Forecasting Tools and Techniques

Southern Agricultural Outlook Conference

Forrest Stegelin

Ag & Applied Economics

University of Georgia

- **"Those who forecast the future do so not because they know, but because they were asked."**

John Kenneth Galbraith, economist

Forecasts are not predictions of an event.

- Outlook statements forecasting an outcome or future situation, all of which require forecasting tools and techniques and assumptions.

- Requests of extension economists:
  - **Policy-driven** (2014 Farm Act – PLC or ARC?)
  - **Price- or cost-driven** (price of input or final product, and resulting profits?)
  - **Sales-driven** (gross sales for a firm or industry, unit sales, or market share?)
  - **Finance-driven** (interest rates, inflation, likelihood of recession, or other macroeconomic concerns?)
  - Or **of some additional nature** (breakeven, capital investment analysis, elasticity evaluation, cash flow, decision trees, game theory?)

Purpose of a forecast.

- Reduce the range of uncertainty within which management judgments must be made.

- Forecasting process must adhere to two rules:
  - Forecast must be **technically correct and produce forecasts accurate enough to meet the firm's needs**, and
  - **Forecasting procedure and its results must be effectively presented to management** so that the forecasts are utilized in the decision-making process to the firm's advantage and justifiable on a cost-benefit basis.

Judgmental forecasting.

- **Analysis using judgment, common sense, intuition or gut-feelings, and business experience** must be brought to bear at the point where these important techniques generate results, and only the individual has a feel for the weighting or prioritizing of those techniques.

- **Five factors of forecasting:**
  - **Accuracy desired**
  - **Time permitted to develop the forecast**
  - **Complexity of situation**
  - **Time period to be projected**
  - **Amount of resources available (money, personnel, technology, databases)**

In introducing the topic of forecasting

- **Review of basic descriptive statistical concepts:**
  - **Population**
  - **Sample**
  - **Mean**
  - **Degrees of freedom**
  - **Probability distributions**
  - **Hypothesis testing**

- **Graph data for visual availability and visual learners – correlations, cycles, trends, scatter plots, patterns**

- In choosing a forecasting technique, discuss
  - The **method** (naïve to sophisticated)
  - **Pattern** of data (stationary, trended, seasonal, cyclical)
  - **Time horizon** (short, intermediate, long-term)
  - **Type of model** (time series, causal, cross-sectional).

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To select the appropriate forecasting technique properly, forecaster must be able to:

- Define the nature of the forecasting problem
- Explain the nature of the data under investigation
- Describe the capabilities and limitations of potentially useful forecasting techniques
- Develop some predetermined criteria on which the selection decision can be made.

- No one silver bullet, so try multiple techniques.

- Sometimes the most naïve methods are sufficient – asking questions, panel of experts, extrapolation, prior experience/history, gut feel, intuition.

Stationary data

- Data whose average value is not changing over time.

- Such situations are when the demand patterns influencing the series are relatively stable.

- Use available history of data series to estimate its average value => the forecast for future periods.

- More sophisticated techniques involve updating the estimate as new information becomes available.

- Useful when initial estimates are unreliable or when the stability of the average is in question.

- Updating techniques provide some degree of responsiveness to changes in the underlying structure of the series.

Stationary forecasting techniques used when:

- **Forces generating a series have stabilized and the environment in which series exists is relatively unchanging** (unit sales of product in maturation stage of its life cycle, number of sales resulting from a constant level of effort, breakdowns per week on assembly line having uniform production rate).

- **A very simple model is needed because of lack of data or for ease of explanation or implementation** (new business with very little historical data available).

- **Stability may be obtained by making simple corrections for factors such as population growth or inflation** (changing income to per capita income, changing dollar sales to constant dollar amounts).

- **Series may be transformed into a stable one** (logarithms, square roots, differences).

- **Series is a set of forecast errors from forecasting technique that is considered adequate.**

Techniques to be considered when forecasting stationary data:

- **Naïve methods**,

- **Simple averaging methods**,

- **Moving averages**,

- Simple exponential smoothing,

- Box-Jenkins methods.

Trended series of data

- Contains a long term component that represents the growth or decline in the series over an extended period of time.

- Common for economic time series to contain a trend.

Forecasting techniques for trended data are used whenever:

- **Increased productivity and new technology lead to changes in life style** (demand for electronic components and demand for rail service or railroad usage)

- **Increasing population causes increases in demand for goods and services** (sales revenues of consumer goods, demand for energy consumptions, use of raw materials)

- **Purchasing power of the dollar affects economic variables due to inflation** (salaries, production costs, prices)

- **Market acceptance increases** (growth period in the life cycle of a new product)

Techniques to be considered when forecasting trended series data include:

- Linear moving average,

- Linear exponential smoothing,

- Quadratic exponential smoothing,

- Simple regression
  (Qdemand = Pown, Psubstitutes, Pcomplements, Population, Income, Tastes & Preferences, Seasonality)

- Growth curves, and

- Exponential models.

Seasonal series

- A time series with a pattern of change that repeats itself year after year.

- Usually involves selecting either a multiplicative or additive method and then estimating seasonal indexes from the history of the series, which are then used to include seasonality in forecasts or to remove such effects from the observed values.

Forecasting techniques for seasonal data used whenever:

- **Weather influences the variable of interest** (electrical consumption, seasonal sports activities, clothing styles, agricultural growing seasons, weekender and diy'er activities)

- **The annual calendar influences the variable of interest** (retail sales influenced by holidays, three-day weekends, school calendars).

Techniques to be considered when forecasting seasonal data:

- Classical decomposition,

- Exponential smoothing,

- Time series regression, and

- Box-Jenkins methods.

Cyclical data series

- The wavelike fluctuation around the trend.

- Tend to repeat in the data every two, three, or more years

- Difficult to model because their patterns are not stable.

- The up-down wavelike fluctuations around the trend rarely repeat at fixed intervals of time, and the magnitude of the fluctuations also tends to vary.

- Often requires finding coincidental or leading economic indicators of macroeconomics.

Forecasting techniques for cyclical data are used whenever

- **The business cycle influences the variable of interest** (economic, market, competitive factors)

- **Shifts in popular tastes occur** (fashion, music, food, color)

- **Shifts in population occur** (wars, famines, epidemics, natural disasters)

- **Shifts in the product life cycle occur** (introduction, growth, maturity (and saturation), and decline)

Techniques to be considered when forecasting cyclical series data include:

- Classical decomposition,

- Economic indictors,

- Econometric models,

- Multiple regression, and

- Box-Jenkins methods.

Time horizon has direct bearing on selection of forecasting technique.

- As forecasting horizon increases, a number of quantitative techniques become less applicable.

- Moving averages, exponential smoothing and Box-Jenkins models are poor predictors of economic turning points, whereas econometric models are more useful.

Thank you for your attention and interest.
Are there any questions or comments?
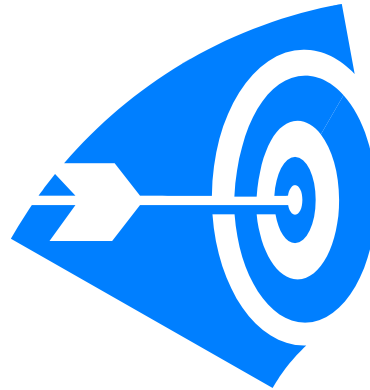
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For further information contact Forrest Stegelin at stegelin@uga.edu.

Selected References:

- Wilson, J.H. and Barry Keating. 2002. *Business Forecasting.* McGraw-Hill.