

## **Robustness, Infinitesimal Neighborhoods, and Moment Restrictions**

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### **Abstract:**

This paper explores the issue of robustness in parameter estimation under moment restrictions. Suppose the econometrician observes data generated from a probability distribution that is a perturbed version of the probability measure that determines the parameter value via the moment restrictions. Such perturbation can be regarded as a consequence of data errors, misspecification and other factors, following the literature of robust statistical estimation. There are two aspects in assessing robustness properties of an estimator. One is about bias, that is, the behavior of the limit of an estimator as the model moves away from the true probability measure. The other is about dispersion, often measured by the asymptotic variance of the estimator. As far as one considers a global perturbation, the former factor typically dominates, thereby making the latter a second order issue. An alternative approach is to consider the effect of local perturbation within shrinking topological neighborhoods of the original probability distribution, so that both bias and variance matter asymptotically. Such analysis, put loosely, enables the researcher to assess robustness in terms of asymptotic mean squared error (MSE). This approach is useful in analyzing the robustness of GMM and other methods. Asymptotic optimality results along this line of analysis are presented.