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## Bias and Multiplicity in Producer Risk Estimation under Simplified Conformity Assessment Models

This work investigates how accounting for multiple sources of input measurement uncertainty affects the estimation of global risk in manufacturing processes. For example, conformity assessment for Non-Automatic Weighing Instruments involves several quantities of interest, one of which is the producer risk—the probability of incorrectly rejecting a conforming instrument—which is strongly dependent on how measurement uncertainty is treated. In current industrial practice, risk estimation is sometimes based solely on compliance with Maximum Permissible Error (MPE) limits using standard weights. Such an approach neglects additional sources of uncertainty and may distort both producers' and consumers' global risk evaluations. In this study, we contrast this simplified framework with more comprehensive scenarios that explicitly account for standard weight uncertainty and the implementation of guard bands. The results demonstrate that omitting these elements leads to systematic bias. Moreover, the analysis reveals multiple input configurations that yield identical global producer risk, indicating non-uniqueness with respect to process centring. In contrast, no such multiplicity is observed for the global consumer risk. These findings highlight the need for more rigorous uncertainty modelling in conformity assessment to ensure reliable risk quantification.

### Special/ Invited session

### Classification

Both methodology and application

### Keywords

producer global risk, input multiplicity, conformity assessment

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