Randomization Tests under a Weak Convergence Assumption

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Abstract

Randomization tests provide a general means of constructing tests that control size in finite samples whenever the distribution of the observed data exhibits a symmetry under the null hypothesis. Here, by a symmetry we mean that the distribution of the observed data remains invariant with respect to a group of transformations. In this paper, we provide conditions under which the same construction may be used to construct tests that asymptotically control size whenever the limiting distribution of a function of the data exhibits a symmetry under the null hypothesis. An important application of this idea is in settings where the data may be grouped into "clusters" where the parameter of interest is identified within each cluster. In such settings, we show that a function of the data satisfies our symmetry requirement under weak assumptions. In particular, our results allow for the clusters to be heterogeneous and also have dependence not only within each cluster, but also across clusters. We show that our approach enjoys several advantages over other approaches in these settings. Among other things, our approach leads to a test that is asymptotically similar, which we show via a simulation study translates into improved power at many alternatives. Finally, we use our results to revisit the analysis of Angrist and Lavy (2009), who use differences-in-differences to examine the impact of a cash award on exam performance for low-achievement students in Israel.

KEYWORDS: Randomization tests, clustered data, differences-in-differences, heterogeneity, weak convergence

JEL classification codes:

References

Angrist, J. and Lavy, V. (2009). The effects of high stakes high school achievement awards: Evidence from a randomized trial. *American Economic Review* 1384–1414.