

Semiparametric robust mean estimations based on the orderliness of quantile averages

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1 As one of the most fundamental problems in statistics, robust loca-
2 tion estimation has many prominent solutions, such as the symmetric
3 trimmed mean, symmetric Winsorized mean, Hodges–Lehmann es-
4 timator, Huber M-estimator, and median of means. Recent studies
5 suggest that their biases concerning the mean can be quite different
6 in asymmetric distributions, but the underlying mechanisms largely
7 remain unclear. This study establishes two forms of orderliness within
8 a wide range of semiparametric distributions. Further deductions ex-
9 plain why the Winsorized mean typically has smaller biases compared
10 to the trimmed mean; two sequences of semiparametric robust mean
11 estimators emerge. Building on the γ - U -orderliness, the superiority
12 of the median Hodges–Lehmann mean is discussed.

semiparametric | mean-median-mode inequality | asymptotic | unimodal
| Hodges–Lehmann estimator

1 Hodges–Lehmann inequality and γ - U -orderliness

2 **Data Availability.** Data for Figure ?? are given in SI Dataset
3 S1. All codes have been deposited in [GitHub](#).

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