Using Multisite Instrumental Variables to Estimate Treatment Effects and Treatment Effect Heterogeneity

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The present study examines the performance of five estimators in estimating the treatment effect and treatment effect heterogeneity under simulation constellations that resemble the features of the large-scale multisite trials in education, such as those examined in Weiss, et al (2017). Importantly, the data-generating model includes some degree of **non-compliance** at each site.

Estimator	Description
$MSTIV_{pooled}$	Instrumental variables approach that pools data across sites
$MSTIV_{2SLS}$	Uses site-by-treatment instruments in 2SLS
$MSTIV_{EB}$	Uses shrunken first-stages estimates in second stage of 2SLS
ITT	Multilevel model focusing on effects of treatment assignment
AsTreated	Multilevel model focuses on observed treatment receipt (ignores randomization)

Data-Generating Model Design Factors	
Parameter	Levels
Treatment Effect	0, 0.3, 0.7
Treatment Effect *sd*	0, 0.1, 0.25
Compliance	90%, 75%
Selection Bias	0.1, 0.25, 0.5
Number of Sites	200, 100, 50, 20
Average N per Site	200, 100, 50, 20

Treatment Effect Bias and RMSE by Estimator

DGM Values			Bias				
Treatment Effect	Compliance	Selection Bias	$MSTIV_{pooled}$	$MSTIV_{2SLS}$	$MSTIV_{EB}$	ITT	AsTreat
Panel A: Treatment Effect Varies							
0.7	75%	0.25	-0.001	0.008	-0.001	-0.175	0.125
0.3	75%	0.25	-0.006	0.002	-0.006	-0.08	0.122
0	75%	0.25	0.001	0.008	0.001	0.001	0.126
Panel B: Compliance Varies							
0.3	90%	0.25	0.001	0.003	0.001	-0.029	0.050
0.3	75%	0.25	-0.006	0.002	-0.006	-0.080	0.122
Panel C: Selection Bias Varies							
0.3	75%	0.5	-0.001	0.015	-0.001	-0.076	0.252
0.3	75%	0.25	-0.006	0.002	-0.006	-0.080	0.122
0.3	75%	0.1	0.000	0.003	0.000	-0.075	0.052

Note: 50 sites, average of 20 simulees per site, Treatment Effect sd = 0.25. Allocation (50%) and compliance were drawn from an interval of U(-10%, +10%) of their average generating values.

Summary

MSTIV estimators provide unbiased estimates of the effect of actually receiving the treatment, but tend to over-estimate treatment effect heterogeneity when lower levels of heterogeneity are present.

The ITT estimator provides a conservative estimate of the true treatment effect proportional to the degree of noncompliance.

AsTreated estimates are biased in proportion to level of non-compliance and the degree of selection bias.