

McNemar-Bowker Test

Verified Python analysis transcript

Test: McNemar-Bowker Test

Design: Paired four-category G2-to-G3 transition symmetry.

Variables: G2 grade band, G3 grade band

Null hypothesis: For every category pair i,j , the i -to- j and j -to- i transition probabilities are equal.

Primary formula: $X^2_B = \sum_{\{i<j\}} (n_{ij}-n_{ji})^2 / (n_{ij}+n_{ji})$

Valid source rows: 649

Verified results:

bowker_statistic: 76.28157290470723

p_value: 1.9248733079049484e-16

degrees_of_freedom: 3

paired_students: 649

diagonal_agreement: 521

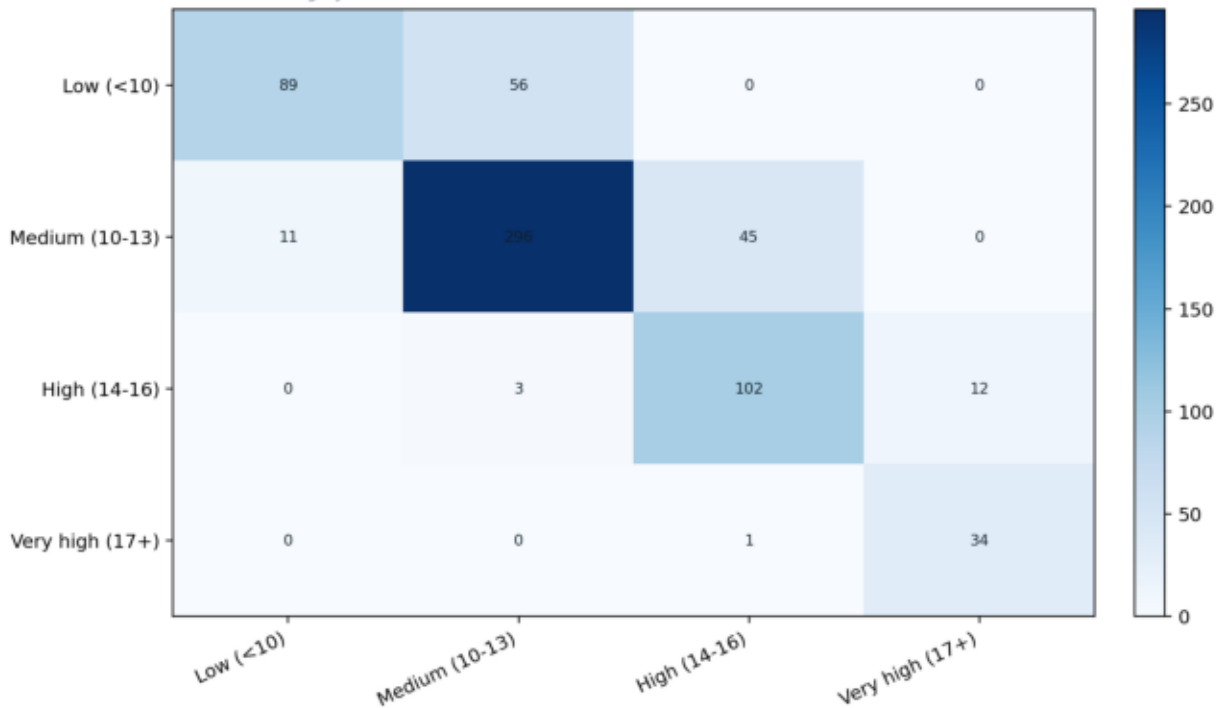
Interpretation:

Bowker chi-square = 76.281573, df = 3, p = 1.92487e-16.

Pair-contribution and direction charts identify which reverse-cell imbalances produce the global asymmetry.

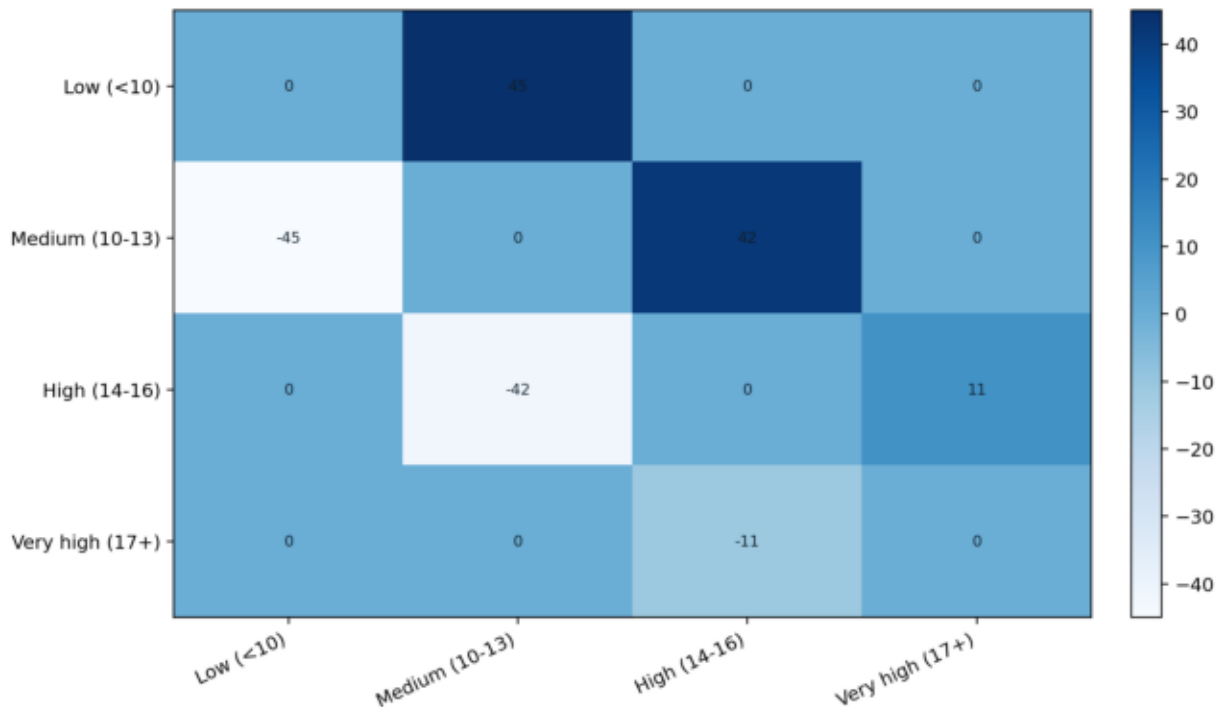
G2 to G3 transition table

Paired four-category observations



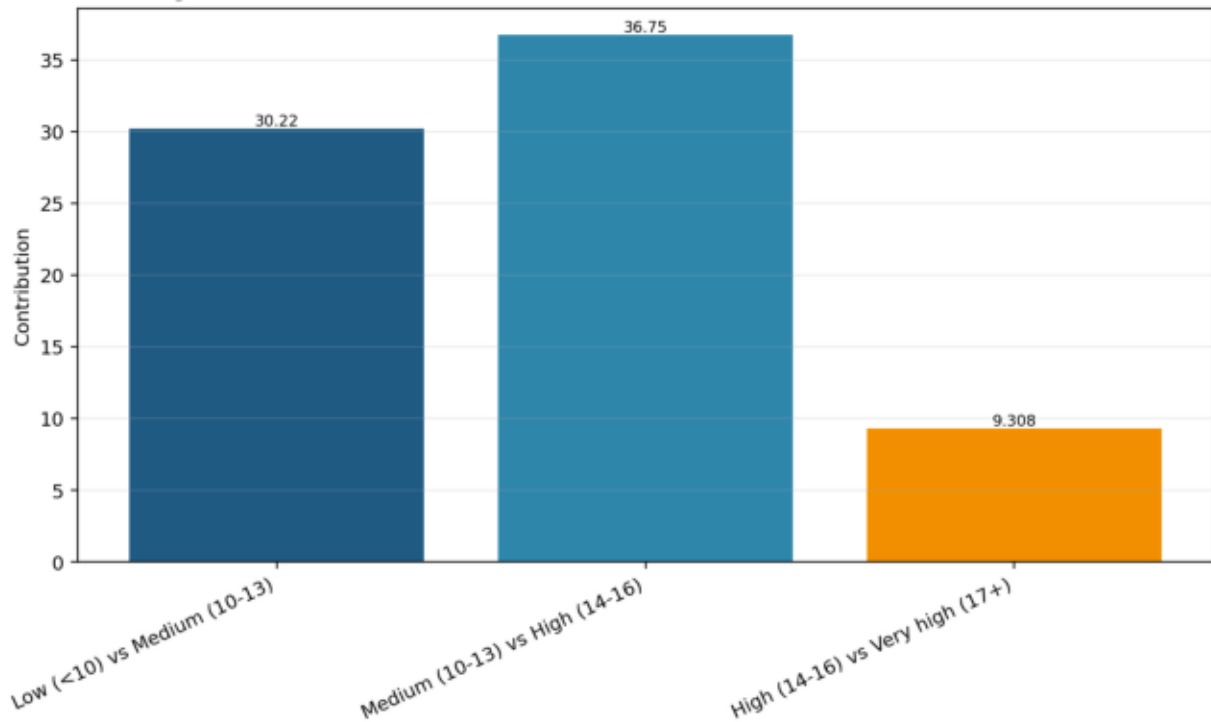
Directional asymmetry matrix

Positive cells exceed the reverse transition



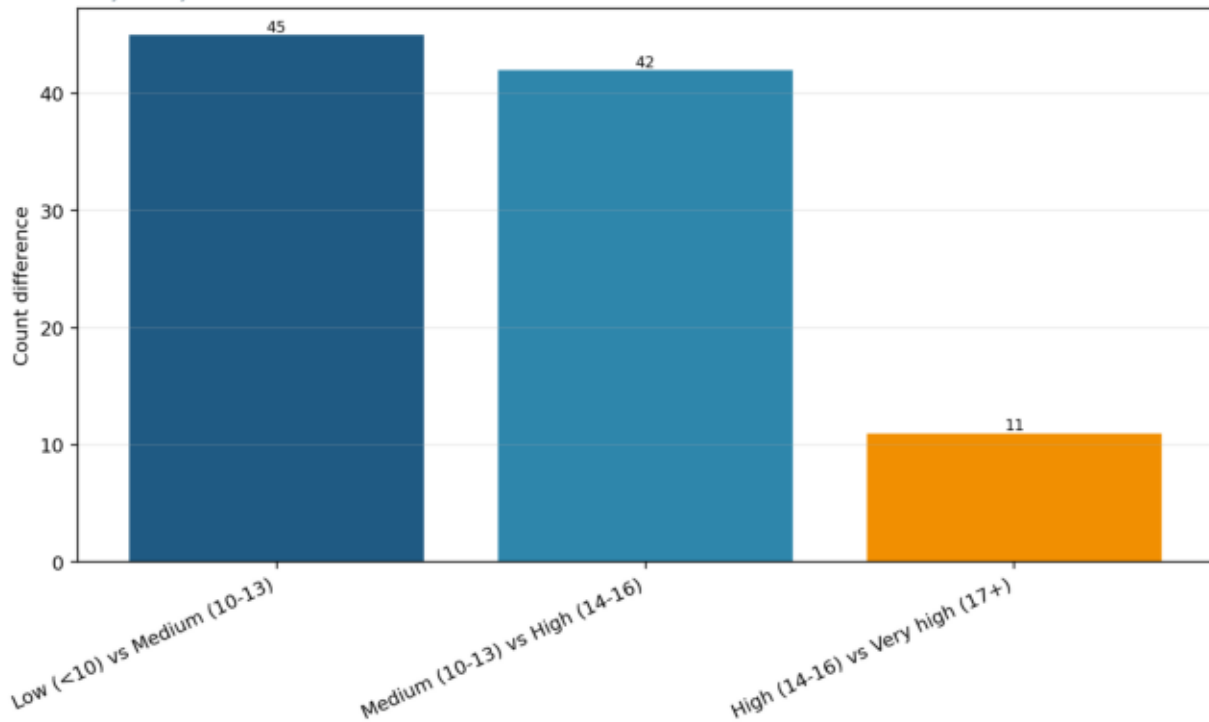
Reverse-pair Bowker contributions

Pairs driving the omnibus statistic



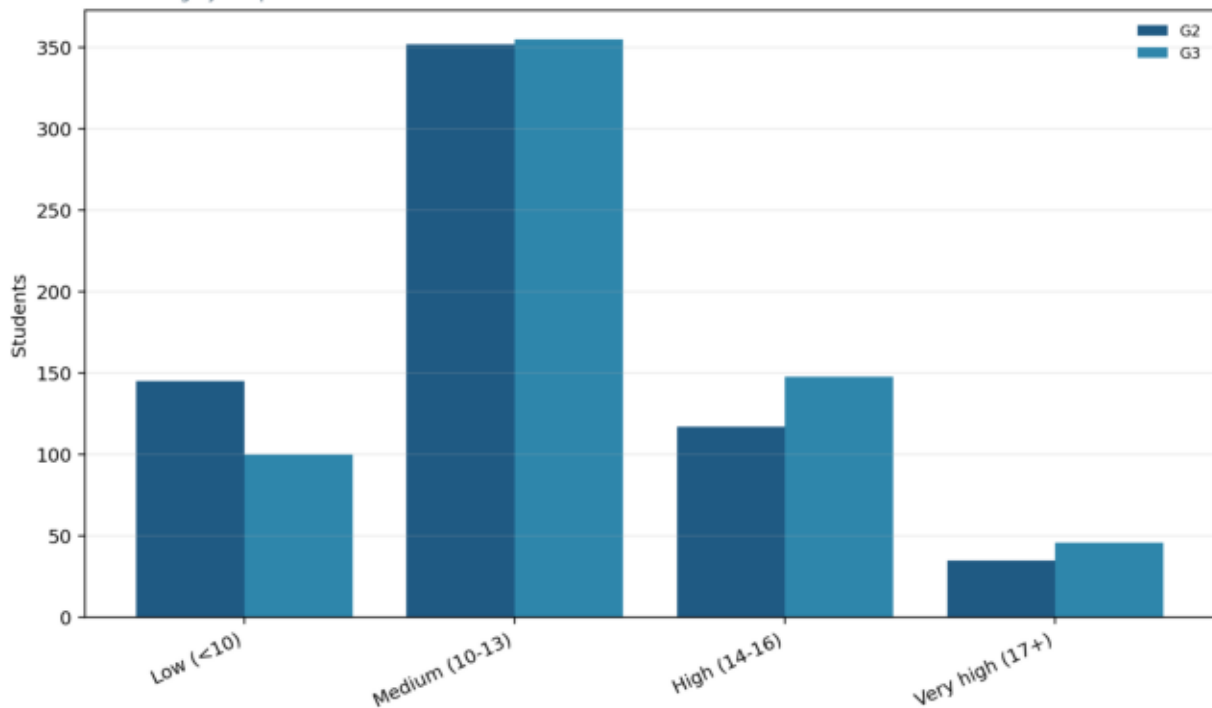
Directional transition differences

i-to-j minus j-to-i



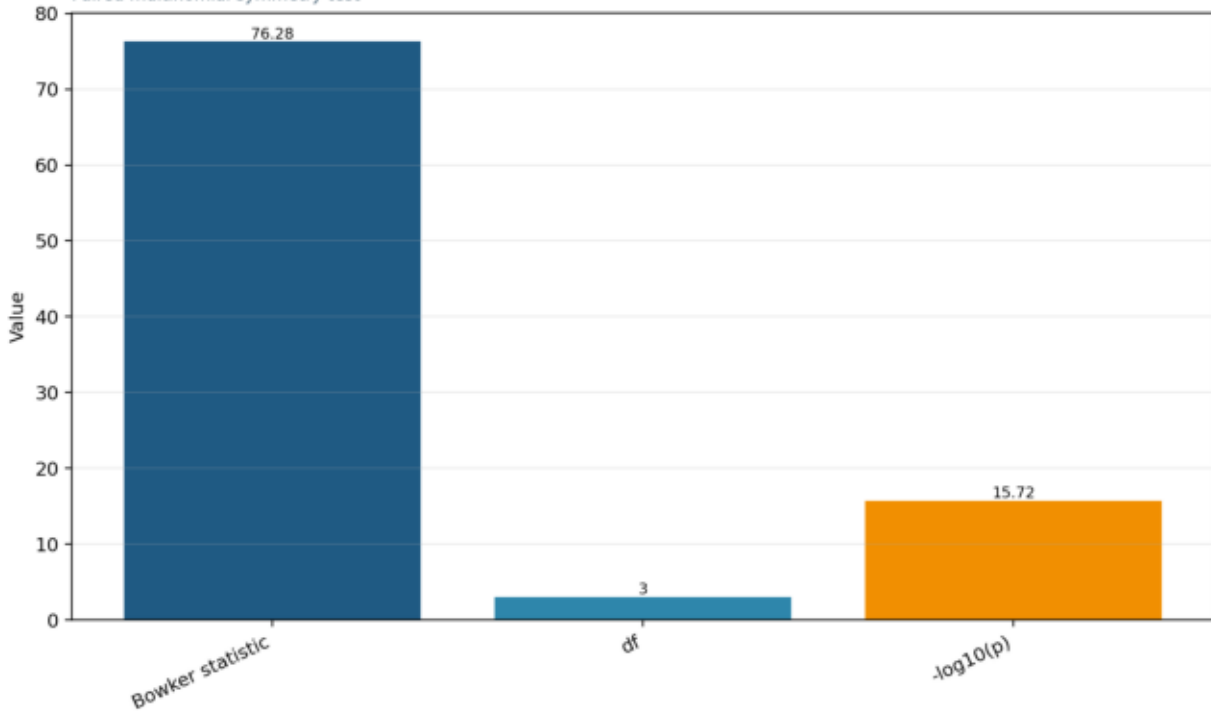
G2 and G3 marginal distributions

Paired category composition over time



McNemar-Bowker result

Paired multinomial symmetry test



Paired Transition Table

Low (<10)	Medium (10-13)	High (14-16)	Very high (17+)
89	56	0	0
11	296	45	0
0	3	102	12
0	0	1	34

Directional Asymmetry

Low (<10)	Medium (10-13)	High (14-16)	Very high (17+)
0	45	0	0
-45	0	42	0
0	-42	0	11
0	0	-11	0

Pair Contributions

i_to_j	j_to_i	difference	contribution
56	11	45	30.2239
45	3	42	36.75
12	1	11	9.30769

Marginal Distributions

G2	G3
145	100
352	355
117	148
35	46