FVA Analysis and *Forecastability*

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About SAS

- World's largest private software company
  - $2.43 billion revenue in 2010
  - 50,000 customer sites / offices in 56 countries
  - Leader in advanced analytics software
    - 35.2% market share (per IDC) – more than double its nearest competitor

  Ranked #1 in Fortune's 100 Best Companies to Work For the past two years. Find more at www.sas.com.

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Agenda

- ## Forecast Value Added Analysis

  - Recap and scientific basis

- ## Assessing Forecastability

  - Various approaches

- ## Setting Forecast Accuracy Objectives

Forecast Value Added Analysis

What is Forecast Value Added?

- Forecast Value Added is defined as

  The change in a forecasting performance metric (such as MAPE, Accuracy, or Bias) that can be attributed to a particular step or participant in the forecasting process

- FVA is measured by comparing the results of a process activity to the results you *would have* achieved without doing the activity

- FVA can be positive or negative

FVA Analysis: The Null Hypothesis

- FVA Analysis is based on basic scientific method, starting with the null hypothesis:

H_0: The specific process activity has *no effect* on process performance

- Analogy: Evaluate a new drug for safety and efficacy by comparing performance to a placebo

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FVA Analysis: The Naïve Forecast

- A naïve forecast serves as the placebo in evaluating forecasting process performance
  - Something simple to compute, requiring the minimum amount of effort and manipulation to prepare a forecast
    - Random Walk (using last known actual)
    - Seasonal Random Walk (using year ago actual)
    - Moving Average

What is FVA Analysis?

- Consider a very simple forecasting process:

```
Demand History  →  Statistical Model
                          ↓
                   Analyst Override
```
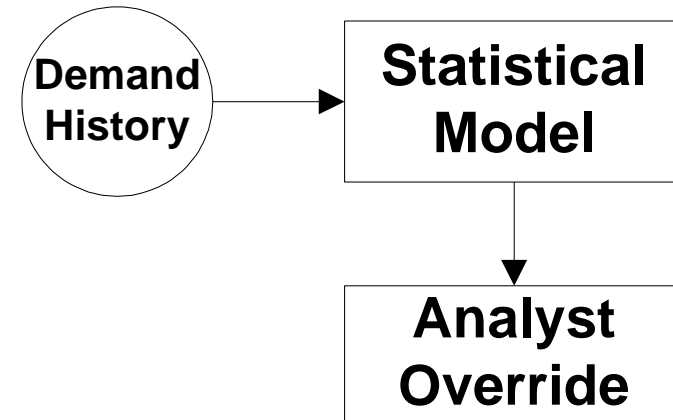
- FVA Analysis compares the accuracy of the statistical forecast (generated by forecasting software) to the accuracy of the analyst's manually adjusted forecast

- FVA Analysis would also compare both to a "naïve" forecast

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FVA Analysis: Comparing to Naïve Forecast

- **The most fundamental FVA analysis is to compare results of your forecasting process to the results you _would have_ achieved by just using a naïve forecast**

  - If you are doing <u>better</u> than a naïve forecast, your process is "adding value"

  - If you are doing <u>worse</u> than a naïve forecast, then you are simply wasting time and resources

Process Step	MAPE	FVA vs. Naive	FVA vs. Stat
Naive	30%	.	.
Statistical	20%	10%	.
Override	25%	5%	-5%

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Why Use FVA Analysis: Eliminate Waste

- **FVA Analysis is used to identify and eliminate non-value adding activities**
  - Streamline the process by eliminating wasted efforts
  - Direct resources to more productive activities
  - Potentially achieve better forecasts

By eliminating those activities that are making the forecast worse, you get better forecasts for free!

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FVA Analysis: Reporting the Results

- **Be cautious in interpreting your FVA results**
  - Don't draw conclusions without sufficient evidence

- **One period of data is not enough!**
  - Over short time periods, results may just be due to chance

- **Use Donald Wheeler's book** <u>Understanding Variation: The Key to Managing Chaos</u> **to guide the analysis**

*If you haven't conducted FVA analysis and know that you are beating a naïve forecast…
then maybe you aren't!!!*

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Forecastability

Objective of the Forecasting process

The objective of the forecasting process is to generate forecasts as _accurate and unbiased_ as you can _reasonably expect_ them to be, and do this as _efficiently_ as possible

What accuracy is reasonable to expect is determined by forecastability

# Forecastability: Lower and Upper Limits

- Boylen: "Forecastability refers to the range of forecast errors that are achievable on average, in the long run"

- Lower limit for forecast accuracy?

  - Naïve model
  - If the naïve model achieves 70% accuracy, then you should be able to achieve no worse than this

- Upper limit for forecast accuracy?

  - Much more difficult problem!!

Forecastability: The Upper Limit

- In order to achieve highly accurate forecasts, we need several things

  - There is a structure or rule guiding the behavior that is being forecast
  - We understand the rule and express it correctly in our forecasting model
  - The rule isn't changing over time
  - There is little variation (randomness) in the behavior about the rule

Accuracy is ultimately limited by the amount of randomness in the behavior about the rule

Forecastability: The Comet Chart

Forecast Accuracy (y-axis)

Volatility (CV) (x-axis)
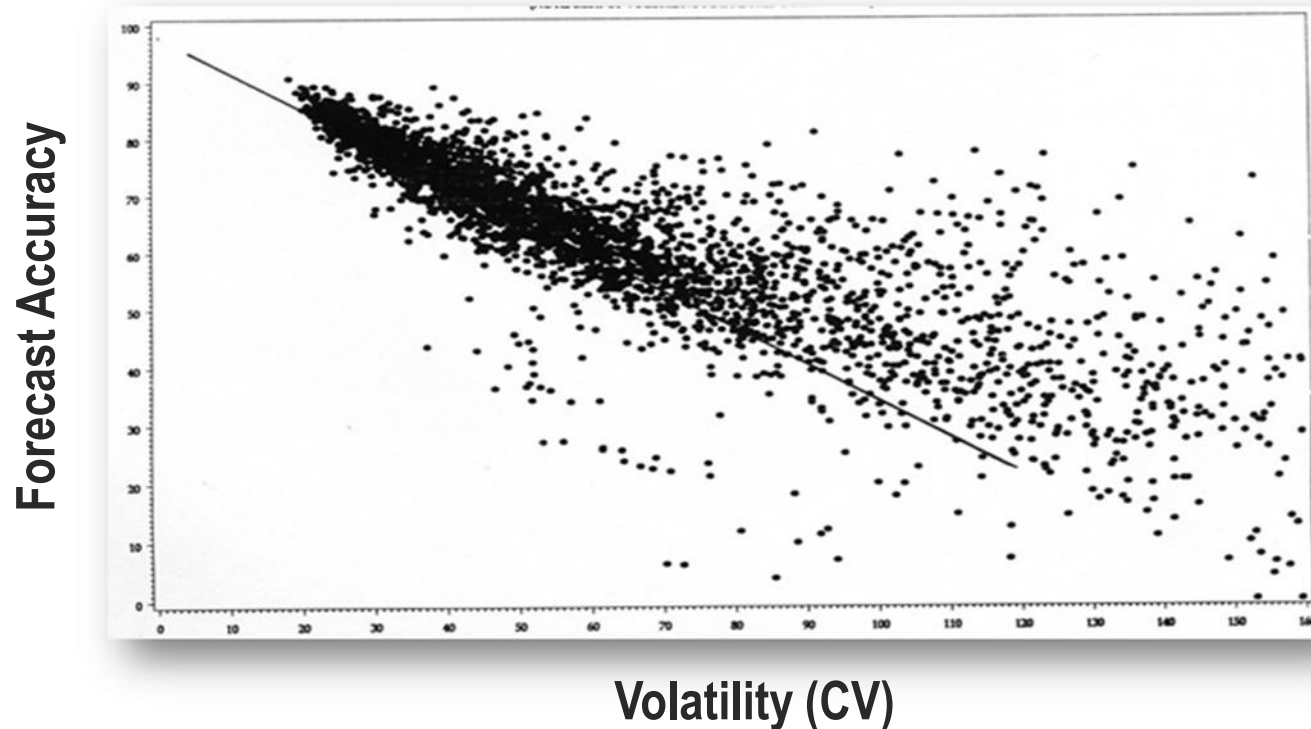
The forecast accuracy we achieve is largely dependent on the volatility of what we are trying to forecast

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Forecastability: Additional Approaches

- See the Spring 2009 issue of *Foresight* for a special section of assessing forecastability (www.forecasters.org/foresight)

- Includes some fairly sophisticated approaches from physics, graphical decomposition, and information theory

- Critique of CV as being too simplistic and unreliable as an indicator of forecastability

    - Criticisms not as applicable for the types of patterns we deal with in supply chain forecasting

Setting Forecast Accuracy Objectives

Wrong Way to Set Forecasting Objectives

- 100% Accuracy

Wrong Way to Set Forecasting Objectives

- ■ Arbitrary (what management "wants" or "needs" to achieve) – for example "MAPE < 20%"

  - Accuracy is determined more by the nature of behavior you are forecasting (smooth & stable vs. wild & erratic) than by the method

  - E.g. Achieve 60% accuracy in forecasting Heads or Tails in the toss of a fair coin

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Wrong Way to Set Forecasting Objectives

- **Based on industry benchmarks (achieving "best in class" accuracy)**

  - Accuracy is determined more by the nature of behavior you are forecasting (smooth & stable vs. wild & erratic) than by the method

Wrong Way to Set Forecasting Objectives

- **Improve accuracy compared to prior year**
  - Assumes forecastability stays the same
    - Bad assumption if you change the data generating process
      - E.g. move from everyday low pricing to promotion driven

Right Way to Set Forecasting Objectives

- ▪ Achieve forecast accuracy no worse than a naïve model

  - No specific number, since we don't know in advance what accuracy the naïve model will achieve

Focus on process automation and efficiency, and the elimination of process waste

Additional Resources on Today's Topics

- "Forecast Value Added Analysis: Step-by-Step"

  - SAS on-demand webcast
    http://www.sas.com/events/cm/176129/index.html

  - SAS white paper
    http://www.sas.com/reg/wp/corp/6216

- Blog: *The Business Forecasting Deal* (blogs.sas.com/content/forecasting)

- Book: *The Business Forecasting Deal* (available on amazon.com)

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