TAILORING YOUR FORECASTING METHODS TO IMPROVE ACCURACY

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BIOGRAPHY

Nada R. Sanders, Ph.D.

Dr. Sanders is an internationally recognized expert on business forecasting, holding the Iacocca Chair at Lehigh University and is Principal at NRS Consulting. She has a Ph.D. and MBA from the Ohio State University and is author of over one hundred scholarly publications, including three books. She has served on the board of the International Institute of Forecasters (IIF) and was Associate Editor and co-founder of Foresight: The International Journal of Applied Forecasting.

Dr. Sanders has extensive business experience offering consulting and training services. She has worked with companies including Nike, Mattel, AT&T, IDG, Schottenstein Corp., Cognitive TPG, MTC Corp., Ciba Corning, and numerous others.
TAILORING YOUR FORECASTING METHODS TO IMPROVE ACCURACY

AGENDA

- Principles of Forecasting
- Combining Disparate Data
- Segmenting & Dissecting Data
- Key Take-Aways

October 18, 2012 Webinar
Accurate forecasting provides a significant competitive advantage

**Good forecasts** ⇒
- correctly estimate demand
- anticipate disruptions
- identify new markets & trends

**Poor forecasts** ⇒
- excess inventory
- poor customer service
- missed opportunity
HOW TO IMPROVE ACCURACY?

- **Technology & software alone are not the answer**
  - Need understanding of basic forecasting principles

- **Rules to improve accuracy:**
  1. Follow established forecasting principles
  2. Combine data from disparate sources
  3. Segment & Dissect Data
I. PRINCIPLES OF FORECASTING

1. FORECASTS ARE MORE ACCURATE FOR GROUPS OF ITEMS RATHER THAN FOR INDIVIDUAL ITEMS:

   - Low level data are usually very irregular.

   - Forecast errors at the low level are often many times greater than errors from forecasting aggregate series.

   - Example: you cannot have the same accuracy for global PC sales versus sales of Media Tablets in one low-income market.
Illustration of a Time Series

Ben & Jerry’s Quarterly Sales

Legend

BENJERRY

A Monthly Time Series:
Diamond Ring Sales

DiamondRings2502 - 530772502

History
A Weekly Time Series: Soft Drink Product Sales
I. PRINCIPLES OF FORECASTING

- Use “Top Down” forecasting approach to leverage this principle:
  - Forecast group as a whole and each product separately, then allocate the group total to the individual products proportionally.

- Higher level: countrywide or product family

- Lower level: individual region or item level

- Use same technique by location
I. PRINCIPLES OF FORECASTING

2. CLEAN DIRTY DATA

• Missing Data Values
• Trading Day Adjustments
• Outliers (or Special Event) Adjustments
• Constant versus Current Price Data
I. PRINCIPLES OF FORECASTING

3. SOMETIMES THERE IS NO DATA

- Look to historical analogies
- Identify “like” products and study their patterns
- Use “structured analogy process”
I. PRINCIPLES OF FORECASTING

4. MATCH METHOD TO DATA

DATA = PATTERN + RANDOMNESS

Type of Data Pattern

- Level – data fluctuates around a mean
- Trend – data exhibits increasing or decreasing pattern
- Seasonality – pattern that regularly repeats
- Cycle – patterns caused by politics, economy, etc.
- Noise – Randomness
II. COMBINE DISPARATE DATA

1. QUALITATIVE (MANAGERIAL) FORECASTS
   - Judgmental, subjective, based on opinions.

2. QUANTITATIVE FORECASTS (Analytics)
   - Objective, based on mathematics and statistics.

➢ They have complementary strengths
MANAGERIAL FORECASTS - STRENGTHS

- Highly responsive to latest changes in environment.

- Can include “inside” and “soft” information difficult to quantify.

- Can compensate for “one-time” or unusual events.
Human cognitive limitations:
- limited attention span
- short-term memory
- difficulty in understanding causal relationships

Biases:
- lack of consistency
- optimism
- wishful thinking
- political manipulation
QUANTITATIVE FORECASTS - STRENGTHS

- Objective
- Consistent
- Can process large amounts of data
- Can consider many variables and complex relationships
QUANTITATIVE FORECASTS - WEAKNESSES

- Slow to react to changing environments.
- Only as good as the model and data it is based upon.
- Can be costly and time consuming to model ‘soft’ information.
- Requires technical understanding.
Each method has its strengths and weaknesses

Best forecasting method is one that integrates both approaches

⇒ Combining
1. Mechanical combining

Managerial Forecast

Combine Forecasts

Final Forecast $F_{t+k}$

Quantitative Forecast $F_t = f(x_1, \ldots, x_n)$
MECHANICAL COMBINING

- Provides improved accuracy
- Objective
- May not provide user with sense of “ownership”
2. Managerial Input to Model Building

Managerial Opinion → Identify patterns, Select variables, Define parameters → Quantitative Model $F_t = f(x_1...x_n)$ → Final Forecast $F_{t+k}$
MANAGERIAL INPUT TO MODEL BUILDING

- Least subject to bias
- Objective
- Time consuming and slow to react to change
3. Managerial Adjustment

**METHODS OF COMBINING**

**Quantitative Forecast**

\[ F_t = f(x_1 \ldots x_n) \]

**Managerial Opinion**

**Adjust Forecast**

**Final Forecast**

\[ F_{t+k} \]
MANAGERIAL ADJUSTMENT

- Most popular method in practice.
- Enables rapidly reacting to change.
- 91% of companies report using it.
- Has high potential for introducing bias.
- Provides user with sense of “ownership.”
WHEN TO ADJUST QUANTITATIVE FORECASTS

1. ADJUST IF THERE IS DOMAIN KNOWLEDGE

- Managerial adjustment with domain knowledge can improve accuracy.
- Managers with higher understanding of market conditions generate better adjustments.
- Adjustment without domain knowledge can reduce accuracy.
DOMAIN KNOWLEDGE IS KEY

- Blind extrapolation of past data can be misleading:
  - If 165,000 people were living in Las Vegas in 1980
    - 260,000 in 1990
    - 480,000 in 2000
    - Can you assume a trend?
  - In 1910 a Bell telephone statistician: “Every woman in America will be employed as a switchboard operator.” It clearly missed automated switching.
WHEN TO ADJUST QUANTITATIVE FORECASTS

2. ADJUST IN SITUATIONS WITH HIGH DEGREE OF UNCERTAINTY

- Quantitative models cannot deal with discontinuities or pattern changes

- Experienced managers found superior to quantitative models when estimating:

  *onset, duration and magnitude of change*
WHEN TO ADJUST QUANTITATIVE FORECASTS

3. ADJUST WHEN THERE ARE KNOWN CHANGES IN THE ENVIRONMENT

- Compensate for specific events not captured by the model (e.g. advertising campaign or delayed shipment).

- Adjust to compensate for past events that are not expected to re-occur in the forecast horizon (e.g. labor strike).
1. **STRUCTURE THE ADJUSTMENT PROCESS**

- Decompose process into subtasks (e.g. decompose a time series into trend, seasonal, and random components.)

- Can be computer aided or pencil and paper.

- Today’s software enables adjustment
2. CONSIDER METHOD OF DATA PRESENTATION

- Graphical presentation is better for trend data, tabular otherwise.
- Graphical is better for short term forecasts, tabular for long term.
- Graphical is better for macro data, tabular for micro data.
3. DOCUMENT ALL ADJUSTMENTS

- Keep record of adjustments made and reasons for adjusting.
- Process serves as feedback and aids learning.
4. MONITOR FORECAST ACCURACY OF ALL ADJUSTMENTS

- Measure adjustments with formal forecast accuracy measures
- Process provides feedback
III. SEGMENT & DISSECT DATA

- All forecasts are not the same
- Best strategy is to segment series and use differential approaches to each segment
- Segmentation can be based on:
  - ABC Analysis
  - Sales
  - Promotions
  - Degree of Importance
III. SEGMENT & DISSECT DATA

- Segment series based on “forecastability”

- Consider measuring “forecastability” of series by coefficient of variation.

  - CV = Standard Deviation/ Mean
  - **Rule of Thumb**: CV< 20% stable; CV>50% unstable; CV>100% unforecastable
WHICH MODEL FOR WHICH DATA?

Degree of Importance

Low

High

Low CV

Stability - CV

High CV

- Combination Models (Adjustment)
- Multivariate Models (Model Building)
- Automate (Time Series)

- Managerial Forecasts
- Combination Models (Adjustment)
- Combination (Mechanical)
- Automate (Time Series)
III. SEGMENT & DISSECT DATA

- Consider segregating series by stability and data pattern
  - Segregate by stable and unstable; type of data pattern
  - Process tends to increase overall accuracy

- Consider disaggregating the variable to be forecast.
  - Separate variable to be forecast and forecast them separately
KEY TAKE-AWAYS

TO IMPROVE FORECAST ACCURACY:

- Do not ‘blindly’ apply technology and software
- Understand & follow established forecasting principles
- Understand & work with today’s software capabilities
KEY TAKE-AWAYS

- Combine data from disparate sources
  - Qualitative & Quantitative Forecasts are not mutually exclusive: *don’t use one to the exclusion of the other.*
  - Combining often gives best forecast accuracy.

- Segment & dissect data for best results
  - Time permitting, experiment with a variety of forecasting models and a variety of segmentation strategies.
KEY TAKE-AWAYS

- Remember: *One size does not fit all.*

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