

Likelihood-Ratio Chi-Square Test of Independence

Verified Python analysis transcript

Test: Likelihood-Ratio Chi-Square Test of Independence

Design: Two-way school-by-grade-band analysis using deviance rather than Pearson residual weighting.

Variables: school, G3 grade band

Null hypothesis: School and grade band are independent.

Primary formula: $G^2 = 2 \sum_{ij} O_{ij} \ln(O_{ij}/E_{ij})$

Valid source rows: 649

Verified results:

statistic: 57.075209233479

p_value: 2.4766132037089447e-12

degrees_of_freedom: 3

cramers_v: 0.2965523758256303

minimum_expected_count: 16.018489984591678

cells_expected_below_5: 0

pearson_chi_square: 59.534045213043086

pearson_p_value: 7.392451635150176e-13

Interpretation:

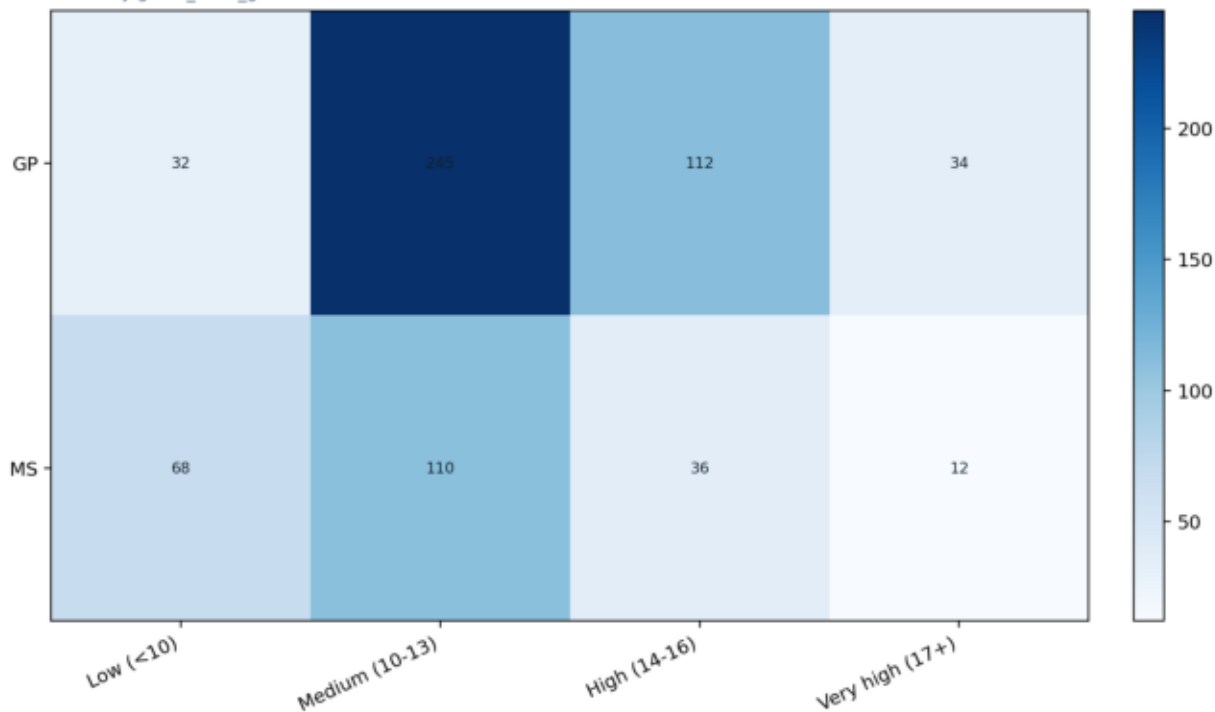
The primary statistic is 57.075209 with $p = 2.47661e-12$.

Cramer's V is 0.296552 and the minimum expected count is 16.018.

Interpret the residual and contribution tables before describing which cells account for the global result.

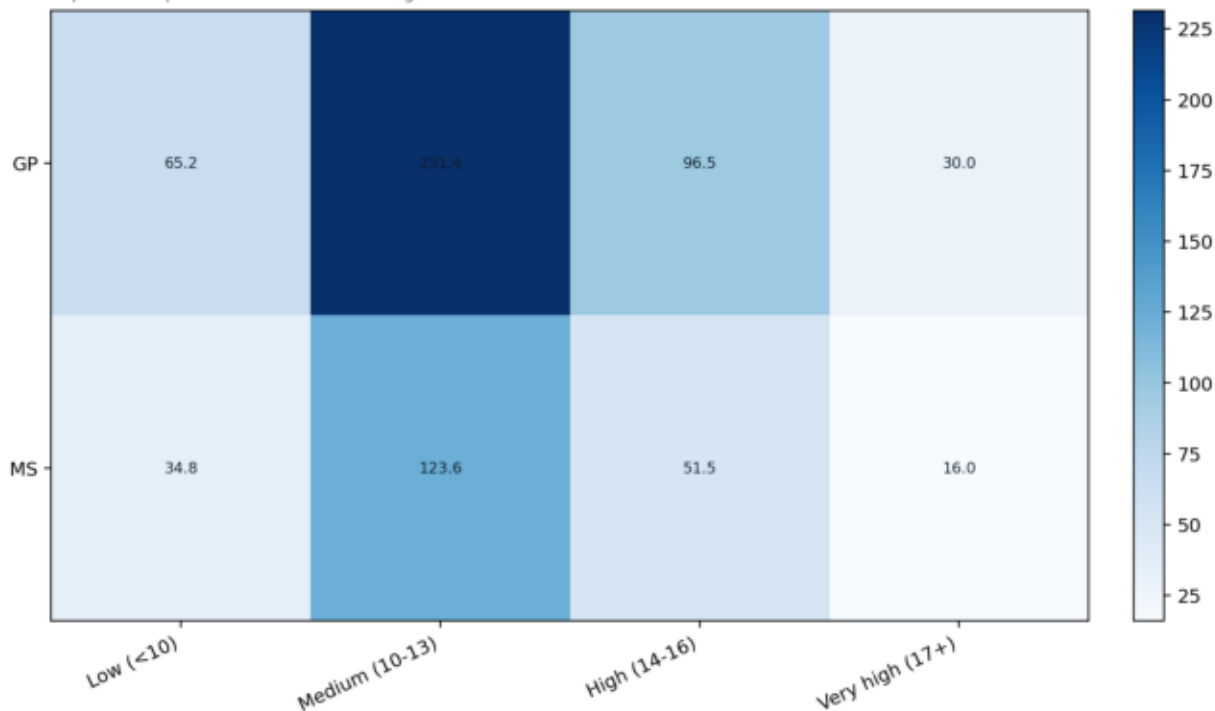
Observed categorical counts

school by grade_band_g3



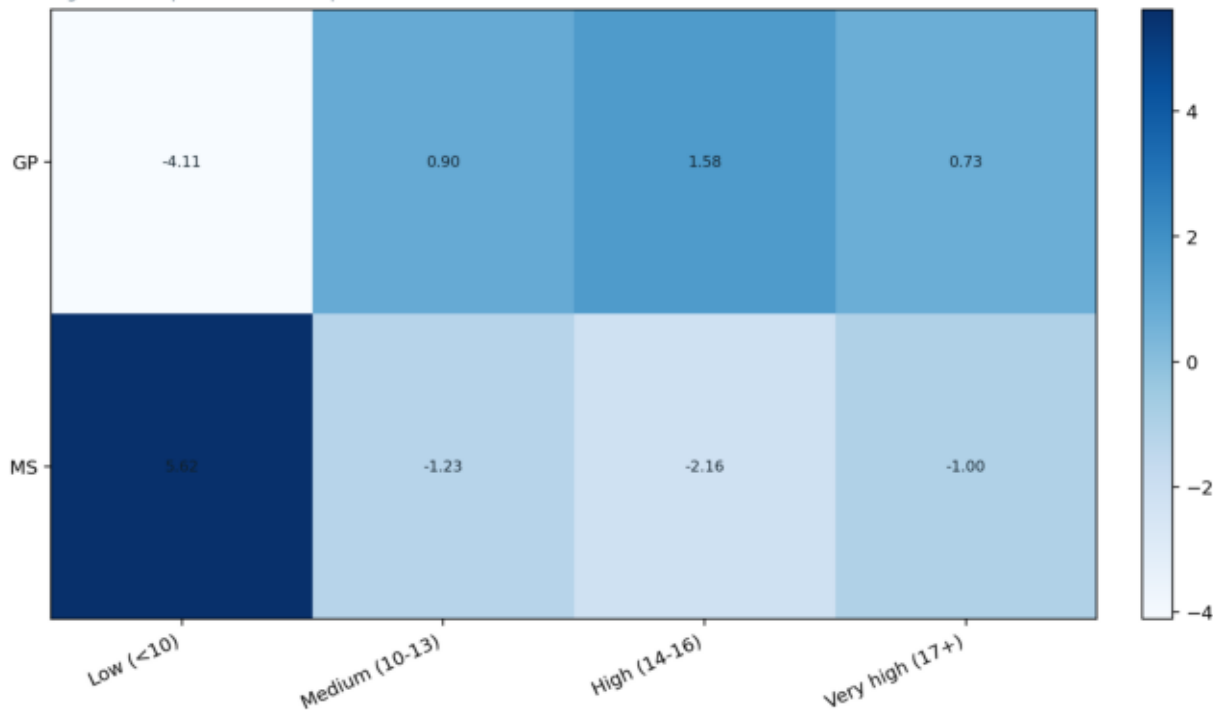
Expected counts under the null

Expected frequencies from the fitted margins



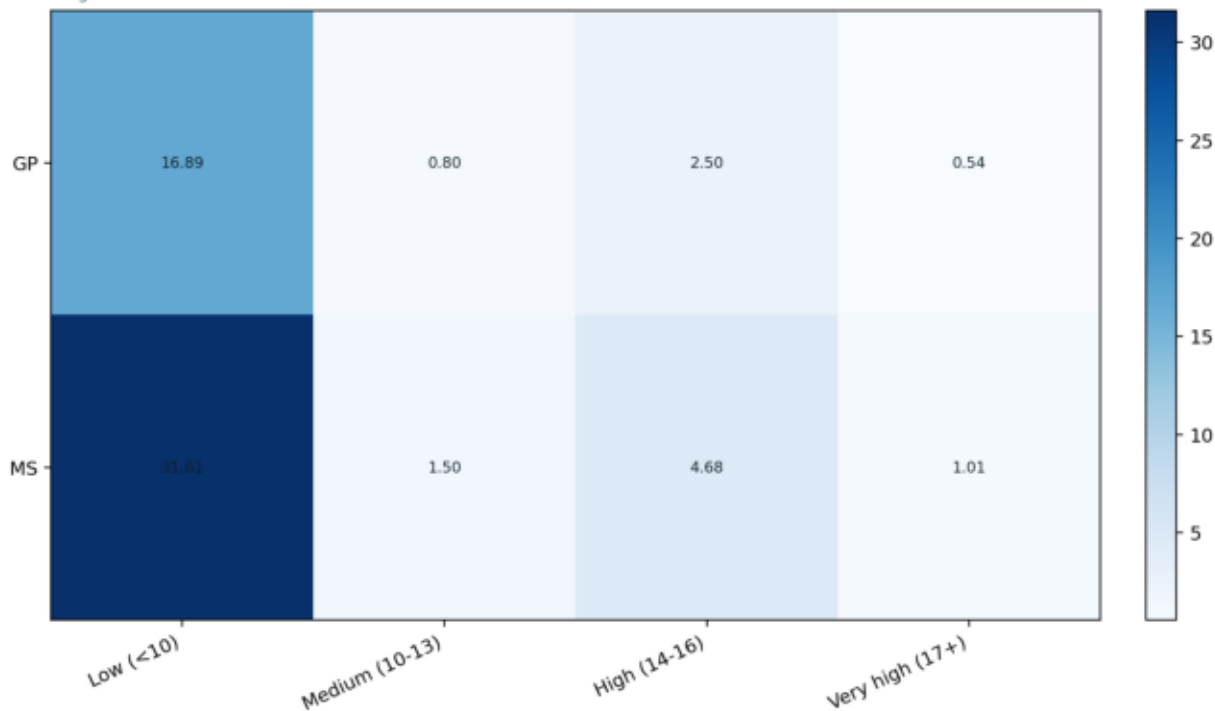
Pearson residual pattern

Signed cell departures from independence



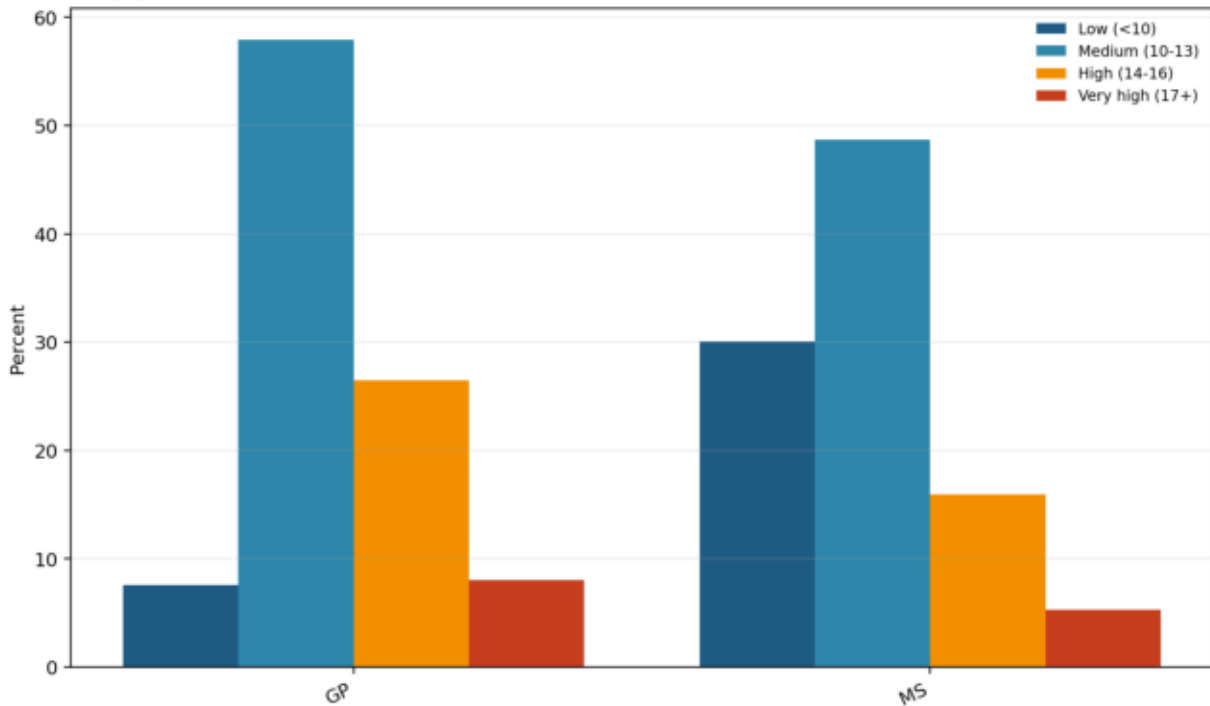
Cell contributions to the statistic

Larger values contribute more evidence



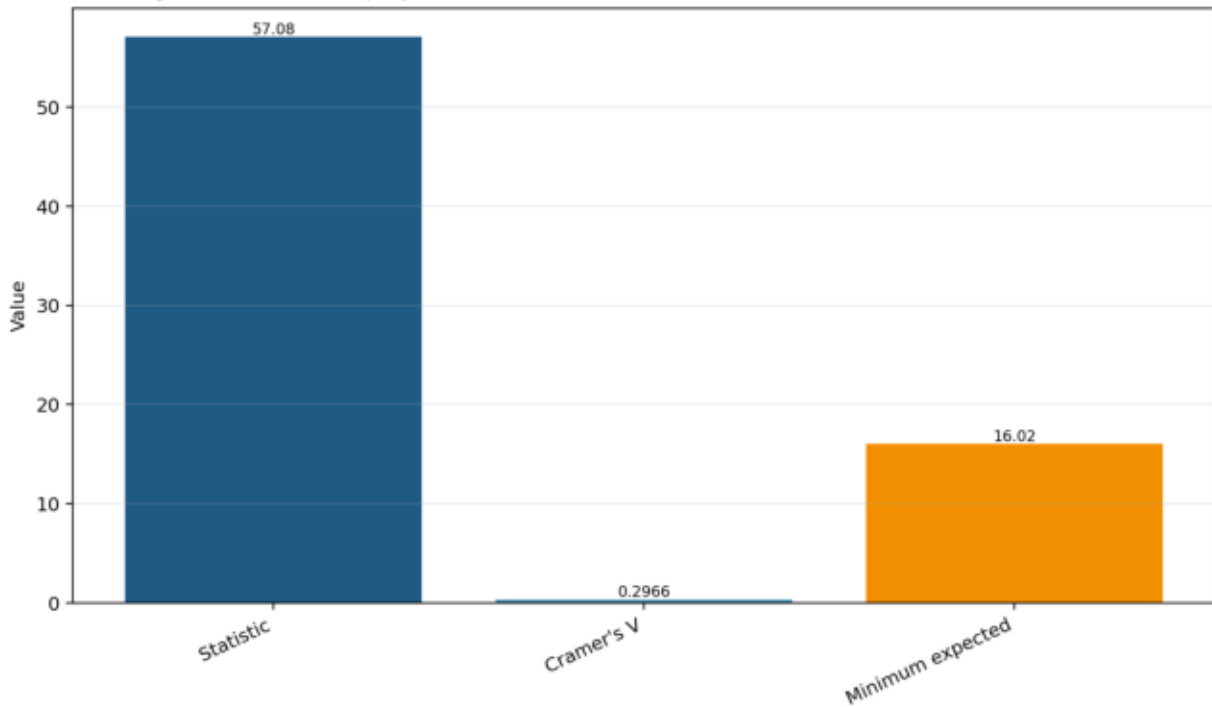
Row percentage comparison

Category distribution within each row



Model diagnostics

test strength, effect size, and adequacy



Likelihood-ratio and Pearson statistics

Different residual weighting on the same table



Observed Counts

Low (<10)	Medium (10-13)	High (14-16)	Very high (17+)
32	245	112	34
68	110	36	12

Expected Counts

Low (<10)	Medium (10-13)	High (14-16)	Very high (17+)
65.1772	231.379	96.4622	29.9815
34.8228	123.621	51.5378	16.0185

Pearson Residuals

Low (<10)	Medium (10-13)	High (14-16)	Very high (17+)
-4.10953	0.895459	1.58201	0.733899
5.62222	-1.22507	-2.16434	-1.00404

Cell Contributions

Low (<10)	Medium (10-13)	High (14-16)	Very high (17+)
16.8882	0.801846	2.50276	0.538607
31.6094	1.5008	4.68437	1.0081