Time-Series Econometric Forecasting:
Global Forecast of the Price of a Raw Material

Category: *International Manufacturer*

Methods: *Autoregressive Time-Series Regression, Decision Tool, Econometrics, Ensemble Model, Model Validation, Time-Series, Forecasting, Variable Selection*

Summary

A client company (an international manufacturer) had experienced unprecedented volatility in the price of a primary raw-material input used to produce several of its products. The client desired to build a forecasting model to forecast the price of the raw material input, for 1 to 12 months into the future. A time-series dataset was constructed, including monthly data for the price and approximately 1,200 current-period or lagged potential predictor variables. An ensemble of Autoregressive Time-Series Models were developed to predict future prices. The client company used forecasted raw material prices to better control costs of production and to increase profitability.

Strategic Issues

Rapid growth in Asian economies were causing periodic excess demand and large increases in the price of a particular raw material input to the client's production process. In addition, new supplies of this raw material were rapidly appearing causing its periodic oversupply and consequent reduction in price. In order to better manage raw-material inventories and improve profitability, our client needed to anticipate future changes in the raw material's price.

Research Objectives

The purpose of the research was to develop a forecasting model of the global price of a particular raw material. Specifically, the goals were to:

- Assemble a database of macroeconomic time-series variables that would serve as potential predictors of the price of the raw material.
- Apply time-series regression techniques to build a robust forecasting model of the price of the raw material.

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- Produce a forecast simulation tool, enabling our client to input updated predictor variables and view updated forecasts of the price of the raw material.

Research Design and Methods

The Advanced Analytics team constructed a time-series analysis dataset, adjusting all series to be monthly, appropriately handling missing values. Variable selection methods were applied to more than 160 macroeconomic variables to identify the most promising linear and nonlinear predictors, lagged predictors, and combinations of predictors. Measurement of predictive power was based on mean absolute prediction error. More than 2000 unique econometric models were investigated and evaluated in order to identify the 5 top models for each desired forecast time horizon (1 month, 2 months, 3 months, 6 months, 9 months, and 12 months).

A forecast simulator was built based on an ensemble of Autoregressive Time-Series Models to forecast 1, 2, 3, 6, 9, and 12 months into the future, correcting appropriately for serial correlation (the correlation over time of the impact of unobserved variables on the variable being predicted—in this case, price). The ensemble technique combined forecasts from multiple models, thus increasing forecast reliability.

Results

An Excel-based forecasting tool was developed that allowed the client's management team to enter updated values of predictor variables each month and forecast the future price of the raw material.

The client company subsequently validated the model by comparing forecasted vs. actual values for the first several months. The resulting forecast accuracy was impressive, causing the client company to:

- Use the model forecasts as an input to business operations.
- Commission a subsequent study, applying the forecasting method in another product category.

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