

# The Catchword Phrase

Let's define the different types of programs that do "automatic modeling":

1. The user specifies the model and the data and wishes the software package to automatically estimate the best parameters for the given model. This is a very narrow definition of "automatic forecasting".
2. The user specifies the data and a number of models that are to be tried and pitted against one another in order to assess the best model and the companion best set of parameters. This is analogous to forcing the data to conform to a previously specified model or set of models coming from a list. The concept of shoe-horning comes to mind. Different software packages try 10, 50 and even 500 "different models" in this kind of gambit. Some of these "different models" are simply different power transformations like logs, reciprocals, etc. Some software packages use a "within sample data" approach with the user selecting either explicitly or implicitly the particular statistic that is to be used to determine the best model e.g. R-squared or the AIC or the MAD. Other packages retain a few values (n) from the tail end of the series and measure a pure forecast error statistic for purposes of the competition and model selection. On first blush this would seem to be appropriate, but after review a glaring hole is found in this logic. What happens if you use a different "n". This normally is referred to as the tail-wagging-the-dog syndrome as totally different conclusions can be obtained simply by changing "n". These procedures fail in practice due to the lack of objectivity driven by the selection of "n", the withheld values. This definition is less narrow than Option 1, but a far cry from Option 3.
3. The user specifies the data and the software package generates a series of possible models based upon the data. In this approach the number of models, their form is data driven not model list driven as in Option 2. Model identification proceeds as if an intelligent reviewer was at the helm performing pattern recognition based upon the data. After due diligence trying each of the logically selected models with associated optimal parameters the system declares a winner. The extent of the dynamic (i.e. data-driven) model selection is an important factor in assessing how aggressive individual software packages are in ferreting out the best model. Some packages incorporate the detection not only of the autoregressive memory, but allow the specific inclusion of Pulses, Level Shifts, Seasonal Pulses and Local Time Trends. An important distinction frequently overlooked is if the model selection process include tests of necessity and or sufficiency or does it simply report a final model that may be blemished in either regard. Statistical forecasting can be relegated completely to the automatic forecasting capability of forecasting software if the software performs the required analytical functions in order to assess a statistically correct model. Some software packages are not generally capable of recognizing and adjusting for "special events". A one time special event occurring in a recent October may well lead to a model that erroneously projects upward spikes in all Octobers to come. This important distinction reflects the need to distinguish a Pulse from a Seasonal Pulse. For example, a one-time outlier or pulse in a recent October is accounted for and does not correctly reflect a permanent condition whereas a sequence of unusual pulses in recent October's may well augur for the need for suggest permanent October effect.

**The catchword phrase** “automatic forecasting” is used by a number of software manufacturers to define their product. There are important reasons to pursue exactly how the term is being used in order to assess the degree of automation that is in place. We discuss the concept of “automatic modeling” and non-automatic forecasting as the mere routinization of repetitive interaction is a necessary component, but not a sufficient component.

The software package should stipulate if the automatic process applies to just univariate ( no explicit Exogenous variables or events suggested by the user ) or to both univariate and causal models where causal variables can either be suggested by the user or empirically identified by the software itself. If the data is clean and free of unusual activity then Option 2 (seen below) will normally suffice. Like an automatic transmission, automatic forecasting using the limited shoe-horn approach of Option 2 will work well in normal and usual circumstances. When the road is rocky and full of turns as real-world data is then one needs to have inline sensors that adjusts the speed and traction capabilities thus providing a proxy for a skilled driver with a manual transmission. For difficult data, there is a useful alternative for professional model evaluation and this is Option 3 fully implemented and capable of rendering a final model that contains a sufficient set of parameters which generate a noise process that is free of correlative structure and meets the Gaussian requirements including a zero mean everywhere and constant variance.

Furthermore, suggested causal variables may have a lead effect in order to correctly measure the impact e.g. demand for beer in advance of the holidays or reduced demand by a consumer after having been advised of a deep discount that starts two days hence.

Asking the user to construct these lead variables and submit them for a back-stepping procedure denies the existence of an automatic process. The software should perform this task not the user.

This definition of “automatic forecasting” is much more comprehensive and fundamentally describes the software developed by Automatic Forecasting Systems. In summary one has to ask the salient question. “Can the software develop a model that has never been developed before? If the answer is “Yes” then the software package passes the **Litmus Test** for thoroughness.

It is important that the implementation of Option 3 utilizes an all-possible approach to developing suggested models. Consider the case where exogenous variables exist. There are six possible approaches before considering power transforms, variance changes and/or parameter changes.

- A fix ARIMA structure then the X Lag structures and then develop the Intervention Variables
- B fix ARIMA structure then the Intervention Variables and then the X Lag structures
- C fix the X Lag structures then the Intervention Variables and then the ARIMA structure
- D. fix the X Lag structure then ARIMA structure and then the Intervention Variables.
- E. fix the Intervention Variables then the X Lag structure then the ARIMA structure
- F. fix the Intervention Variables then the ARIMA structure and then the X Lag structure