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Corrections to Rule-based Forecasting: Findings from a replication

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Corrections to Rule-Based Forecasting: Findings from A Replication

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Abstract
Rule-Based Forecasting (RBF) is an expert system that combines forecasts from simple extrapolation methods based on features of time series. In this study, we provide corrections to ten of the 99 rules contained in RBF. These corrections were identified during a replication of RBF. Empirical comparisons indicate that the corrections did not lead to a noticeable improvement in accuracy when tested against some of the original data. However, in light of the fact that several studies are extending the work on RBF, it is important to report on these corrections to RBF.

Keywords
Calibration, Validation, Rule-based systems

There are numerous benefits in replicating empirical studies. In particular, direct replications can validate previous findings and test for mistakes. Adya (1996) conducted a replication of Collopy and Armstrong's (1992) Rule-Based Forecasting (RBF). While translating Rule-based Forecasting from a Pascal-Hypercard platform to a more efficient and accessible C++ platform, Adya (1996) identified ten errors in the reporting and implementation of the rules. Some errors were found by a visual comparison of the original and replicated models. Others were identified when detailed trace routines that mapped the outputs of both versions of RBF revealed differences.

Independent extensions and tests of RBF have been published by Vokurka et al., 1996, Tashman & Kruk, 1996, and others. Still others are in process. Therefore, it is important to fully report on corrections to RBF.

Six of the rules contained in RBF were incorrectly reported in Collopy and Armstrong (1992) but were correctly implemented in RBF's working version. The corrected versions of these rules are presented in the Appendix A. Four of them (rules 34, 35, 74, 75) failed to indicate the correct formula for causal force adjustments of short and long model levels. Two (32, 71) failed to pick up a weighting change made during calibration. Four rules (33, 69, 72, 85) were correctly reported in Collopy and Armstrong (1992) but were incorrectly implemented in the working version of RBF.

To examine the effects of corrections to the last four rules, we reanalyzed Validation 3, involving 36 time series from the M-competition data set (Table 3 in Collopy & Armstrong, 1992). Rules 33 and 69 influenced 13 series in this sample. Rule 79 applied to 14 time series while rule 85 did not apply to any series.

The Table reports Mean Absolute Percentage Errors (MAPEs) for V3 on the corrected version of RBF. Results indicate that there were no significant changes in forecast accuracy as a consequence of these corrections. This is possibly because the corrected rules constitute only 4% of the rule base and because few of these series were affected by the rules. In short, the replication adds support to the previous findings.

Forecast errors do not change significantly after correction			
median APEs for validation sample V3			
	1-ahead	6-ahead	Cumulative
RBF in C&A	6.3	23.6	15.0
RBF Corrected	6.2	23.3	14.7

Copies of the updated rule-base are available to those who are interested in doing research on rule-based forecasting. (It is not available for commercial purposes.) The complete set of corrected rules is provided at http://forecasting.cwru.edu.

It is recommended that researchers use corrected rules for further research. The corrections might be important when making extensions to new types of data.

Acknowledgements

Appendix A. Corrections to RBF rule-base

The following rules were incorrectly reported in Collopy and Armstrong (1992) but were correctly implemented in RBF. The rules 32, 34, and 35 relate to the short model while rules 71, 74, and 75 apply to the long model.

Rules 32 and 71: unstable recent trends

IF there is an unstable recent trend THEN add 45% to the weights on the random walk and subtract it from that on the other three methods. (The weight adjustment was incorrectly reported as 30%.)

Rules 34 and 74: last observation consistent with causal forces

IF the difference between the last observation and the current level is in the same direction as the causal forces THEN replace the level by L'=L+((0.3{abs(x-L)/s)})∗x-L)), where x is the last observation, L is the level determined from the application of the short model level estimation rules, and S is the standard deviation of the trend adjusted series. (The level adjustment was incorrectly reported as L'=L+0.3{abs(x-L)/s)}.)

Rules 35 and 75: last observation inconsistent with causal forces

IF the difference between the last observation and the current level is not in the same direction as the causal forces THEN replace the level by L'=L-((0.3{abs(x-L)/s)})∗(x-L)), where x is the last observation, L is the level determined from the application of the short model level estimation rules, and S is the standard deviation of the trend adjusted series. (The level adjustment was incorrectly reported as L'=L-0.3{abs(x-L)/s)}.)

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