

PCA Parallel Analysis

Standalone verified Python analysis

Test: PCA Parallel Analysis

Design: Full-correlation PCA eigenvalues compared with deterministic 95th-percentile random eigenvalues.

Variables: G1, G2, G3, famrel, freetime, goout

Null hypothesis: No observed PCA eigenvalue exceeds its random 95th-percentile counterpart.

Formula: Retain component j when $\lambda_j(R) > Q_{.95}[\lambda_j(R_{\text{random}})]$.

Source rows: 649

Calculated metrics:

retained_components: 2

replications: 200

first_observed_eigenvalue: 2.7828698961540006

first_random_threshold: 1.1894837041690534

variables: 6

Independent reference values:

retained_components: 2

replications: 200

first_observed_eigenvalue: 2.7828698961540006

first_random_threshold: 1.1894837041690534

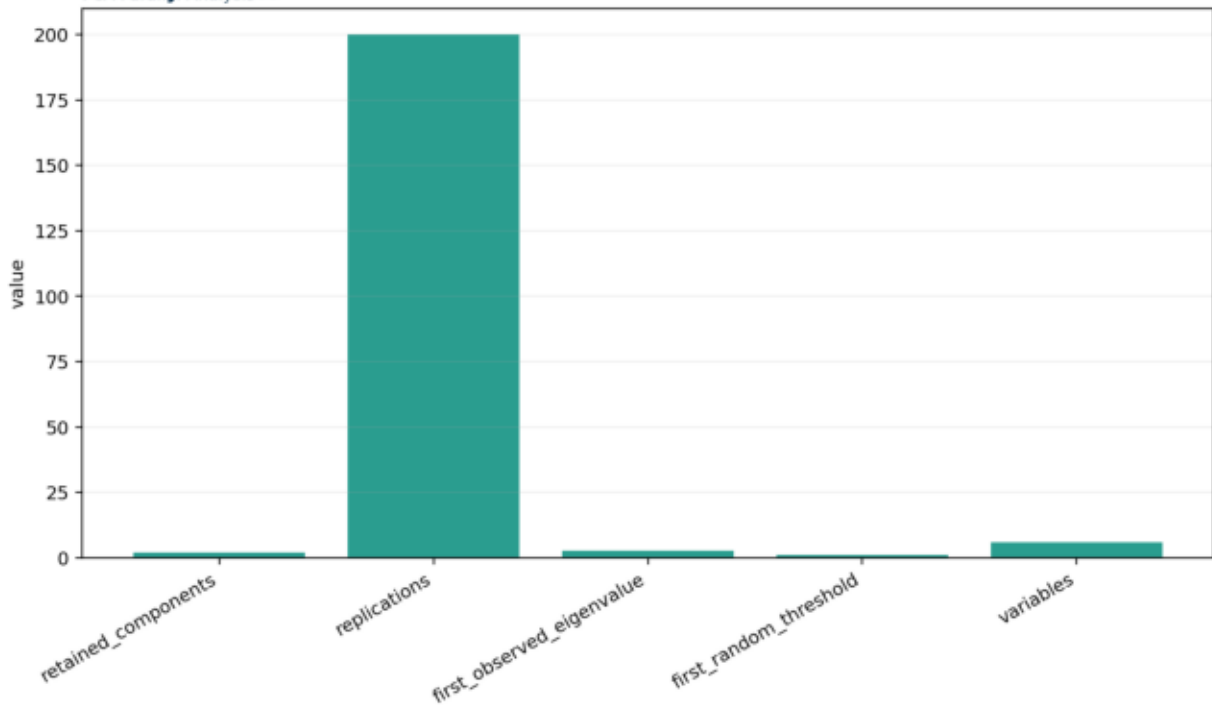
variables: 6

Interpretation:

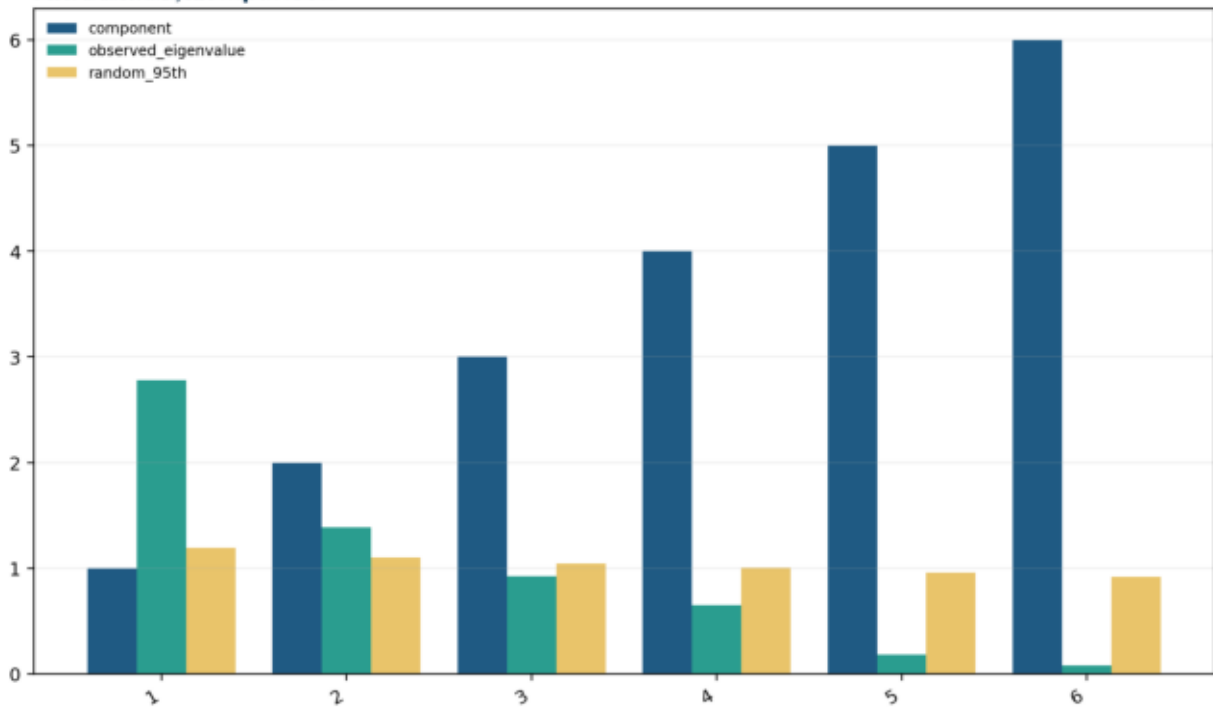
PCA parallel analysis compares full-correlation eigenvalues with random 95th percentiles.

Retained components=2.

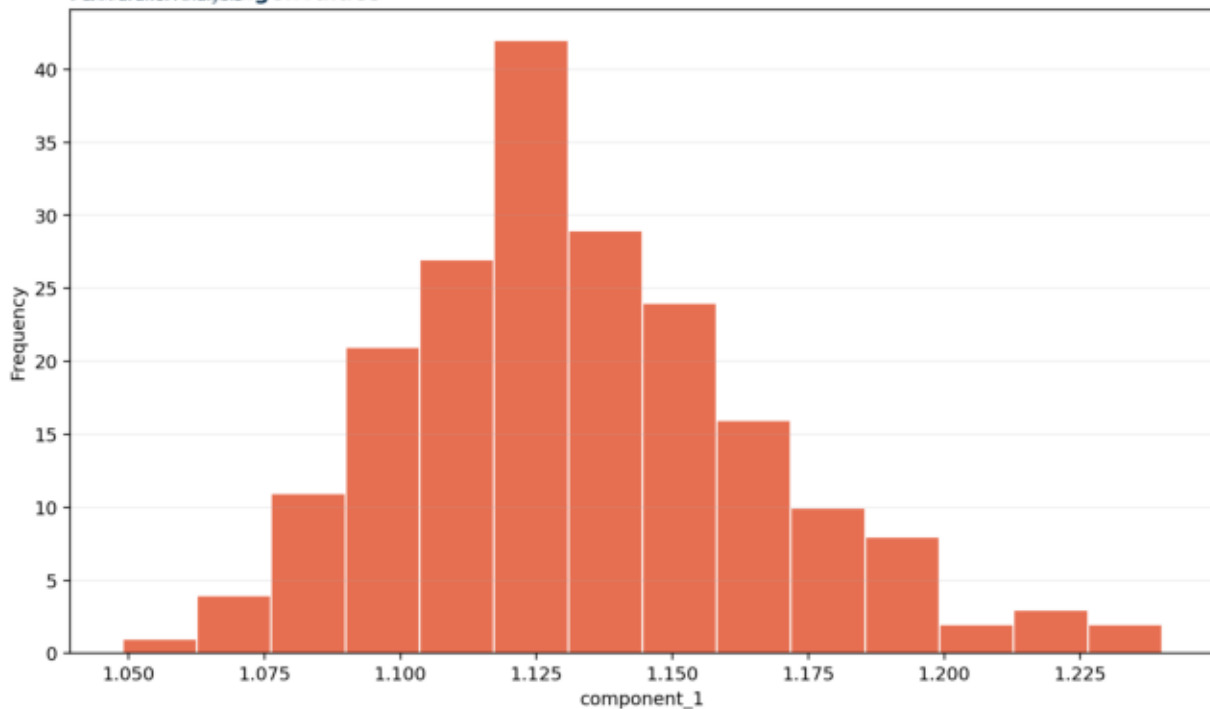
Primary Metrics



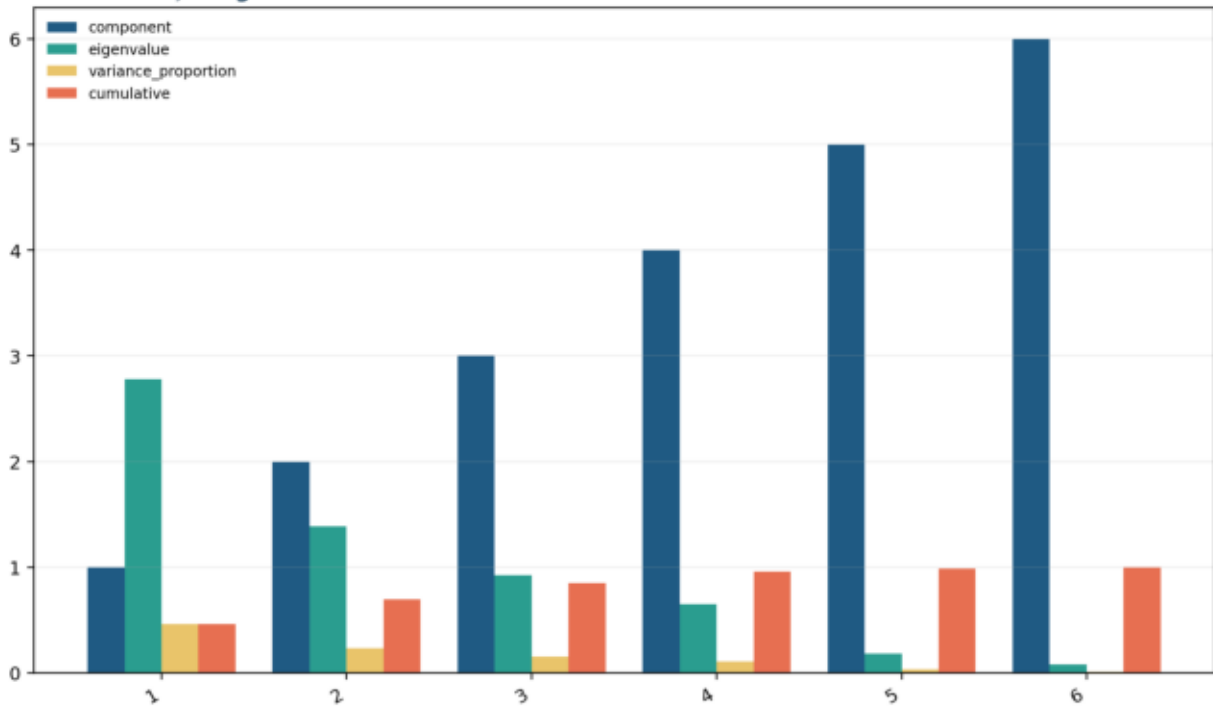
Pca Parallel Comparison



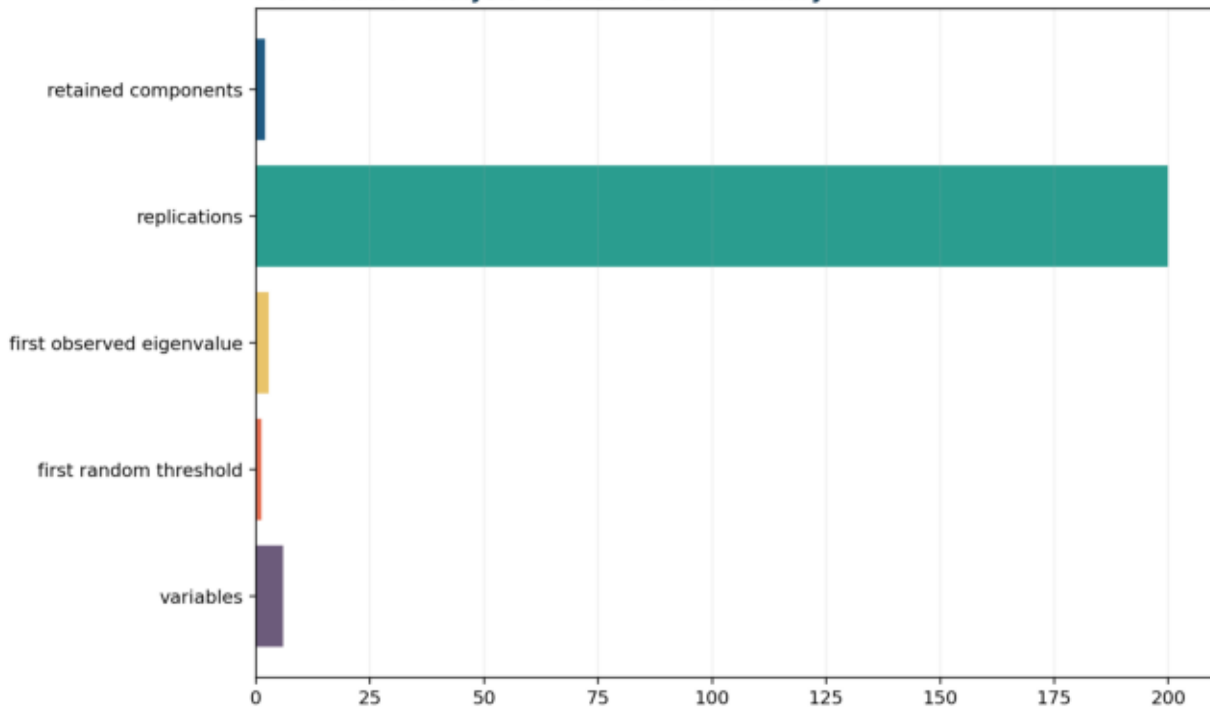
Random Pca Eigenvalues



Observed Pca Eigenvalues



PCA Parallel Analysis verified result summary



Primary Metrics

metric	value
retained_components	2
replications	200
first_observed_eigenvalue	2.78287
first_random_threshold	1.18948
variables	6

Pca Parallel Comparison

component	observed_eigenvalue	random_95th	retain
1	2.78287	1.18948	True
2	1.3848	1.10115	True
3	0.924099	1.0466	False
4	0.650103	1.00328	False
5	0.182299	0.9607	False
6	0.0758252	0.915395	False

Random Pca Eigenvalues

component_1	component_2	component_3	component_4	component_5	component_6
1.10269	1.09386	0.998295	0.979596	0.93661	0.88895
1.18716	1.05651	1.01253	0.958267	0.928932	0.856603
1.12396	1.05311	1.00505	0.978172	0.935373	0.904335
1.20288	1.09269	1.00176	0.963173	0.900617	0.838882
1.21732	1.11843	0.979998	0.954844	0.914456	0.81496
1.12974	1.0766	1.01446	0.991026	0.919065	0.869115
1.11747	1.09736	1.02555	0.997172	0.89638	0.866066
1.09016	1.05111	1.00906	0.987923	0.950192	0.911554
1.17976	1.06421	1.00936	0.968603	0.917299	0.86077
1.12083	1.0777	1.01792	0.966328	0.930531	0.886691
1.04885	1.04057	0.996447	0.990547	0.971456	0.952131
1.16481	1.07381	1.03542	0.967776	0.900845	0.85734
1.07212	1.0521	1.00791	0.984743	0.956802	0.926323
1.16538	1.07825	1.01532	0.946146	0.932476	0.862428
1.10293	1.08108	1.0166	0.996377	0.923809	0.87921
1.11725	1.04563	1.01963	1.00806	0.941653	0.867782
1.08795	1.06728	1.01949	0.989021	0.93955	0.896708
1.16926	1.09071	0.998988	0.95996	0.911457	0.869624
1.18833	1.11264	1.03998	0.92858	0.904789	0.825681
1.15377	1.08513	0.983739	0.963138	0.933212	0.881011
1.131	1.06712	1.02325	0.96615	0.920021	0.89245
1.10478	1.06459	1.02632	0.985914	0.935203	0.883202
1.09242	1.05428	1.01813	0.985797	0.936088	0.913284
1.08633	1.06919	1.00081	0.981274	0.978689	0.883707
1.14358	1.03569	0.993603	0.984046	0.935362	0.907722
1.13282	1.11033	0.984488	0.959326	0.926538	0.886496

Observed Pca Eigenvalues

component	eigenvalue	variance_proportion	cumulative
1	2.78287	0.463812	0.463812
2	1.3848	0.230801	0.694612
3	0.924099	0.154016	0.848629
4	0.650103	0.108351	0.956979
5	0.182299	0.0303832	0.987362
6	0.0758252	0.0126375	1