

Adapting to Misspecification

Timothy Armstrong, Patrick Kline, and Liyang Sun*

February 2023

Abstract

Empirical research typically involves an efficiency-robustness tradeoff. A researcher seeking to estimate a scalar parameter can invoke strong assumptions to motivate a restricted estimator that is precise but may be heavily biased if the assumptions are violated, or they can relax some of these assumptions to motivate a more variable unrestricted estimator that is asymptotically unbiased. When a bound on the bias of the restricted estimator is available, it is optimal to shrink the unrestricted estimator towards the restricted estimator. For settings where a bound is not known, or when that bound may not be sharp, we propose shrinkage estimators that are adaptive: they minimize the percentage increase in worst case risk relative to an oracle that knows the magnitude of the restricted estimator's bias. We show how to compute the adaptive estimator by solving for a least favorable prior in a weighted convex minimax problem. A simple lookup table is provided for computing the adaptive estimates from the restricted and unrestricted estimates, their standard errors, and their correlation. We revisit several influential empirical papers and study how estimates of economic parameters change when adapting to misspecification.

*We thank Isaiah Andrews, Manuel Arellano, Stéphane Bonhomme, Bryan Graham, and Aleksey Tetenov for helpful discussions on this project. Replication code is available at <https://github.com/lusun20/MissAdapt>. The paper also benefited from the comments of conference audiences at Aarhus Workshop Econometrics I, CEMFI Fall Econometrics Conference, and ASSA 2023. Liyang Sun gratefully acknowledges support from the Institute of Education Sciences, U.S. Department of Education, through Grant R305D200010.