

# Tracking Accuracy: A Crucial Key to Improve Your Forecasts



Forecast**PRO**

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# What We'll Cover

**Introductions**

**Why Track Accuracy?**

**How Do We Go About It?**

**How Do We Measure Error?**

**How Do We Spot Problems?**

**Summary**

**Q&A**

- To improve your forecasting process
  - Forecasting should be a continuous improvement process
  - Improving your forecasting requires knowing what's working and what's not.

# Why Track Forecast Accuracy?

- To improve your forecasting process
- To gain insight into expected performance

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- To benchmark

# Why Track Forecast Accuracy?

- To improve your forecasting process
- To gain insight into expected performance
- To benchmark
- To spot problems early

- Within-sample
- Out-of-sample
  - Generated using a hold-out approach
  - Generated using “wait and see”

The logo for Forecast PRO features the word "Forecast" in a black serif font, followed by "PRO" in a bold, pink, sans-serif font. A white lightning bolt graphic is positioned behind the "PRO" text.

# Forecast PRO Within-sample Errors

- Percentage-based error
- Unit-based error
- Relative error

- **MAPE:** Mean Absolute Percent Error  
Tells you the average error size as a percent.
- **MAD:** Mean Absolute Deviation  
Tells you the average error size in units.

- The MAPE is easy to interpret, even when you don't know a product's demand volume. However, the MAPE is scale sensitive and becomes meaningless for low-volume data or data with zero demand periods.
- The MAD is a good statistic to use when analyzing a single product's forecast and you know the demand volume.

- Aggregating error measurements across products can be problematic.
- When aggregating MAPEs, low-volume products can dominate the results.
- When aggregating MADs, high-volume products can dominate the results.
- When aggregating across products some corporations establish weighted error measurements to properly reflect the various products relative importance to the corporation. This is an excellent practice.

- Can aid the model-building process.
- Big differences indicate superior models
- ***NOT*** a good indicator of expected performance.

# Forecast **PRO** Hold-out Analysis

- Allows you to compare different approaches
- Provides insight into expected accuracy
- May be difficult to simulate your true forecasting process

A horizontal banner with a blue gradient background. The text 'Forecast PRO Real-time Tracking' is centered. 'Forecast' is in a dark blue serif font, 'PRO' is in a bold pink sans-serif font with a white diagonal slash through it, and 'Real-time Tracking' is in a white sans-serif font.

Forecast **PRO** Real-time Tracking



# Building a Forecast Archive

We begin with historic data through December 2008 and generate a forecast

Date	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09
<b>Actual</b>						
<b>Origin</b>						
2008-Dec	25,950	11,808	12,429	11,302	6,033	8,211

Once January's demand is known we generate a new forecast

Date	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09
<b>Actual</b>	18,468						
<b>Origin</b>							
2008-Dec	25,950	11,808	12,429	11,302	6,033	8,211	
2009-Jan		12,697	14,114	13,535	6,837	9,726	6,780



# Building a Forecast Archive

Once February's demand is known we generate a new forecast

Date	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09
<b>Actual</b>	18,468	9,720						
<b>Origin</b>								
2008-Dec	25,950	11,808	12,429	11,302	6,033	8,211		
2009-Jan		12,697	14,114	13,535	6,837	9,726	6,780	
2009-Feb			13,265	12,913	6,654	9,102	6,574	8,493



# Building a Forecast Archive

Once March's demand is known we generate a new forecast

Date	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
<b>Actual</b>	18,468	9,720	15,552						
<b>Origin</b>									
2008-Dec	25,950	11,808	12,429	11,302	6,033	8,211			
2009-Jan		12,697	14,114	13,535	6,837	9,726	6,780		
2009-Feb			13,265	12,913	6,654	9,102	6,574	8,493	
<b>2009-Mar</b>				<b>9,623</b>	<b>4,364</b>	<b>6,983</b>	<b>4,801</b>	<b>6,901</b>	<b>14,710</b>

Once April's demand is known we generate a new forecast

Date	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09
<b>Actual</b>	18,468	9,720	15,552	10,692						
<b>Origin</b>										
2008-Dec	25,950	11,808	12,429	11,302	6,033	8,211				
2009-Jan		12,697	14,114	13,535	6,837	9,726	6,780			
2009-Feb			13,265	12,913	6,654	9,102	6,574	8,493		
2009-Mar				9,623	4,364	6,983	4,801	6,901	14,710	
2009-Apr					4,367	6,994	4,802	6,905	14,725	17,624

Once May's demand is known we generate a new forecast

Date	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09
<b>Actual</b>	18,468	9,720	15,552	10,692	6,804						
<b>Origin</b>											
2008-Dec	25,950	11,808	12,429	11,302	6,033	8,211					
2009-Jan		12,697	14,114	13,535	6,837	9,726	6,780				
2009-Feb			13,265	12,913	6,654	9,102	6,574	8,493			
2009-Mar				9,623	4,364	6,983	4,801	6,901	14,710		
2009-Apr					4,367	6,994	4,802	6,905	14,725	17,624	
<b>2009-May</b>						<b>6,873</b>	<b>4,800</b>	<b>6,858</b>	<b>14,554</b>	<b>17,527</b>	<b>15,184</b>



# Building a Forecast Archive

Once June 2009 sales are known, we can compare the forecasts in the red box to what actually happened--this is the basis for a "waterfall" report

Date	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09
<b>Actual</b>	18,468	9,720	15,552	10,692	6,804	7,776					
<b>Origin</b>											
2008-Dec	25,950	11,808	12,429	11,302	6,033	8,211					
2009-Jan		12,697	14,114	13,535	6,837	9,726	6,780				
2009-Feb			13,265	12,913	6,654	9,102	6,574	8,493			
2009-Mar				9,623	4,364	6,983	4,801	6,901	14,710		
2009-Apr					4,367	6,994	4,802	6,905	14,725	17,624	
2009-May						6,873	4,800	6,858	14,554	17,527	15,184

# A Waterfall Report

**Adjusted forecast**  
Showing forecasts

Date	2009-Jan	2009-Feb	2009-Mar	2009-Apr	2009-May	2009-Jun
<b>Actual</b>	18,468	9,720	15,552	10,692	6,804	7,776
<b>Origin</b>						
2008-Dec	25,950	11,808	12,429	11,302	6,033	8,211
2009-Jan		12,697	14,114	13,535	6,837	9,726
2009-Feb			13,265	12,913	6,654	9,102
2009-Mar				9,623	4,364	6,983
2009-Apr					4,367	6,994
2009-May						6,873
<b>Lead time</b>	1	2	3	4	5	6
<b>Series Analysis</b>						
No. observations	6	6	6	6	6	6
Avg. Forecast	12,129	12,811	13,373	13,778	14,061	13,474
Avg. Error	627	1,309	1,871	2,276	2,559	1,972
MAD	2,859	2,862	3,226	2,785	3,070	2,298
Avg. Perc. Error	-0.1%	5.3%	12.7%	17.1%	19.6%	15.7%
MAPE	23.9%	23.6%	23.5%	20.4%	25.0%	18.5%
CMAPE	6.0%	6.0%	6.5%	5.3%	6.3%	5.0%

- The strongest of all approaches
- Tracks your actual forecast process
- Allows you compare statistical vs. adjusted forecasts
- Provides insight into expected accuracy

# Forecast **PRO** Exception Reports

- Reduces the need for manual review.
- Allows you to focus on the items where human attention is most needed.

- Tracking forecast accuracy allows you to improve your forecasting process, gain insight into expected performance, benchmark and spot problems quickly.
- All error measurement statistics have strengths and weaknesses and care should be used when selecting which ones to focus on.
- Out-of-sample performance provides a better measure of expected forecast accuracy than within-sample performance.
- Exception reports are a useful tool to zero in on forecasts that need human attention.

- This webinar utilized Forecast Pro TRAC.
- To learn more about Forecast Pro TRAC please:
  - visit [www.forecastpro.com](http://www.forecastpro.com), or
  - contact BFS to arrange for a live demo via the Web.

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# Forecast **PRO** Questions?



Thank you for attending!

**The M3-Competition:** results, conclusions and implications. (2000) S. Makridakis and M. Hibon. International Journal of Forecasting, 16: 451-476.

**Out-of-sample Tests of Forecasting Accuracy:** an analysis and review. (2000) L.J. Tashman. International Journal of Forecasting, 16: 437-450.

**How to Assess the Cost of Forecast Error**, Feature Section in Foresight, Issues 7 and 8 (Summer and Fall 2007)

**Forecast Accuracy Measurement: Two Innovations**, Foresight, Issue 7 Summer 2007

**Forecast-Accuracy Metrics for Inventory Control and Intermittent Demand**, Feature Section in Foresight, Issue 4, (June 2006).

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