Replication and Evidence Factors in Observational Studies: Multiple possible Instruments Plus Control Groups as Evidence Factors in a Study of the Effectiveness of Catholic Schools

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Abstract:
A series of observational studies can replicate each other in finding an association between an exposure and an outcome. But if each of these studies is susceptible to unmeasured biases in the same way this replication does not strengthen the evidence for a treatment effect. Conducting the same observational study with a larger sample size also does not strengthen the evidence. To be of value, a replication should remove, or reduce, or at least vary a potential source of bias that resulted in uncertainty in earlier studies. Multiple analyses provide evidence about unmeasured biases if: (i) certain biases that would invalidate one analysis do not bias another analysis, (ii) each analysis is insensitive to small or moderate biases of the type that might invalidate that analysis, and (iii) these several analyses would be nearly statistically independent if the treatment had no effect. Analyses of this type are possible in a single study; these analyses are called “evidence factors”. I will provide a general introduction to evidence factors. Evidence factors analysis is often available to us in various types of studies. I will present some design and analytic tools to form evidence factors in a study. I will demonstrate these tools in forming 3 evidence factors in a study of the effectiveness of Catholic high schools on income that has a couple of instruments: being Catholic and living close to a Catholic school; neither of which is unarguably a valid instrument for going to a Catholic school.

Keywords:
Causal inference; evidence factors; instrumental variables; sensitivity analysis

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