

**SKEW- t REPLICATED MEASUREMENT ERROR MODEL FOR
METHOD COMPARISON DATA**

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Method comparison studies are designed to determine whether the two methods of quantifying a continuous variable are compatible enough to be used interchangeably. The linear mixed-effects model is often used to model method comparison data when the methods have the same measurement scale. During the data collection, Measurement Errors (MEs) will occur in observations of covariates and response variables, and these mistakes may be caused by using different measuring scales or methods. If these MEs are not considered, the conclusion will be misleading. This study discusses the framework for modelling method comparison data for quantitative measurements with the MEs, called the 'Measurement Error Model' (MEM). These models generally assume normality for true covariates and errors. However, these assumptions are frequently violated in practice due to the skewness and heavy tails. The key objective of this research is to develop a Skew- t Replicated Measurement Error Model (ST-RMEM) under skew- t distribution for true covariate and t distribution for errors with a matching degree for analyzing the degree of similarity and agreement between the two methods. Further, the Skew-Normal RMEM (SN-RMEM) and Normal RMEM (N-RMEM) models were considered for comparative purposes. The expectation-maximization (EM) approach was used to fit the model. The simulation research was carried out to validate the proposed methodology using sample bias (BIAS), standard deviation (SD), root mean square error (RMSE), and coverage probability (CP) measures. These values under ST-RMEM were better than the N-RMEM and SN-RMEM in all cases. Moreover, this methodology is demonstrated by analyzing subcutaneous fat data. In addition, the Total Deviation Index (TDI) and Concordance Correlation Coefficient (CCC) were utilized to assess method agreement. The CCC estimate for ST-RMEM is 0.990, with a lower bound of 0.984, while the TDI estimate for ST-RMEM is 0.034, with an upper bound of 0.050, suggesting good agreement amongst the methods. These results indicate that our suggested model works well for analyzing replicated method comparison data with measurement errors, skewness, and heavy tails, which are frequent in many fields such as medical research, epidemiological studies, economics, and the environment.

Keywords: Agreement, Concordance correlation, EM algorithm, Replicated measurement error model, Skew- t distribution