# On constraints and interrelations between nonparametric and polychoric correlations for variables measured on the Likert scale

**Shubhabrata Das**

*Indian Institute of Management, Bangalore, India*

**Abstract**

Nonparametric correlations, such as Spearman's rank correlation and Kendall's tau, have been widely utilized for nearly a century to analyze ordinal data. Chatterjee correlation [1] is a more recent development on that front which captures associations within a broader structure. This study examines these three measures, particularly in the context of ordinal variables measured using the Likert scale. All these measures have adaptations for handling ties. However, for Likert scale variables, ties occur frequently as a norm rather than exception. We specifically investigate whether the Chatterjee correlation can be modified to effectively handle Likert scale data. Since all the above correlations are based on rank, they inherently stem from the perspective of sampled data. The corresponding population parameters have been partially addressed: Nešlehová [2] has explored this for Kendall's tau and Spearman's correlation, while the strong consistency of the Chatterjee correlation also provides some insights. We reflect on these population parameters, with a particular focus on their potential role in factor analysis with Likert scale data, aiming to improve the interpretation of underlying factors. Finally, we explore the possible connections between the different nonparametric correlations and polychoric correlation.

## Keywords

Chatterjee correlation, Factor analysis, Ordinal, Kendal's tau, Spearman's rank correlation.

## References

[1] Chatterjee, S. (2020). A New Coefficient of Correlation. *Journal of the American Statistical Association, 116(536)*, 2009–2022.

[2] Nešlehová, J. (2007). On rank correlation measures for noncontinuous random variables. *Journal of Multivariate Analysis, 98(3)*, 544–567.