

# Semiparametric robust mean estimations based on the orderliness of quantile averages

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

1 **Inequalities related to weighted averages**

2 So far, it seems plausible that the bias of a reasonable weighted  
3 average should be monotonically related to its degree of robust-  
4 ness in a semiparametric distribution, since it is a linear com-  
5 bination of quantile averages. Analogous to the  $\gamma$ -orderliness,  
6 the  $\gamma$ -trimming inequality for a right-skewed distribution is  
7 defined as  $\forall 0 \leq \epsilon_1 \leq \epsilon_2 \leq \frac{1}{1+\gamma}, TM_{\epsilon_1, \gamma} \geq TM_{\epsilon_2, \gamma}$ . While  
8  $\gamma$ -orderliness is a sufficient condition for the  $\gamma$ -trimming in-  
9 equality, as proven in the SI Text, it is not necessary, as shown  
10 below.

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

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