

## Factor Analysis HW04

**13 Variables:**

Prod\_Qual200 Ecommerce200 Tech\_support200 Complaint200 Adv200 Prod\_Line200 Sales\_Image200  
Pricing200 Warranty200 New\_Prod200 Ordering200 Price\_Flex200 Del\_Speed200

Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Prod_Qual200	200	7.89400	1.38301	1579	5.00000	10.00000
Ecommerce200	200	3.76500	0.76892	753.00000	2.20000	5.70000
Tech_support200	200	5.24300	1.65519	1049	0.40000	8.90000
Complaint200	200	5.36750	1.20996	1074	1.50000	8.70000
Adv200	200	4.06150	1.14706	812.30000	1.50000	6.90000
Prod_Line200	200	5.81500	1.31740	1163	2.30000	8.40000
Sales_Image200	200	5.24800	1.12857	1050	2.50000	8.20000
Pricing200	200	6.97100	1.58125	1394	3.70000	10.00000
Warranty200	200	6.04850	0.87535	1210	3.70000	8.40000
New_Prod200	200	5.21050	1.49600	1042	1.20000	9.50000
Ordering200	200	4.24200	0.91192	848.40000	1.20000	6.70000
Price_Flex200	200	4.46400	1.19265	892.80000	2.30000	7.50000
Del_Speed200	200	3.81600	0.74937	763.20000	1.60000	5.50000

Descriptive Statistics

Pearson Correlation Coefficients, N = 200					
Prob >  r  under H0: Rho=0					
	Prod_Qual200	Ecommerce200	Tech_support200	Complaint200	Adv200
Prod_Qual200	1.00000 0.6295	-0.03432 0.6295	0.08660 0.2227	0.08955 0.2073	-0.05390 0.4484
Ecommerce200	-0.03432 0.6295	1.00000	0.04051 0.5689	0.19176 0.0065	0.50520 <.0001
Tech_support200	0.08660 0.2227	0.04051 0.5689	1.00000	0.15188 0.0318	0.02782 0.6958
Complaint200	0.08955 0.2073	0.19176 0.0065	0.15188 0.0318	1.00000	0.23422 0.0008
Adv200	-0.05390 0.4484	0.50520 <.0001	0.02782 0.6958	0.23422 0.0008	1.00000
Prod_Line200	0.50930 <.0001	0.07712 0.2778	0.16934 0.0165	0.56829 <.0001	0.11667 0.0999
Sales_Image200	-0.11610 0.1016	0.78822 <.0001	0.08570 0.2276	0.25566 0.0003	0.62675 <.0001
Pricing200	-0.44811 <.0001	0.17729 0.0120	-0.09180 0.1961	-0.07727 0.2768	0.09918 0.1624
Warranty200	0.10920 0.1237	0.10310 0.1463	0.83782 <.0001	0.18084 0.0104	0.03515 0.6212
New_Prod200	0.13563 0.0555	-0.04101 0.5643	-0.03777 0.5954	0.09036 0.2032	0.06273 0.3775
Ordering200	0.08304 0.2424	0.21689 0.0020	0.12075 0.0885	0.74108 <.0001	0.23013 0.0010
Price_Flex200	-0.48721 <.0001	0.18624 0.0083	-0.02917 0.6818	0.41772 <.0001	0.26007 0.0002
Del_Speed200	0.06662 0.3486	0.24081 0.0006	0.13237 0.0617	0.87807 <.0001	0.32307 <.0001

Pearson Correlation Coefficients, N = 200					
Prob >  r  under H0: Rho=0					
	Prod_Line200	Sales_Image200	Pricing200	Warranty200	New_Prod200
Prod_Qual200	0.50930 <.0001	-0.11610 0.1016	-0.44811 <.0001	0.10920 0.1237	0.13563 0.0555
Ecommerce200	0.07712 0.2778	0.78822 <.0001	0.17729 0.0120	0.10310 0.1463	-0.04101 0.5643
Tech_support200	0.16934 0.0165	0.08570 0.2276	-0.09180 0.1961	0.83782 <.0001	-0.03777 0.5954
Complaint200	0.56829 <.0001	0.25566 0.0003	-0.07727 0.2768	0.18084 0.0104	0.09036 0.2032
Adv200	0.11667 0.0999	0.62675 <.0001	0.09918 0.1624	0.03515 0.6212	0.06273 0.3775
Prod_Line200	1.00000	0.05041 0.4784	-0.48263 <.0001	0.23655 0.0007	0.12641 0.0745
Sales_Image200	0.05041 0.4784	1.00000	0.19998 0.0045	0.16285 0.0212	0.00866 0.9031
Pricing200	-0.48263 <.0001	0.19998 0.0045	1.00000	-0.08538 0.2293	-0.12132 0.0870
Warranty200	0.23655 0.0007	0.16285 0.0212	-0.08538 0.2293	1.00000	0.03031 0.6701
New_Prod200	0.12641 0.0745	0.00866 0.9031	-0.12132 0.0870	0.03031 0.6701	1.00000
Ordering200	0.44352 <.0001	0.28367 <.0001	-0.06049 0.3949	0.20417 0.0037	0.13707 0.0529
Price_Flex200	-0.34923 <.0001	0.27219 <.0001	0.46975 <.0001	-0.04073 0.5669	0.04702 0.5085
Del_Speed200	0.61190 <.0001	0.29868 <.0001	-0.05516 0.4379	0.18298 0.0095	0.14728 0.0374

Pearson Correlation Coefficients, N = 200 Prob >  r  under H0: Rho=0			
	Ordering200	Price_Flex200	Del_Speed200
Prod_Qual200	0.08304 0.2424	-0.48721 <.0001	0.06662 0.3486
Ecommerce200	0.21689 0.0020	0.18624 0.0083	0.24081 0.0006
Tech_support200	0.12075 0.0885	-0.02917 0.6818	0.13237 0.0617
Complaint200	0.74108 <.0001	0.41772 <.0001	0.87807 <.0001
Adv200	0.23013 0.0010	0.26007 0.0002	0.32307 <.0001
Prod_Line200	0.44352 <.0001	-0.34923 <.0001	0.61190 <.0001
Sales_Image200	0.28367 <.0001	0.27219 <.0001	0.29868 <.0001
Pricing200	-0.06049 0.3949	0.46975 <.0001	-0.05516 0.4379
Warranty200	0.20417 0.0037	-0.04073 0.5669	0.18298 0.0095
New_Prod200	0.13707 0.0529	0.04702 0.5085	0.14728 0.0374
Ordering200	1.00000	0.41926 <.0001	0.77297 <.0001
Price_Flex200	0.41926 <.0001	1.00000	0.51298 <.0001
Del_Speed200	0.77297 <.0001	0.51298 <.0001	1.00000

There are 18 total, 16 positive, and two negative, correlations that are significant at < .01. With 11 correlations having coefficients above 0.5.

Partial Correlations Controlling all other Variables					
	Prod_Qual200	Ecommerce200	Tech_support200	Complaint200	Adv200
Prod_Qual200	1.00000	0.09828	0.02373	0.01907	0.03652
Ecommerce200	0.09828	1.00000	-0.01461	-0.05864	0.00627
Tech_support200	0.02373	-0.01461	1.00000	0.09557	0.08612
Complaint200	0.01907	-0.05864	0.09557	1.00000	-0.11246
Adv200	0.03652	0.00627	0.08612	-0.11246	1.00000
Prod_Line200	-0.02610	0.06741	-0.05099	0.06460	0.15087
Sales_Image200	-0.11342	0.68484	-0.07379	0.08514	0.43855
Pricing200	-0.11610	0.08031	-0.06840	-0.00368	-0.03975
Warranty200	-0.01270	-0.01820	0.83893	-0.08362	-0.13172
New_Prod200	0.12764	-0.09529	-0.11311	-0.09020	0.03363
Ordering200	0.08622	-0.00322	-0.11355	0.21165	-0.05905
Price_Flex200	-0.16488	0.05227	-0.02261	0.04530	0.15731
Del_Speed200	0.07185	-0.03767	0.02750	0.18807	-0.07688

Partial Correlations Controlling all other Variables					
	Prod_Line200	Sales_Image200	Pricing200	Warranty200	New_Prod200
Prod_Qual200	-0.02610	-0.11342	-0.11610	-0.01270	0.12764
Ecommerce200	0.06741	0.68484	0.08031	-0.01820	-0.09529
Tech_support200	-0.05099	-0.07379	-0.06840	0.83893	-0.11311
Complaint200	0.06460	0.08514	-0.00368	-0.08362	-0.09020
Adv200	0.15087	0.43855	-0.03975	-0.13172	0.03363
Prod_Line200	1.00000	-0.20432	0.02078	0.08115	0.06496
Sales_Image200	-0.20432	1.00000	0.05804	0.15192	0.04559
Pricing200	0.02078	0.05804	1.00000	0.05800	-0.09443
Warranty200	0.08115	0.15192	0.05800	1.00000	0.09137
New_Prod200	0.06496	0.04559	-0.09443	0.09137	1.00000
Ordering200	-0.07607	0.06525	-0.06981	0.14300	0.03495
Price_Flex200	-0.95623	-0.19152	0.14895	0.03566	0.08776
Del_Speed200	0.93336	0.16585	-0.07388	-0.04531	-0.03479

There is 3 relatively high partial correlations. Prod\_Line200 with Price\_Flex200, Prod\_Line200 with Del\_Speed200, and Tech\_support with Warranty200.

Partial Correlations Controlling all other Variables			
	Ordering200	Price_Flex200	Del_Speed200
Prod_Qual200	0.08622	-0.16488	0.07185
Ecommerce200	-0.00322	0.05227	-0.03767
Tech_support200	-0.11355	-0.02261	0.02750
Complaint200	0.21165	0.04530	0.18807
Adv200	-0.05905	0.15731	-0.07688
Prod_Line200	-0.07607	-0.95623	0.93336
Sales_Image200	0.06525	-0.19152	0.16585
Pricing200	-0.06981	0.14895	-0.07388
Warranty200	0.14300	0.03566	-0.04531
New_Prod200	0.03495	0.08776	-0.03479
Ordering200	1.00000	-0.03349	0.17321
Price_Flex200	-0.03349	1.00000	0.92907
Del_Speed200	0.17321	0.92907	1.00000

Kaiser's Measure of Sampling Adequacy: Overall MSA = 0.63247661					
Prod_Qual200	Ecommerce200	Tech_support200	Complaint200	Adv200	Prod_Line200
0.89027960	0.68562130	0.51681179	0.93856054	0.76758408	0.46467719

Kaiser's Measure of Sampling Adequacy: Overall MSA = 0.63247661						
Sales_Image200	Pricing200	Warranty200	New_Prod200	Ordering200	Price_Flex200	Del_Speed200
0.63123061	0.91236725	0.53842475	0.57098786	0.92905433	0.41928952	0.55835110

Overall MSA of 0.63247661 is acceptable. Individual variables Price\_Flex200 and Prod\_Line200 are < .5  
Price\_Flex200 will be dropped first.

**Prior Communality Estimates: ONE**

Eigenvalues of the Correlation Matrix: <b>Total = 13</b> Average = 1				
	Eigenvalue	Difference	Proportion	Cumulative
1	3.83532914	1.16031090	0.2950	0.2950
2	2.67501824	0.95345226	0.2058	0.5008
3	1.72156598	0.17774745	0.1324	0.6332
4	1.54381853	0.57464019	0.1188	0.7520
5	0.96917834	0.39430213	0.0746	0.8265
6	0.57487622	0.08568289	0.0442	0.8708
7	0.48919332	0.06778881	0.0376	0.9084
8	0.42140452	0.13310641	0.0324	0.9408
9	0.28829810	0.09821922	0.0222	0.9630
10	0.19007888	0.03534403	0.0146	0.9776
11	0.15473485	0.02699770	0.0119	0.9895
12	0.12773715	0.11897043	0.0098	0.9993
13	0.00876672		0.0007	1.0000

Eigenvalues greater than 1 for the first four factors indicate that the factor explains more variance than a single original variable.

**0 factors will be retained by the NFACTOR criterion.**

Partial Correlations Controlling all other Variables						
	Prod_Qual200	Ecommerce200	Tech_support200	Complaint200	Adv200	Prod_Line200
Prod_Qual200	1.00000	0.09103	0.02785	0.01178	0.01087	0.45582
Ecommerce200	0.09103	1.00000	-0.01582	-0.05641	0.01469	0.05963
Tech_support200	0.02785	-0.01582	1.00000	0.09467	0.08363	-0.10038
Complaint200	0.01178	-0.05641	0.09467	1.00000	-0.10677	0.07280
Adv200	0.01087	0.01469	0.08363	-0.10677	1.00000	0.00153
Prod_Line200	0.45582	0.05963	-0.10038	0.07280	0.00153	1.00000
Sales_Image200	-0.08454	0.68849	-0.07079	0.07799	0.42137	-0.07374
Pricing200	-0.14422	0.08921	-0.07259	0.00311	-0.01671	-0.42042
Warranty200	-0.01885	-0.01637	0.83887	-0.08214	-0.12778	0.16089
New_Prod200	0.11519	-0.09118	-0.11557	-0.08665	0.04822	-0.06504
Ordering200	0.09307	-0.00498	-0.11288	0.21047	-0.06517	-0.15060
Del_Speed200	-0.22293	0.02949	0.01755	0.62283	0.18963	0.41534

Partial Correlations Controlling all other Variables						
	Sales_Image200	Pricing200	Warranty200	New_Prod200	Ordering200	Del_Speed200
Prod_Qual200	-0.08454	-0.14422	-0.01885	0.11519	0.09307	-0.22293
Ecommerce200	0.68849	0.08921	-0.01637	-0.09118	-0.00498	0.02949
Tech_support200	-0.07079	-0.07259	0.83887	-0.11557	-0.11288	0.01755
Complaint200	0.07799	0.00311	-0.08214	-0.08665	0.21047	0.62283
Adv200	0.42137	-0.01671	-0.12778	0.04822	-0.06517	0.18963
Prod_Line200	-0.07374	-0.42042	0.16089	-0.06504	-0.15060	0.41534
Sales_Image200	1.00000	0.03041	0.14792	0.02944	0.07306	-0.03331
Pricing200	0.03041	1.00000	0.06407	-0.08259	-0.07568	0.17636
Warranty200	0.14792	0.06407	1.00000	0.09493	0.14197	-0.03294
New_Prod200	0.02944	-0.08259	0.09493	1.00000	0.03215	0.12688
Ordering200	0.07306	-0.07568	0.14197	0.03215	1.00000	0.38436
Del_Speed200	-0.03331	0.17636	-0.03294	0.12688	0.38436	1.00000

There is only 1 relatively high partial correlation between Tech\_support200 and Warranty200.

Kaiser's Measure of Sampling Adequacy: Overall MSA = 0.69153034					
Prod_Qual200	Ecommerce200	Tech_support200	Complaint200	Adv200	Prod_Line200
0.62788549	0.67869567	0.51437953	0.79592458	0.77749981	0.70410518

Kaiser's Measure of Sampling Adequacy: Overall MSA = 0.69153034					
Sales_Image200	Pricing200	Warranty200	New_Prod200	Ordering200	Del_Speed200
0.65498753	0.68239999	0.53309596	0.56080584	0.85514114	0.71073277

The overall MSA of 0.69153034 is acceptable and there are no MSA values below 0.5. The data is suitable for Factor Analysis. The next step will be to determine how many factors to extract.

**Prior Commuality Estimates: ONE**

Eigenvalues of the Correlation Matrix: Total = 12 Average = 1				
	Eigenvalue	Difference	Proportion	Cumulative
1	3.70469974	1.37656394	0.3087	0.3087
2	2.32813581	0.64324878	0.1940	0.5027
3	1.68488703	0.41421562	0.1404	0.6431
4	1.27067141	0.31847694	0.1059	0.7490
5	0.95219446	0.37911244	0.0793	0.8284
6	0.57308202	0.08521256	0.0478	0.8761
7	0.48786946	0.13336289	0.0407	0.9168
8	0.35450656	0.13242417	0.0295	0.9463
9	0.22208239	0.03475414	0.0185	0.9648
10	0.18732825	0.05226794	0.0156	0.9805
11	0.13506031	0.03557775	0.0113	0.9917
12	0.09948256		0.0083	1.0000

After removing the variable Price\_Flex200, the first four factors decrease slightly and are still greater than 1. They still indicate that the factor explains more variance than a single original variable. Using a percentage of variance criterion of .80 the fifth factor will be examined, but it is not above 1.

**0 factors will be retained by the NFACTOR criterion.**

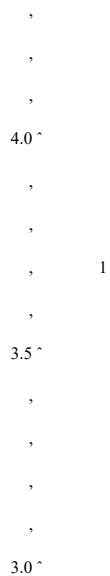
**Prior Communality Estimates: ONE**

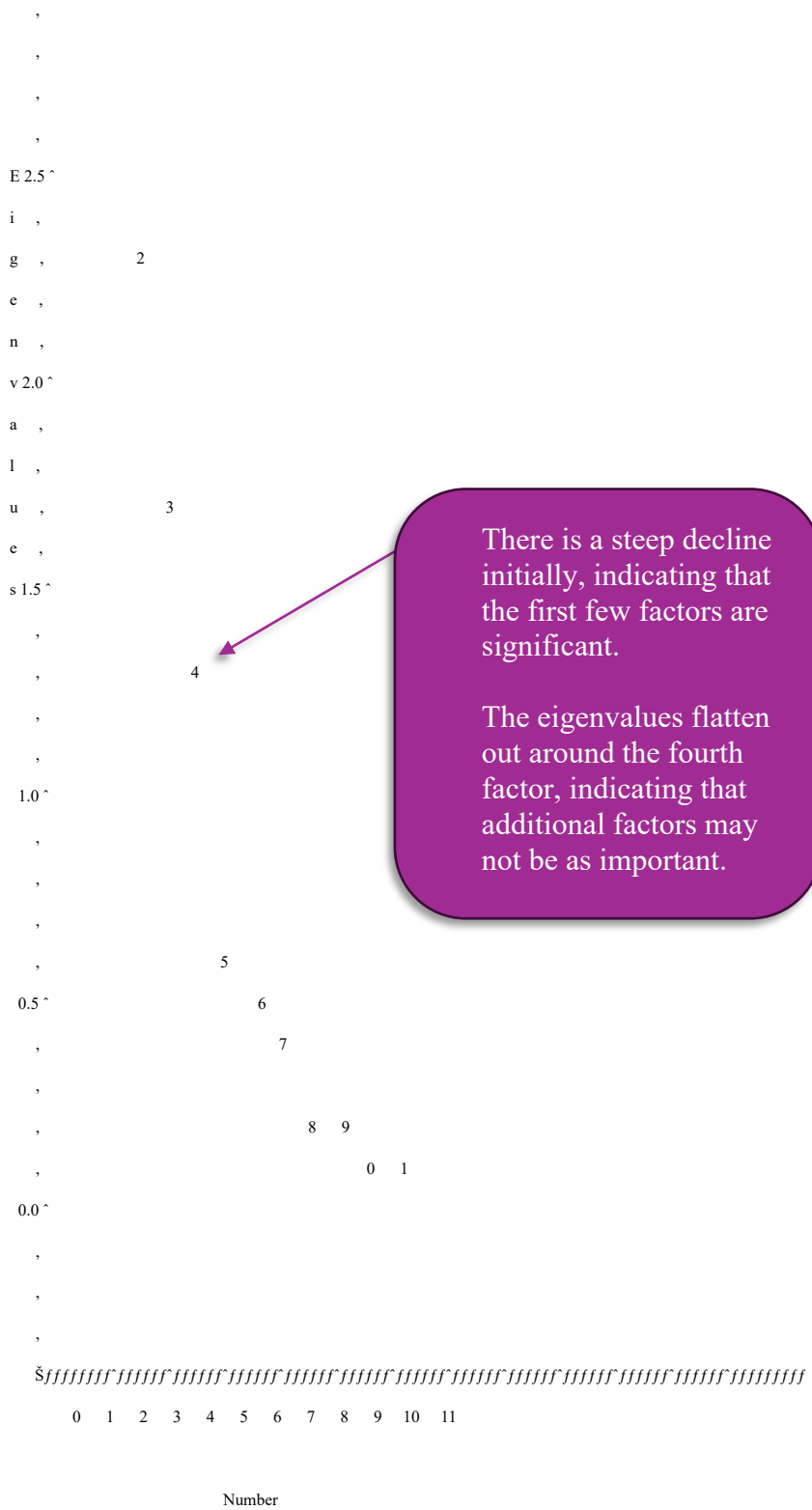
Eigenvalues of the Correlation Matrix: Total = 12 Average = 1				
	Eigenvalue	Difference	Proportion	Cumulative
1	3.70469974	1.37656394	0.3087	0.3087
2	2.32813581	0.64324878	0.1940	0.5027
3	1.68488703	0.41421562	0.1404	0.6431
4	1.27067141	0.31847694	0.1059	0.7490
5	0.95219446	0.37911244	0.0793	0.8284
6	0.57308202	0.08521256	0.0478	0.8761
7	0.48786946	0.13336289	0.0407	0.9168
8	0.35450656	0.13242417	0.0295	0.9463
9	0.22208239	0.03475414	0.0185	0.9648
10	0.18732825	0.05226794	0.0156	0.9805
11	0.13506031	0.03557775	0.0113	0.9917
12	0.09948256		0.0083	1.0000

The factor analysis on the Eigenvalues criterion shows four values above 1, supporting the extraction of four factors, but the percentage of variance for the 5<sup>th</sup> value is .8284 supporting the possibility of a fifth factor.

**11 factors will be retained by the NFACTOR criterion.**

### Scree Plot of Eigenvalues





The above scree plot supports 4 factors, with the 5<sup>th</sup> factor below 1. Four factors will be extracted for the next step, varimax and promax rotations.

Factor Pattern								
	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7	Factor8
Prod_Qual200	0.22680	-0.57725	-0.05282	0.56639	-0.10939	0.42557	0.24187	-0.16939
Ecommerce200	0.47275	0.63795	0.09143	0.38864	-0.09923	0.20849	-0.28540	0.08894
Tech_support200	0.33514	-0.21467	0.86355	-0.10730	0.05343	-0.05458	0.06199	-0.00346
Complaint200	0.83635	-0.09791	-0.22704	-0.34360	-0.07142	0.00993	0.00547	0.06878
Adv200	0.48907	0.53887	-0.03450	0.33826	0.05797	-0.37036	0.44735	-0.07823
Prod_Line200	0.68521	-0.51046	-0.14857	0.18645	-0.16573	0.00008	0.04663	0.33791
Sales_Image200	0.53696	0.68476	0.12048	0.31088	0.00140	0.02976	-0.15686	-0.02341
Pricing200	-0.16280	0.66201	0.07059	-0.44382	0.10773	0.44643	0.31723	0.11915
Warranty200	0.41168	-0.19954	0.83406	-0.07791	0.10939	0.02564	-0.01821	-0.00224
Ordering200	0.17233	-0.17297	-0.19152	0.16480	0.93132	0.04239	-0.05584	0.05800
Del_Speed200	0.79294	-0.04440	-0.20224	-0.32033	0.02371	0.07086	-0.10475	-0.40497

Factor Pattern				
	Factor9	Factor10	Factor11	Factor12
Prod_Qual200	-0.09734	-0.02363	-0.01814	-0.03360
Ecommerce200	-0.01596	0.25429	-0.04825	0.01411
Tech_support200	-0.13285	0.09752	0.21797	0.00360
Complaint200	-0.27682	-0.04497	-0.08696	0.15858
Adv200	0.02844	0.06930	-0.04000	0.02907
Prod_Line200	0.23544	-0.02496	0.08715	0.07485
Sales_Image200	-0.02777	-0.30980	0.09110	-0.02294
Pricing200	0.07679	-0.00849	0.03028	0.02568
Warranty200	0.12662	-0.07405	-0.23332	-0.00739
New_Prod200	-0.01572	0.01575	0.01353	0.01504
Ordering200	0.19097	0.04905	0.06353	0.04784
Del_Speed200	-0.04912	0.03099	-0.01620	-0.25058

The factor pattern shows that Prod\_Qual200 may be an issue because it loads in factor2 and factor4.

Final Communality Estimates: Total = 8.988394					
Prod_Qual200	Ecommerce200	Tech_support200	Complaint200	Adv200	Prod_Line200
0.70823806	0.78987722	0.91562984	0.87867725	0.64517534	0.78692085

Sales_Image200	Pricing200	Warranty200	New_Prod200	Ordering200	Del_Speed200
0.86838362	0.66672098	0.91103133	0.12345337	0.77424332	0.92004281

New\_Prod200 has a communality below 0.5. It will be dropped and the model will be rerun.

**4 factors will be retained by the NFACTOR criterion.**

Unrotated - Factor Pattern				
	Factor1	Factor2	Factor3	Factor4
<b>Prod_Qual200</b>	0.21664	-0.57535	-0.05929	0.58179
<b>Ecommerce200</b>	0.48312	0.62844	0.10678	0.39143
<b>Tech_support200</b>	0.34033	-0.24294	0.85225	-0.12819
<b>Complaint200</b>	0.83675	-0.11103	-0.25319	-0.32344
<b>Adv200</b>	0.49310	0.53908	-0.01061	0.32843
<b>Prod_Line200</b>	0.67938	-0.52056	-0.17472	0.21492
<b>Sales_Image200</b>	0.54581	0.67760	0.14267	0.30178
<b>Pricing200</b>	-0.15228	0.66061	0.08295	-0.46134
<b>Warranty200</b>	0.41418	-0.22372	0.82986	-0.10573
<b>Ordering200</b>	0.79117	-0.05215	-0.21714	-0.31300
<b>Del_Speed200</b>	0.87375	-0.05823	-0.26339	-0.28884

**Model after dropping New\_Prod200**

Variables  
 Prod\_Qual200,  
 Adv200,  
 Prod\_Line200, and  
 Sales\_Image200 load  
 on more than one  
 factor. Next step will  
 be varimax rotation.

Final Communality Estimates: Total = 8.925355					
Prod_Qual200	Ecommerce200	Tech_support200	Complaint200	Adv200	Prod_Line200
0.71995368	0.79295562	0.91759715	0.88120390	0.64173676	0.80925682

Sales_Image200	Pricing200	Warranty200	Ordering200	Del_Speed200
0.86847781	0.67930540	0.92143734	0.77379453	0.91963610

All communalities are > 0.5

**Rotation Method: Varimax**

Rotated Factor Pattern				
	Factor1	Factor2	Factor3	Factor4
Prod_Qual200	0.00821	-0.00522	0.84730	0.04414
Ecommerce200	0.08207	0.88483	-0.03943	0.04179
Tech_support200	0.06591	0.01066	0.05405	0.95405
Complaint200	0.92538	0.11826	0.07285	0.07467
Adv200	0.17297	0.78135	-0.00876	-0.03516
Prod_Line200	0.58140	0.04616	0.67586	0.11098
Sales_Image200	0.15406	0.90566	-0.12421	0.09533
Pricing200	-0.03221	0.16091	-0.80669	-0.04032
Warranty200	0.12007	0.06821	0.07707	0.94680
Ordering200	0.86301	0.14758	0.02631	0.08083
Del_Speed200	0.93537	0.18981	0.07207	0.05921

Assigning variables to factors with high loadings. All variables load on only one factor.

**Factor1:**  
Complaint200  
Ordering200  
Del\_Speed200

**Factor 2:** Ecommerce200  
Adv200  
Sales\_Image200

**Factor 3:**  
Prod\_Qual200  
Prod\_Line200  
Pricing200

**Factor 4:**  
Tech\_support200  
Warranty200

Final Communality Estimates: Total = 8.925355					
Prod_Qual200	Ecommerce200	Tech_support200	Complaint200	Adv200	Prod_Line200
0.71995368	0.79295562	0.91759715	0.88120390	0.64173676	0.80925682

Sales_Image200	Pricing200	Warranty200	Ordering200	Del_Speed200
0.86847781	0.67930540	0.92143734	0.77379453	0.91963610

All communalities are > 0.5

**Prior Communality Estimates: ONE**

Eigenvalues of the Correlation Matrix: Total = 11 Average = 1				
	Eigenvalue	Difference	Proportion	Cumulative
1	3.68305705	1.37244996	0.3348	0.3348
2	2.31060709	0.64219141	0.2101	0.5449
3	1.66841568	0.40514039	0.1517	0.6966
4	1.26327529	0.68885301	0.1148	0.8114
5	0.57442228	0.08332678	0.0522	0.8636
6	0.49109550	0.13074044	0.0446	0.9083
7	0.36035506	0.13743449	0.0328	0.9410
8	0.22292057	0.03457697	0.0203	0.9613
9	0.18834360	0.05215727	0.0171	0.9784
10	0.13618633	0.03486478	0.0124	0.9908
11	0.10132155		0.0092	1.0000

The factor analysis on the Eigenvalues criterion shows four values above 1, supporting the extraction of four factors with the percentage of variance for the 4<sup>th</sup> value at .8114 or 81.1%.

**4 factors will be retained by the NFACTOR criterion.**

**Rotation Method: Promax**

Target Matrix for Procrustean Transformation				
	Factor1	Factor2	Factor3	Factor4
Prod_Qual200	0.00000	-0.00000	1.00000	0.00014
Ecommerce200	0.00082	1.00000	-0.00009	0.00010
Tech_support200	0.00034	0.00000	0.00018	1.00000
Complaint200	1.00000	0.00204	0.00047	0.00051
Adv200	0.01051	0.94579	-0.00000	-0.00009
Prod_Line200	0.28180	0.00014	0.42588	0.00190
Sales_Image200	0.00472	0.93554	-0.00238	0.00108
Pricing200	-0.00006	0.00758	-0.94162	-0.00012
Warranty200	0.00204	0.00037	0.00052	0.97126
Ordering200	0.98573	0.00481	0.00003	0.00079
Del_Speed200	0.96865	0.00790	0.00043	0.00024

**Rotation Factor Pattern: Promax**

Rotated Factor Pattern (Standardized Regression Coefficients)				
	Factor1	Factor2	Factor3	Factor4
Prod_Qual200	-0.11685	0.07858	0.87705	-0.00632
Ecommerce200	-0.05904	0.90863	0.02700	0.00704
Tech_support200	-0.02330	-0.03077	-0.01071	0.96582
Complaint200	0.95534	-0.03250	-0.03418	-0.00096
Adv200	0.05824	0.79026	0.04285	-0.07639
Prod_Line200	0.50810	0.01244	0.62734	0.02793
Sales_Image200	0.02219	0.90721	-0.07166	0.06074
Pricing200	0.05867	0.09302	-0.81780	0.00394
Warranty200	0.02240	0.02282	0.01216	0.95094
Ordering200	0.88969	0.00412	-0.07246	0.01170
Del_Speed200	0.95546	0.04135	-0.02873	-0.02002

Promax offers the same solution as varimax, however, *Prod\_Line200* does not load as high.

**Factor 1:**

Complaint200  
Ordering200  
Del\_Speed200

**Factor 2:**

Ecommerce200  
Adv200  
Sales\_Image200

**Factor 3:**

Prod\_Qual200  
Prod\_Line200  
Pricing200

**Factor 4:**

Tech\_support200  
Warranty200

<b>3 Variables:</b>	Complaint200 Del_Speed200 Ordering200
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Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Complaint200	200	5.36750	1.20996	1074	1.50000	8.70000
Del_Speed200	200	3.81600	0.74937	763.20000	1.60000	5.50000
Ordering200	200	4.24200	0.91192	848.40000	1.20000	6.70000

Cronbach Coefficient Alpha	
Variables	Alpha
Raw	0.899866
Standardized	0.921909

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
Complaint200	0.852208	0.862545	0.859848	0.871950
Del_Speed200	0.891378	0.832053	0.884774	0.851291
Ordering200	0.775958	0.880243	0.781216	0.935075

Pearson Correlation Coefficients, N = 200			
Prob >  r  under H0: Rho=0			
	Complaint200	Del_Speed200	Ordering200
Complaint200	1.00000	0.87807 <.0001	0.74108 <.0001
Del_Speed200	0.87807 <.0001	1.00000	0.77297 <.0001
Ordering200	0.74108 <.0001	0.77297 <.0001	1.00000

<b>3 Variables:</b>	Sales_Image200 Ecommerce200 Adv200
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Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Sales_Image200	200	5.24800	1.12857	1050	2.50000	8.20000
Ecommerce200	200	3.76500	0.76892	753.00000	2.20000	5.70000
Adv200	200	4.06150	1.14706	812.30000	1.50000	6.90000

Cronbach Coefficient Alpha	
Variables	Alpha
Raw	0.824467
Standardized	0.842139

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
Sales_Image200	0.792104	0.636967	0.815527	0.671271
Ecommerce200	0.715794	0.770495	0.717075	0.770558
Adv200	0.609440	0.846300	0.598552	0.881572

Pearson Correlation Coefficients, N = 200			
Prob >  r  under H0: Rho=0			
	Sales_Image200	Ecommerce200	Adv200
Sales_Image200	1.00000	0.78822 <.0001	0.62675 <.0001
Ecommerce200	0.78822 <.0001	1.00000	0.50520 <.0001
Adv200	0.62675 <.0001	0.50520 <.0001	1.00000

<b>3 Variables:</b>	Prod_Qual200 Prod_Line200 pricing2
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Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Prod_Qual200	200	7.89400	1.38301	1579	5.00000	10.00000
Prod_Line200	200	5.81500	1.31740	1163	2.30000	8.40000
pricing2	200	3.02900	1.58125	605.80000	0	6.30000

Cronbach Coefficient Alpha	
Variables	Alpha
Raw	0.729830
Standardized	0.734704

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
Prod_Qual200	0.551956	0.643791	0.555988	0.651047
Prod_Line200	0.581316	0.615075	0.582859	0.618891
pricing2	0.535173	0.674350	0.535707	0.674878

Pearson Correlation Coefficients, N = 200			
Prob >  r  under H0: Rho=0			
	Prod_Qual200	Prod_Line200	pricing2
Prod_Qual200	1.00000	0.50930 <.0001	0.44811 <.0001
Prod_Line200	0.50930 <.0001	1.00000	0.48263 <.0001
pricing2	0.44811 <.0001	0.48263 <.0001	1.00000

<b>2 Variables:</b>	Tech_support200 Warranty200
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Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
Tech_support200	200	5.24300	1.65519	1049	0.40000	8.90000
Warranty200	200	6.04850	0.87535	1210	3.70000	8.40000

Cronbach Coefficient Alpha	
Variables	Alpha
Raw	0.818306
Standardized	0.911754

Cronbach Coefficient Alpha with Deleted Variable				
Deleted Variable	Raw Variables		Standardized Variables	
	Correlation with Total	Alpha	Correlation with Total	Alpha
Tech_support200	0.837819	.	0.837819	.
Warranty200	0.837819	.	0.837819	.

Pearson Correlation Coefficients, N = 200 Prob >  r  under H0: Rho=0		
	Tech_support200	Warranty200
Tech_support200	1.00000	0.83782 <.0001
Warranty200	0.83782 <.0001	1.00000

**4 Variables:** scale1 scale2 scale3  
scale4

Simple Statistics						
Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
scale1	200	4.47517	0.89077	895.03333	1.83333	6.63333
scale2	200	4.35817	0.88585	871.63333	2.60000	6.80000
scale3	200	5.57933	1.15351	1116	3.43333	7.80000
scale4	200	5.64575	1.21795	1129	2.10000	8.50000

Pearson Correlation Coefficients, N = 200 Prob >  r  under H0: Rho=0				
	scale1	scale2	scale3	scale4
scale1	1.00000	0.31068 <.0001	0.28838 <.0001	0.17285 0.0144
scale2	0.31068 <.0001	1.00000	- 0.07896 0.2664	0.08188 0.2491
scale3	0.28838 <.0001	- 0.07896 0.2664	1.00000	0.15789 0.0256
scale4	0.17285 0.0144	0.08188 0.2491	0.15789 0.0256	1.00000

Correlations are either too low, or they are not significant.

# Factor Analysis Examination Summary

## Research Objective and Analysis Plan

I will use the HBAT200 data set to explore a set of 13 independent metric variables to determine appropriate factors to extract. The process includes exploratory factor analysis starting with an evaluation of a correlation matrix. The goal is to count and examine significant correlations at p-value < 0.01, followed by checking partial correlation values against the correlation matrix values. I will use Kaiser's measure of sampling adequacy to check for MSA values < 0.5, if any are found, the lowest variable will be removed, and the model will be rerun. The next step after the MSA values is determined to be acceptable, will be to check the eigenvalues and the percentage of variance criterion to determine how many factors will be extracted. The communality estimates will be checked for offending variables, if any are found they will be removed, and the model will be rerun. An unrotated factor pattern will be compared to a Varimax, and Promax factor pattern for examination of differences in load of the variables on each factor. Finally summated scales will be used to check for reliability, correlation with each other, and the associated correlation coefficients.

## Examination Details

Pricing has a negative load on Factor 4 (Support) and all other variables are positive. Prod\_Line200 has the lowest magnitude of 0.62734 and is in Factor 3 (Value) and all other variables have a magnitude > 0.7. The factors were developed from the varimax rotation.

**Factors Explain:** 81.1% of total variation.

### Selected Factors (4 Factors)

Factor 1 (**Service**): Complaint200, Del\_Speed200, Ordering200

Factor 2 (**Brand**): Sales\_Image200, Ecommerce200, Adv200

Factor 3 (**Value**): Prod\_Qual200, Prod\_Line200, pricing2 (*Pricing200 corrected for sign*)

Factor 4 (**Support**): Tech\_support200, Warranty200

### Reliability of Factors (Determined using summated scales)

Service: 0.922      Brand: 0.842      Value: 0.735      Support: 0.912

All factors can be considered reliable with a value > 0.7.

### Correlation Coefficients

<b>Service</b>	<b>Brand</b>	<b>Value</b>	<b>Support</b>
0.87807	0.78822	0.50930	0.83782
0.74108	0.62675	0.44811	
0.77297	0.50520	0.48263	

These results suggest that the factor analysis has identified meaningful underlying dimensions in the data related to service, brand, value, and support. These factors demonstrate good internal consistency and show varying degrees of correlation with each other, providing valuable insights into the structure of the data.