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Manna from Heaven or Forbidden Fruit? The (Ab) Use of Control Variables in Research on International Conflict

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Model specification is a ubiquitous challenge in the social sciences. While this issue of *Conflict Management and Peace Science* is dedicated to addressing this topic in the context of research on international conflict, the discussion among the contributors also contains general lessons and debates relevant to statistical analyses of political, economic, and social phenomena. The reader might suspect that when Glenn Palmer first approached us with the idea of putting together a roundtable and special issue on using control variables, we yawned. Nothing could be further from the truth. Not only did we think the topic warranted some good debate and dialogue, but we already had in mind some lively, articulate, and bright scholars who would offer clever insight.[1] We apparently were not alone in our estimation: a record-breaking, spirited audience attended a roundtable featuring these individuals at the 2004 Peace Science Meeting in Houston, Texas. We are confident that the readers of this volume will similarly be engaged and will find the dialogue on the contributions and weakness of control variables useful for their own research.

The origins of this special issue can be traced to James Lee Ray's 2002 Presidential Address to the Peace Science Society (published in 2003). In that address, Ray argued that international conflict scholars had become obsessed with control variables. He warned us of the perils of interpreting results from models with too many independent variables and set down five guidelines for assessing whether to use controls and how to do so if one must. Returning to that theme, Ray leads off this issue with a paper demonstrating what he would consider the pitfalls of multivariate analysis by examining a particular research program, namely a series of dyadic democratic peace papers. John Oneal and Bruce Russett take Ray to task in the next paper, arguing that their own democratic peace research would not have progressed, especially in terms of being able to evaluate alternative theories, without the use of control variables. In our own contribution to this issue, we make a leap of faith and submit some of our own research on the *systemic* democratic peace to Ray's five guidelines,

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[1]We must confess to the prideful sin of including ourselves in this group of intellectuals.

with the goal of evaluating whether and how our substantive results change. We hasten to point out that the control variable debate is not only relevant to democratic peace research. The Ray, Oneal and Russett, and Kadera and Mitchell papers all treat the democratic peace research as an example of the pros and cons of the guidelines in action.

The next three papers move more explicitly to the realm of general research design issues. Entering the discussion, Christopher Achen raises an additional concern regarding the use of control variables. In particular, he examines whether an errant assumption of linear relationships between independent and dependent variables aggravates estimation errors stemming from additional controls. Kevin Clarke directly addresses omitted variable bias, arguing that including more control variables can just as easily cause bias and efficiency problems as remedy them. Tying things together nicely at the end, Harvey Starr connects the issues raised by the other authors to broader themes of theoretical specification, logic of inquiry, and knowledge accumulation.

Several important themes emerge from this compilation of work. First, all contributors stress the importance of rigorous, logical theories for guiding empirical analyses, which entails, at a minimum, clearly specifying the relationships between our independent and dependent variables. Yet, theory development is as much art as science, involving the discovery of interesting puzzles (Zinnes, 1980) and the creation of persuasive arguments to solve them. The study of world politics has witnessed multiple forms of theory development, from induction to descriptive analyses to mathematical modeling. At stake, however, is convincing peers that one's theoretical model is more persuasive than alternative models. From a positivist standpoint, this entails subjecting our theoretical hypotheses to systematic empirical tests.

Yet, the discussion in this volume indicates that even among positivists, there is no single agreed upon format for theory development and testing. At one extreme lie advocates of simple bivariate models and advocates of formal models with very few variables, preferably linked mathematically to statistical models.[2] At the other extreme, we see scholars worried about omitted variable bias attempting to integrate multiple theoretical approaches and producing empirical models with a wide variety of control variables. These models are designed to rule out competing explanations, but advocates of simple models warn that the inferences for our key variables of interest may be biased by the inclusion of these competitors. The contributors to this issue discuss a variety of trade-offs involved in this theoretical modeling process—bias versus efficiency, parsimony versus comprehensiveness, and rigid (e.g., Rule of Three) versus flexible modeling strategies—exposing readers to a wide range of important issues that must be confronted when designing and testing theories.

Second, we need to adopt a more sophisticated approach when developing empirical models, moving away from a "kitchen sink" mentality, and thinking more carefully about the empirical domains to which our theories apply best. This requires detailed attention to both the theoretical and empirical relationships among our independent variables, as Ray (2003) notes when distinguishing competing variables from confounding variables. It also entails the use of descriptive statistical tools to carefully examine our data, especially across different domains (time periods, regions, actor types, etc.). However, large N universes, made possible largely by dyadic datasets, have made ocular inspection of data more difficult.

Third, research questions are best addressed through multiple methods. Large N studies have proven useful in the analysis of international conflict, as Oneal and Russett's paper demonstrates, but we also need to examine theoretical relationships in critical cases and specific contexts (what Most & Starr (1989) label "nice laws"). Work on the democratic

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[2]The latter strategy is advocated by the EITM (Empirical Implications of Theoretical Models) project. For an overview, see Granato and Scioli (2004).

peace is exemplary, as large *N* analyses have been complemented by case studies (e.g., Elman, 1997; Peceny, 1997) and analyses of particular regions (e.g., Lemke, 2002), particular dyads (e.g., Mousseau, 2000), or specific time periods. As Scott Bennett noted in the discussion at the Peace Science Society roundtable, we have a lot of confidence in the democratic peace findings because a plethora of scholars have examined the question using a large variety of empirical tools. Perhaps we should stop training our graduate students to search for the elusive "Holy Grail" of models, and instead teach them how to approach research questions with a variety of theoretical and empirical tools, a theme articulated clearly in Most and Starr's (1989) influential volume on IR research design.

Fourth, because the search for the "Holy Grail" is nearly impossible, we need to provide better information about the robustness of our empirical findings to various model specifications. A typical solution in the IR literature is to present a handful of models to satisfy readers that alternative explanations have been given a fair hearing. Yet, as the number of independent variables increases, the number of possible model specifications explodes, leading to the possibility of running millions of regressions (Sala-I-Martin, 1997). Following in the spirit of Edward Leamer's Extreme Bounds Analysis (EBA), our paper in this volume advises striking a balance between these extremes by limiting the number of control variables included while also presenting the range of parameters and predicted probabilities across all possible model specifications. In sum, knowledge accumulation would be easier if we had a better sense of the uncertainty surrounding our empirical findings.

Finally, a public expression of gratitude is in order. For being good sports and producing excellent research papers, many thanks go to the contributors. For plentiful comments and useful suggestions, we thank the many anonymous reviewers for this issue. Most importantly, we thank Glenn Palmer for coming up with the idea for this special issue and for giving us the opportunities to host a lively roundtable and to pull these papers together in a single publication.

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