

# An Empirical Test of New Forecasting Methods Derived from a Theory of Intelligence: The Prediction of Conflict in Latin America

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**Abstract**—The “compromise” method is a new computer-based forecasting tool, available within the conversational CS package on the MIT Multics. Like regression (least squares) or new forms of Box–Jenkins methods, it estimates the parameters of a multivariate dynamic model and may be used for causal analysis or policy impact analysis. Unlike those maximum-likelihood methods, it does not assume that errors are “white noise,” random and normal. It follows the newer robust philosophy of trying to minimize estimation errors on the assumption that noise will be inextricably dirty. In the case of “strong” dynamic models—models which predict that changes in present variable values lead to comparable changes in future variable values—it may reduce parameter errors by an order of magnitude. Forecasting errors will also be reduced, although the degree of reduction depends on how much randomness exists in the process. When we used the compromise method according to the new “bias” procedure, in order to reestimate the *J-5* model (a nonlinear multi-equation model used by the Department of Defense in long-range forecasting), forecasting errors were reduced by between 0 and 45 percent (with a median of about 20 percent) across different variables, as compared with regression. With simultaneous-equation econometric models, it has reduced them by 50 percent. The procedure has been documented for use by nonprogrammers [1]; it incorporates a new quasi-Newtonian method which can handle many parameters.

## I. BASIC RESULTS

IN 1974, we suggested that a new class of robust methods could outperform regression and Box–Jenkins methods in long-range forecasting [2]. These robust methods did quite well in preliminary tests, but until January 1978 they had never been tested in their ability to estimate multiequation models. These methods share a common philosophy with the better known robust methods of Mosteller, Tukey [3], and others: instead of assuming that a model is perfectly “true” in some form, as in conventional maximum-likelihood estimation, where one maximizes an abstract “probability of truth,” we try to estimate the parameters of a

model in such a way that the model will do a workable job of forecasting *despite* the “dirty noise,” the imperfect specification, and the limited coverage of any realistic model in the social sciences. According to maximum-likelihood theory, one can deduce the “proper method” by elegant abstract reasoning purely from first principles; however, the robust philosophy emphasizes the need for empirical tests—like this one—and the need for an operations-research style of thinking, even when one is carrying out careful mathematical analysis.

In our initial test, we have compared regression against the most up-to-date version of the robust method, the “bias” method formulated in October 1977. We used both methods to estimate the equations of the revised *J-5* model, a model developed by CACI [4], [5] to predict socioeconomic and conflict variables worldwide; forms of this model based on regression are now being used by the Defense Intelligence Agency, *JCS/J-5* and others, to provide long-range forecasts which guide global strategic planning. We found that the bias version of the model outperformed the regression version across virtually all variables for essentially all time intervals of prediction. The median improvement, across variables, was a reduction of roughly 20 percent in the size of errors. The improvement varied over a fairly uniform range, from one case with no improvement (population) to another with a 45 percent cut in error (gross domestic product (GDP)). With population, the bias forecasts seem to be worse, but this is probably a numerical artifact (see the last paragraph of Section III-E). All of this is shown in Table I, where the column for regression “Reg.” may be compared with the column for the new bias method “Bias (actual)”. The rest of this report deals with the interpretation and analysis of Tables I–IV. More recent results have shown an even stronger improvement over regression (median 50 percent).

In this test, we studied the ten Latin American countries for which we could find highly reliable data from 1950 to 1967: Argentina, Brazil, Chile, Columbia, Ecuador, Guatemala, Honduras, Mexico, Peru, and Venezuela. We focused our attention on the “core” of the *J-5* model, the part which predicts the following variables: population, gross investment, domestic government spending, defense expenditure, GDP, consumption, imports, exports, tension ratio,

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