Robustness of Quantal Response Models with Omitted Variables

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Abstract

An increasingly popular method for integrating formal models with empirical tests is quantal response modeling. However, prior Monte Carlo work has assumed that the quantal response model captures exactly the data generating process, which doubtfully would be the case in many models. To test the properties of such models, I run Monte Carlo experiments to see how a full model of the specified system compares to a model of statistical backwards induction (SBI) when the models either omit a variable or use only a proxy variable. As endogeneity increases, SBI estimates start to fare better than the system model, suggesting that SBI is a more robust method for fitting a game theoretic model to field data.

1 Puzzle

Robustness

- Past research assumes the model captures the data-generating process.
- Can the method withstand omitted variable bias?

Estimation Techniques

- Generate a stochastic formal model.
- System model: Directly derive a maximum likelihood estimator (Signorino 1999).
- SBI: Estimate final decision with a probit model, then use the predicted probabilities to estimate prior decisions (Bas, Signorino, & Walker 2006).

2 Method

- Data-generating process: Signorino's crisis bargaining model (Figure 1).
- Misspecify one utility function in analysis.
- Test for estimate properties in two cases: measurement error & endogeneity.
- Compare estimates from system model to SBI estimates.

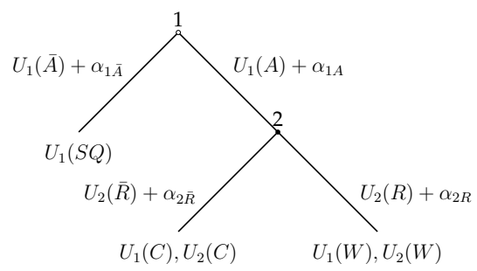

Figure 1: Crisis Bargaining Model

3 Results

Table 1: Percent of bias by measurement error

Specification	Parameter	SBI	System
Full	β_1	-0.82	9.89
	β_2	0.36	8.09
	β_3	-0.13	7.84
	β_4	1.14	7.99
0.9 proxy	β_1	-2.19	10.13
	β_2	-0.75	8.01
	β_3	-5.13	8.03
	β_4	-13.90	14.57
0.7 proxy	β_1	-3.99	10.84
	β_2	-2.49	8.32
	β_3	-11.46	12.01
	β_4	-38.12	38.12
0.5 proxy	β_1	-5.22	11.25
	β_2	-3.89	8.77
	β_3	-15.07	15.31
	β_4	-58.36	58.36

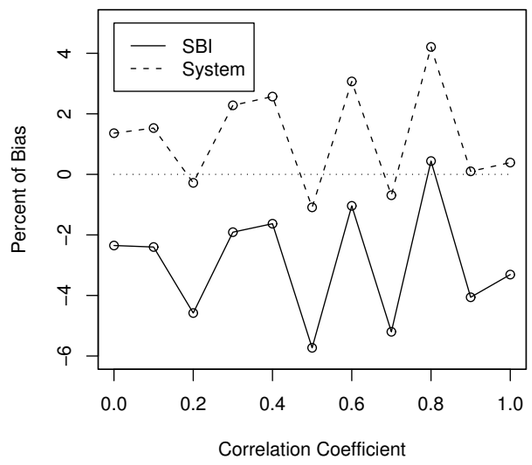

Figure 2: Percent of bias in $\hat{\beta}_1$ by level of endogeneity

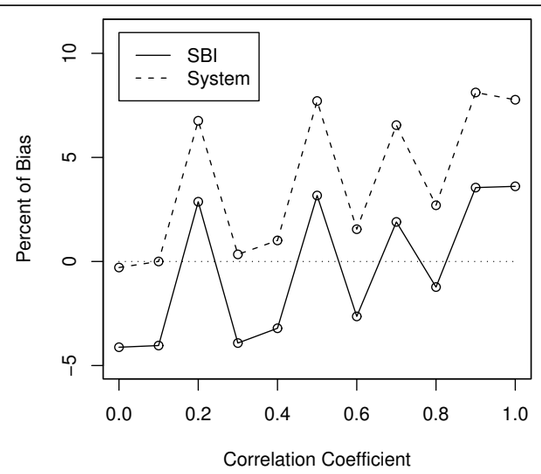

Figure 3: Percent of bias in $\hat{\beta}_2$ by level of endogeneity

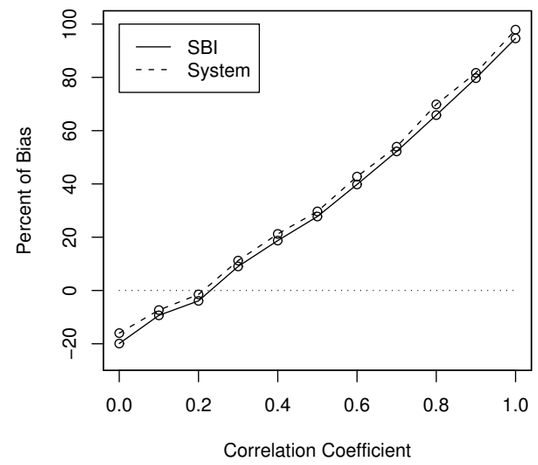

Figure 4: Percent of bias in $\hat{\beta}_3$ by level of endogeneity

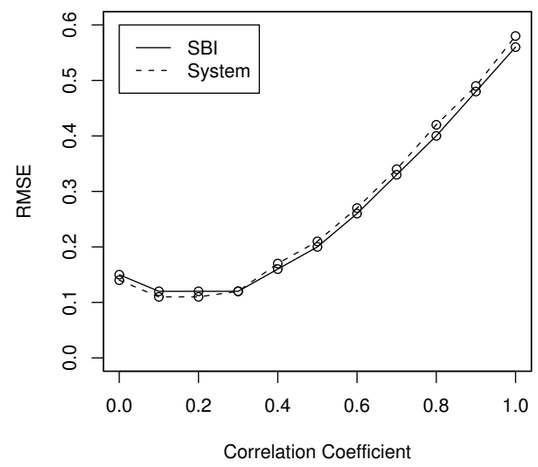

Figure 5: Root mean squared error by level of endogeneity

4 Discussion

Results

- The system model performs marginally better with measurement error and low levels of endogeneity.
- SBI performs marginally better with high levels of endogeneity.

Next Question

- Does SBI produce different field results from past system models?