204	.090
X10 - Advertising	.227	.204	.705	.291
X11 - Product Line	.621	-.724	-.100	.000
X12 - Salesforce Image	.220	.224	.923	.104
X13 - Competitive Pricing	-.119	.753	.339	.144
X15 - New Products	.098	.021	.074	.973
X16 - Order & Billing	.861	-.033	.196	.118
X17 - Price Flexibility	.421	.798	.386	.234
X18 - Delivery Speed	.957	-.005	.251	.185

Extraction Method: Principal Component Analysis. Rotation Method: Oblimin with Kaiser Normalization.