MIT Supply Chain
MANAGEMENT

Jeff Baker, SCM2018

Effect of Override Size on Forecast Value Add

Motivation & Background

- Forecasting drives supply chain response.
- Important in Sales & Operations Planning, where long term, cross-functional decisions are made.
- Overrides often fail to improve forecast accuracy.

Less Wasted Effort

- **Decreased error & bias**
- **Fewer stock-outs**
- **Reduced schedule changes and expedites**

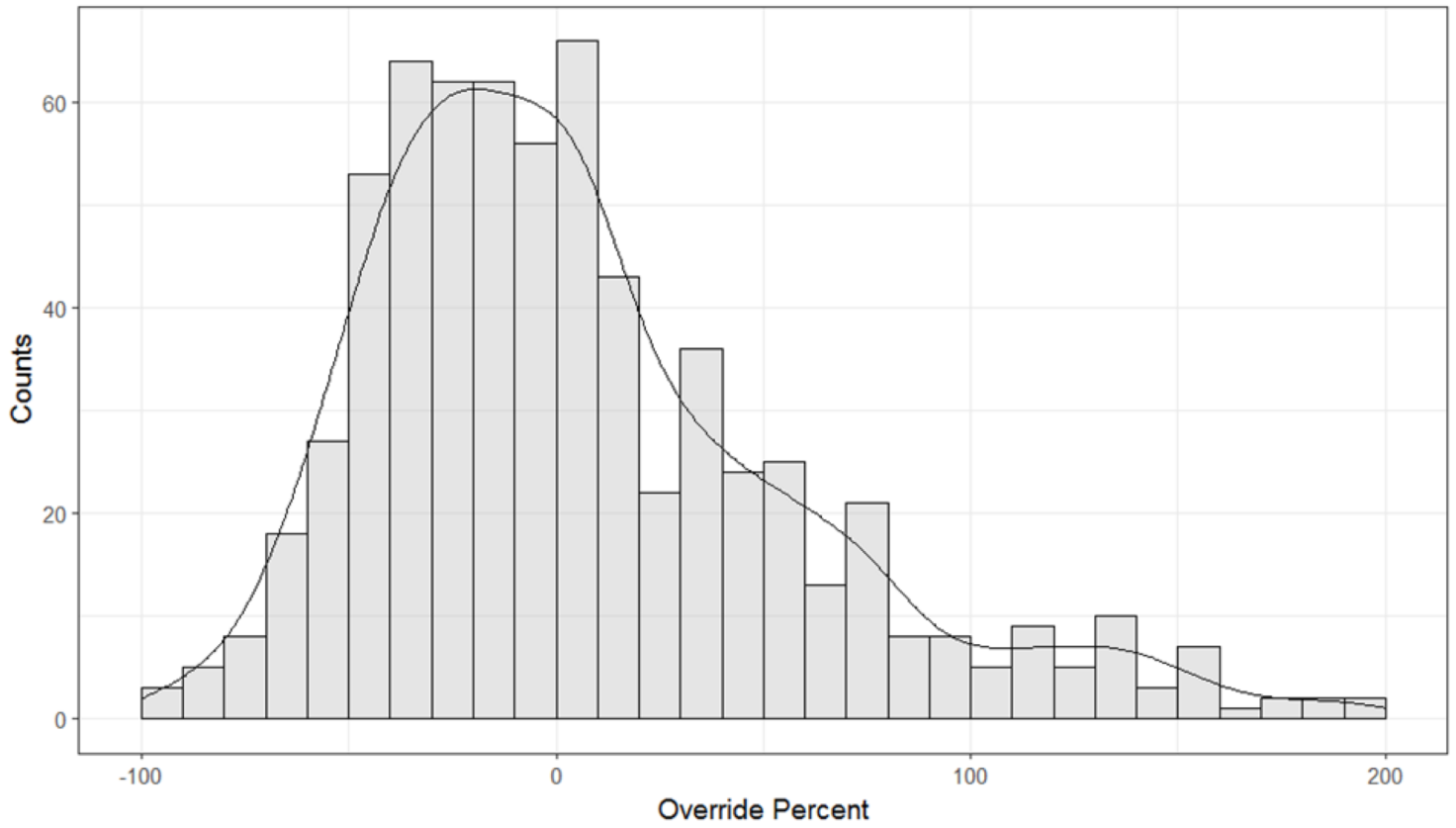
Profitability

- **Higher Customer Service**
- **Engaged experts**
- **Lower Working Capital**

Key Research Questions

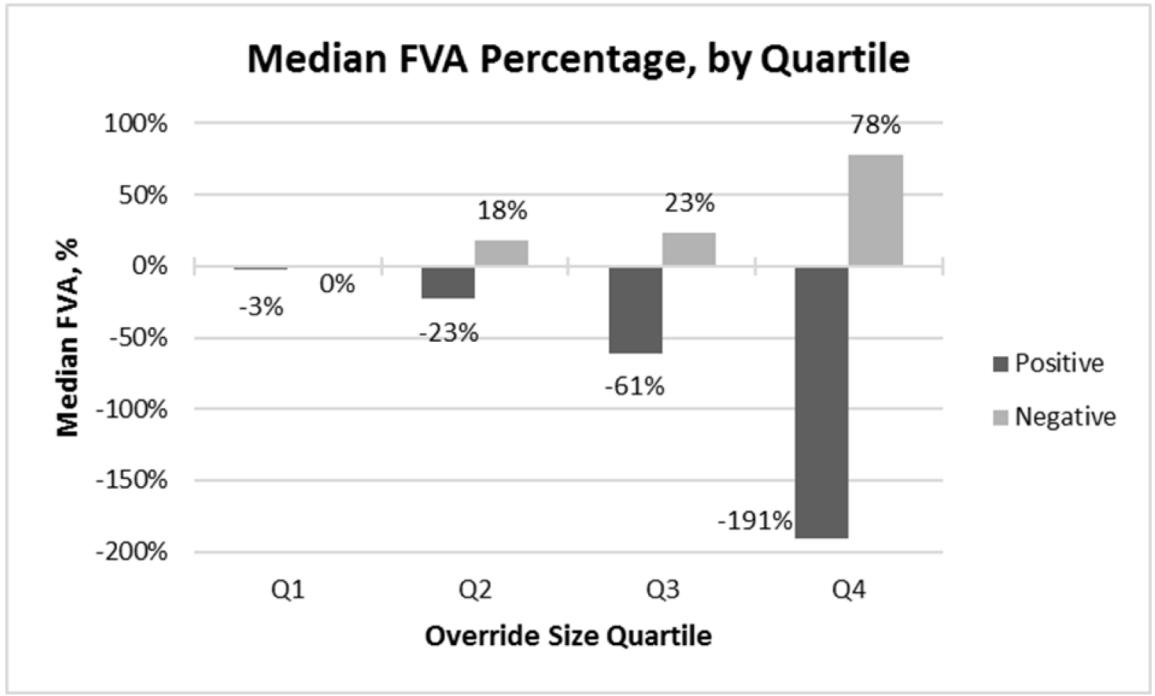
Can a framework be created to increase the accuracy of the final forecast and maximize the value which experts add to the consensus forecasting process?

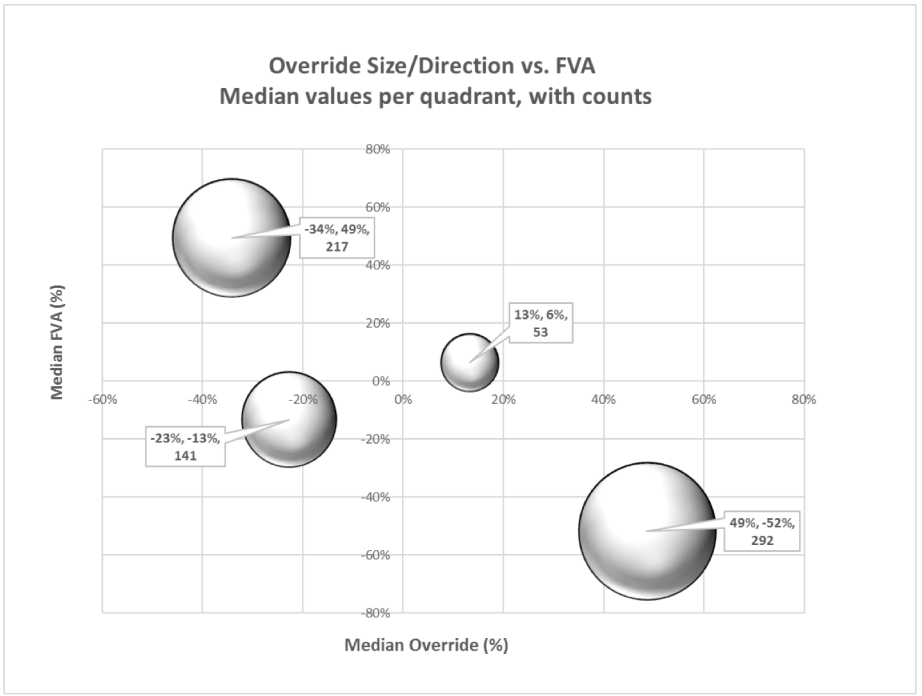
- **Does statistical forecast performance impact improvement opportunities?**
- **Does the size of the override in relation to the underlying variability impact the ability to improve upon it?**
- **Does direction of forecast adjustment matter?**



Case Study – Sporting Goods Manufacturer

- 19 Business Units
- 703 forecasts
  - 345 (+) Overrides
  - 355 (-) Overrides
  - 3 no overrides
- Forecast Value Add
  - Difference between Statistical and Consensus Forecasts
- Error (MAPE) should decrease with expert input
- MAPE, (-) Overrides
  - 180% Stat → 69% Consensus
- MAPE, (+) Overrides
  - 54% Stat → 200% Consensus

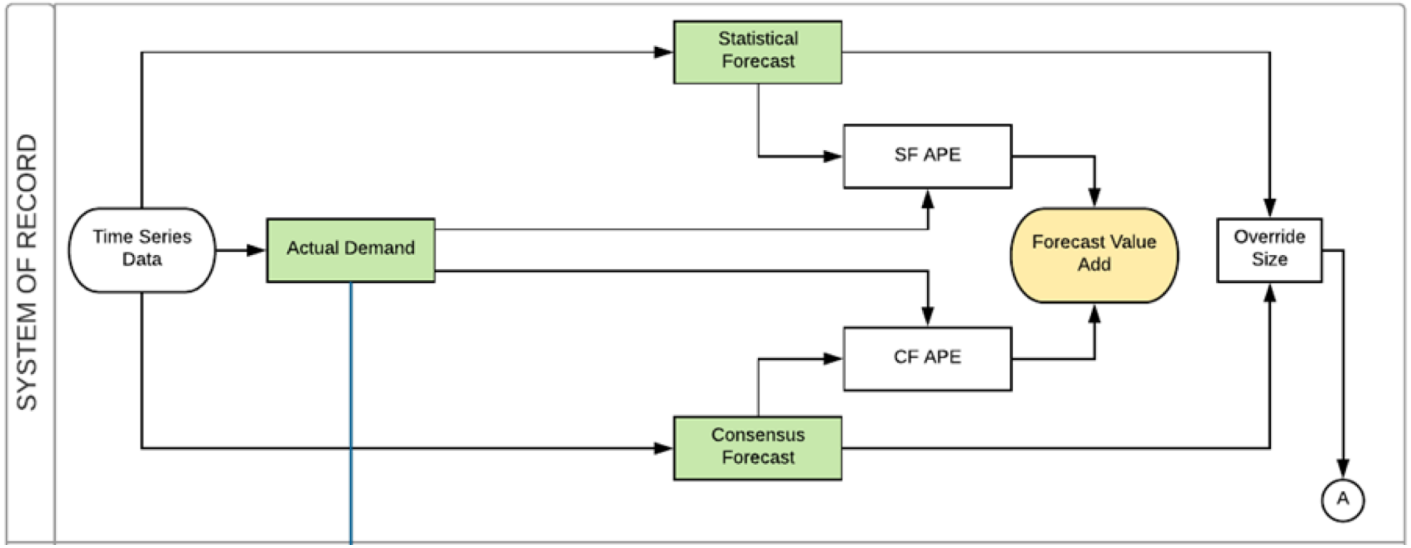




Case Study – Sporting Goods Manufacturer

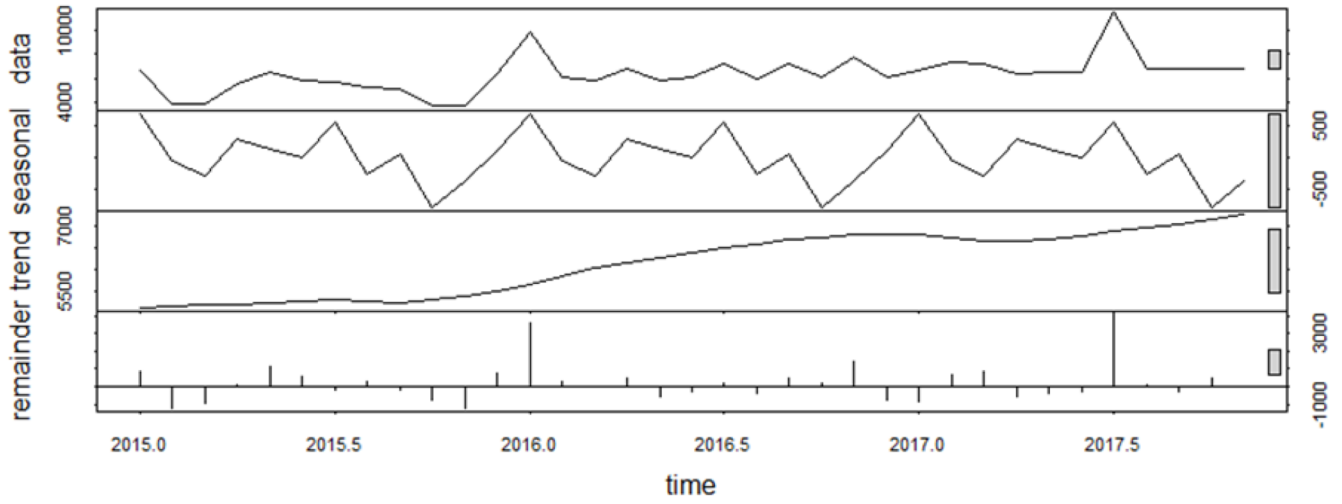
Methodology

- Inputs – Demand, Stat Fcst, Consensus Fcst
- Calculate Forecast Value Added response variable
- Create predictor variables
- Use classification techniques to predict FVA or NVA
  - Classification Tree, Random Forest, Boosted Tree, Logistic Regression



Dispersion-Scaled Overrides (DSO)

- Use Seasonal-Trend decomposition to extract residuals
- Calculate dispersion statistics on the residuals
  - Standard Deviation
  - Mean Absolute % Error
  - Median Absolute % Error
- Divide overrides by dispersion measures to create DSOs



$$Dispersion\ Scaled\ Override_t = {(Override_t)}/{\sigma_{residuals}}$$

$$Dispersion\ Scaled\ Override_t = {(Override_t)}/{MAD_{residuals}}$$

$$Dispersion\ Scaled\ Override_t = {(Override_t)}/{MdAD_{residuals}}$$

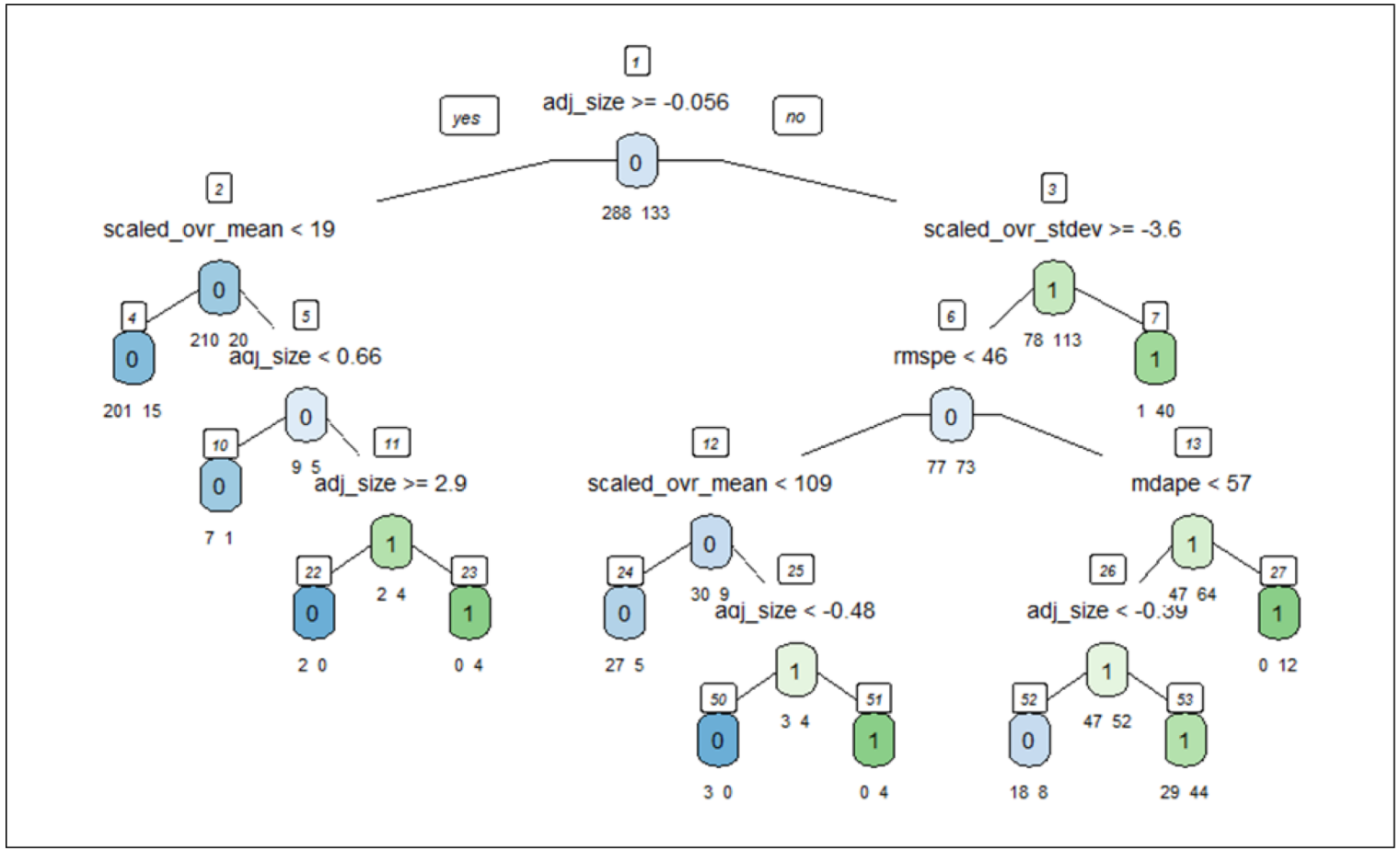
$$Forecast\ Scaled\ Override_t = \frac{Override_t}{Statistical\ Forecast_t}$$

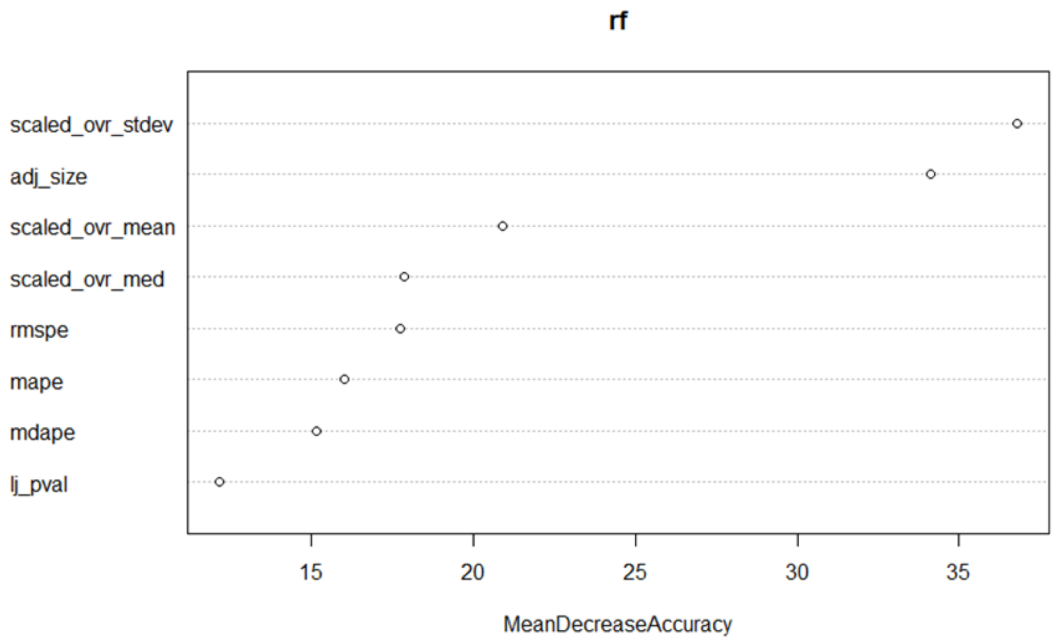
Classification Techniques

- Classification Tree
  - Visual, explainable
- Random Forest
  - Ensemble technique, black box
  - Variable importance plot
- Boosted Tree
  - Over-samples mis-classified records; black-box
- Logistic Regression
  - Probability values for variables

Category	Element
Response Variable	Forecast Value Add. Set to "1" if FVA exceeds 5%, otherwise set to "0"
Predictor Variables: Dispersion-Scaled Overrides	Dispersion-Scaled Override, Root Mean Square Error
	Dispersion-Scaled Override, Mean Absolute Error
	Dispersion-Scaled Override, Median Absolute Error
	Forecast Scaled Override
Predictor Variables: Opportunity Indicators	Root Mean Square % Error (RMSPE) of Statistical
	Mean Absolute % Error (MAPE) of Statistical forecast
	Median Absolute % Error (MdAPE) of Statistical
	Ljung-Box test for Autocorrelation

Classification Tree



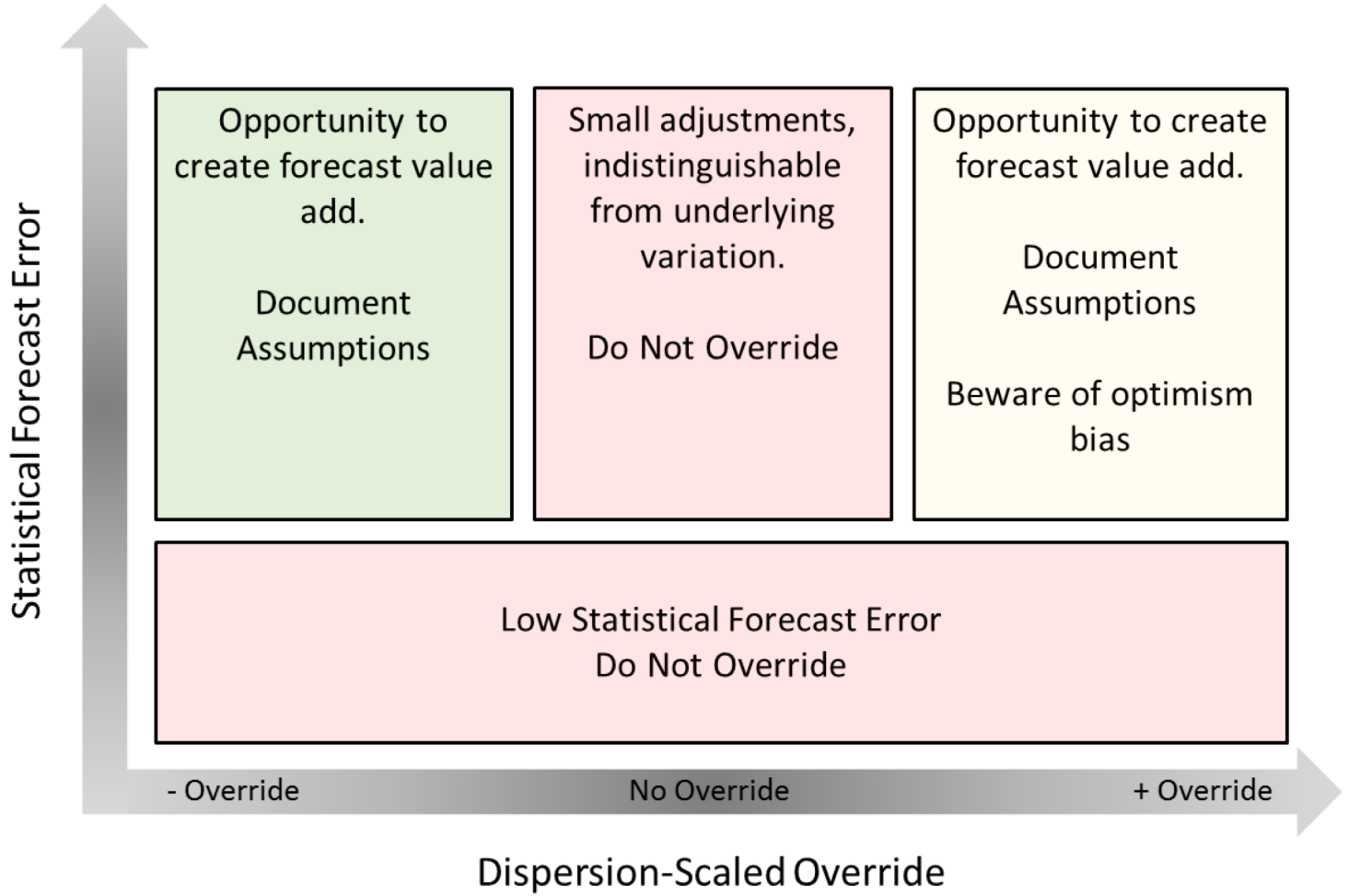


Variable	Pr(>|z|)	Significance
rmspe	0.0282	95% +
mape	0.0476	95% +
mdape	0.9423	
adj_size	0.0121	95% +
scaled_ovr_stdev	0.00000000188	99.99% +
scaled_ovr_mean	0.9196	
scaled_ovr_med	0.1384	
lj_pval	0.6975	

Random Forest, Logistic Regression

Results and Implications

- Results
- Implications
- Future work



Questions?

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