Recent Developments in Econometrics and Time Series: Implications for Forecasting Model Development and Evaluation (Abstract)

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In this talk, I consider some general methodological points and selected recent developments in Econometrics and Time Series which have implications for forecasting model development and evaluation.

As regards general methodological points, we all wish to become expert in forecasting, model development and evaluation. As is well known, an expert is a person who knows the facts and theory of his area and is successful in applying theory to explain past data and to predict as yet unobserved data. Thus to become expert, there is a need to "know the facts". In this regard, there are some "ugly facts" which contradict our pet theories and models and there are some surprising and unusual facts which may be in our data. Both types of facts are of extreme importance, the former for obvious reasons and the latter for their role in prompting the discovery of new theories and models, as emphasized by Hadamard (1945) and others. Also see Zellner (1984) for eight ways to produce unusual facts. All of this points to the extensive use of statistical data analysis techniques designed to identify outlying points and other anomalies in our data and modern statistical graphics so that information in our data can be fully apprehended. Tabular presentations of coefficient estimates, standard errors, etc. are usually not satisfactory summaries of the information contained in a sample of data. In our work on forecasting output growth rates for 18 countries, we have found the use of boxplots and various graphical displays to be extremely useful in summarizing the information in our data.

On theory and modeling, many scientists emphasize that simple models and methods will probably work well in explanation and prediction, the content of Sir Harold Jeffreys's Simplicity Postulate. In U.S. industry, there is the expression KISS, keep it simple stupid. Since some simple models are stupid, I have reinterpreted KISS to mean, keep it sophisticatedly simple. In econometrics, there is a decided tendency to work with models that are much too complicated, for example macroeconometric models containing hundreds of nonlinear stochastic difference equations. For such models, it is extremely difficult to establish whether they have a unique or many solutions and to explain how the models work. Also, their forecasting records have not been exceptionally good---see McNees (1986). The same can be said regarding the use of unrestricted VAR models containing many variables and parameters. To make this point regarding the negative aspects of complexity strongly, in our recent research a single equation autoregressive model of order three containing lagged leading indicator variables was formulated and used to forecast output growth rates and turning points for 18 countries with results that compare favorably with those of large complicated models. An autoregression of order three was employed to permit the existence of two complex conjugate roots and a real root, which has been established empirically by Hong (1988). An "ugly fact" was the finding, contrary to my expectations that an AR(3) model was inadequate in forecasting because it missed badly in the vicinity of turning points. Fortunately, the addition of lagged leading indicator variables improved forecasting performance significantly.

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To summarize, there is a need to be very familiar with one's data, to discover ugly and unusual facts, and to analyze data using statistical graphics, other data analytic techniques, and sophisticatedly simple methods and models. If such methods and models produce good explanations and predictions, the job is done. If the ugly fact of poor performance rears its head, with simple methods and models, it is usually not too hard to figure out what is going wrong, as in the case of the AR(3) model's poor forecasting performance mentioned above, and to patch up the difficulty. Note that this advice conflicts with that of "experts" who recommend models with an infinite number of parameters or models with hundreds or thousands of nonlinear equations, etc. etc. I have never seen a model with an infinite number of parameters or any other very complicated model which works well in explanation and prediction in any area of science. Have you? However, there are many sophisticatedly simple models in science that do work well.

With respect to recent developments in econometrics and time series, there have been so many that it is difficult to comment on all of them. I shall just mention several that we have found useful in our forecasting work. First, Steinian shrinkage techniques have proven useful in improving forecast performance in our work and in earlier work of Thisted and Wecker (1981). In our case, we have a univariate autoregressive leading indicator model (ARLIM) for each of 18 countries. The parameters' values for different countries are not exactly the same but they are somewhat similar. Various shrinkage techniques allow workers to model coefficient vectors as being drawn from a population with a common mean vector and thus to exploit the information that the coefficient vectors are not radically different in value to improve forecast precision. This is indeed a capability which should be of great value in a number of different contexts.

Second, we have found time varying parameter models (TVPMs) to be useful in our work in that they yield forecasts that are somewhat better than those yielded by fixed parameter models. As is well known, parameters may not be fixed in value because of aggregation effects, economic agents' use of adaptive optimization, economic policy changes, etc. Also, TVPMs are nonlinear time series models which can have properties radically different from fixed parameter models. Convenient recursive algorithms are available for implementing TVPMs empirically in a Bayesian fashion--see e.g. West, Harrison and Migon (1985) and Highfield (1986). In our experience with macroeconomic data, recursive parameter estimates indicate that parameters of our ARLIM are probably not fixed in value; see Min (1989). There is also a relation of TVPMs and ARCH, GARCH, etc. models which is currently being studied.

Third, the methodology of forecasting turning points in economic time series has been developed considerably in recent years. We have extended previous work to solve the turning point forecasting problem within a decision theory context. That is the choice between a downturn or no-downturn forecast is made so as to minimize expected loss and similarly for upturn and no-upturn forecasts. Using our ARLIM and a definition of a turning point, a predictive density was employed to compute the probability of a downturn and to make a choice between a downturn and a no-downturn forecast or an upturn and a no-upturn forecast. Application of these methods produced rather good turning point forecasts for 18 countries, 1974-86. Various techniques were employed to evaluate our turning point forecasts including use of scoring rules and comparisons with the performance of several naive turning point forecasters, for example a coin-flipper, an eternal optimist, an eternal pessimist, etc.

Last, a Monte Carlo Simulation Approach (MCSA) has emerged which is very powerful and useful. In this approach, draws are made from a posterior distribution for a set of parameters. For each draw, various functions of the parameters are evaluated and thus the complete posterior distributions for interesting functions of the parameters are obtained. For example, Kass (1985) drew from the posterior distribution of the elements of the inverse of a 9x9 covariance matrix and evaluated its nine roots for each draw. In this way, he obtained the joint posterior distribution of the nine roots. Geweke (1986) and Hong (1988) made draws from the posterior distribution of the autoregressive coefficients of an AR(3) model to compute posterior distributions of the roots of the AR(3) process. Thompson and Miller (1986) have used a similar methodology to compute multi-step ahead predictive distributions for time series models and Karoyli (1988) has employed a MCSA to compute the posterior distributions of option prices given by the Black-Scholes option-pricing model. Zellner, Bauwens and Van Kijk (1989) have used the MCSA to analyze static and dynamic structural econometric models and to yield finite-sample estimation and diagnostic checking procedures.

In conclusion, it is suggested that the general methodological points and the new developments, mentioned above, may be useful in work to produce improved forecasting models and forecasts which will be of great scientific value and useful to private and public decision-makers.

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