SO99+ Demand

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SO99+ Demand planning - Topics

1 Better Decisions, Faster

In v8.60, we made a number of **improvements** to our forecasting engines to give better, faster results

2 Improve “Explainability”

With v8.60, we’ve added functionalities to explain why our engines output specific results, allowing for more transparency and user trust

3 What You Might Have Missed

In v8.50, we added a number of enhancement to our Causals Engine

4 Coming Next

We’ll preview one of the new functionalities in development for one of our next releases.

Agenda Demand

- Improved Alerts
- Use Known Future Customer Orders to Improve Forecasts
- Lost Sales Enhancements
- Flexible Forecast Aggregation Level
- Auto ML Tuning
- NPI Dashboard 
- LightGBM
- Causal Enhancements
- Back-Testing Dashboard

Improved Alerts

Challenge

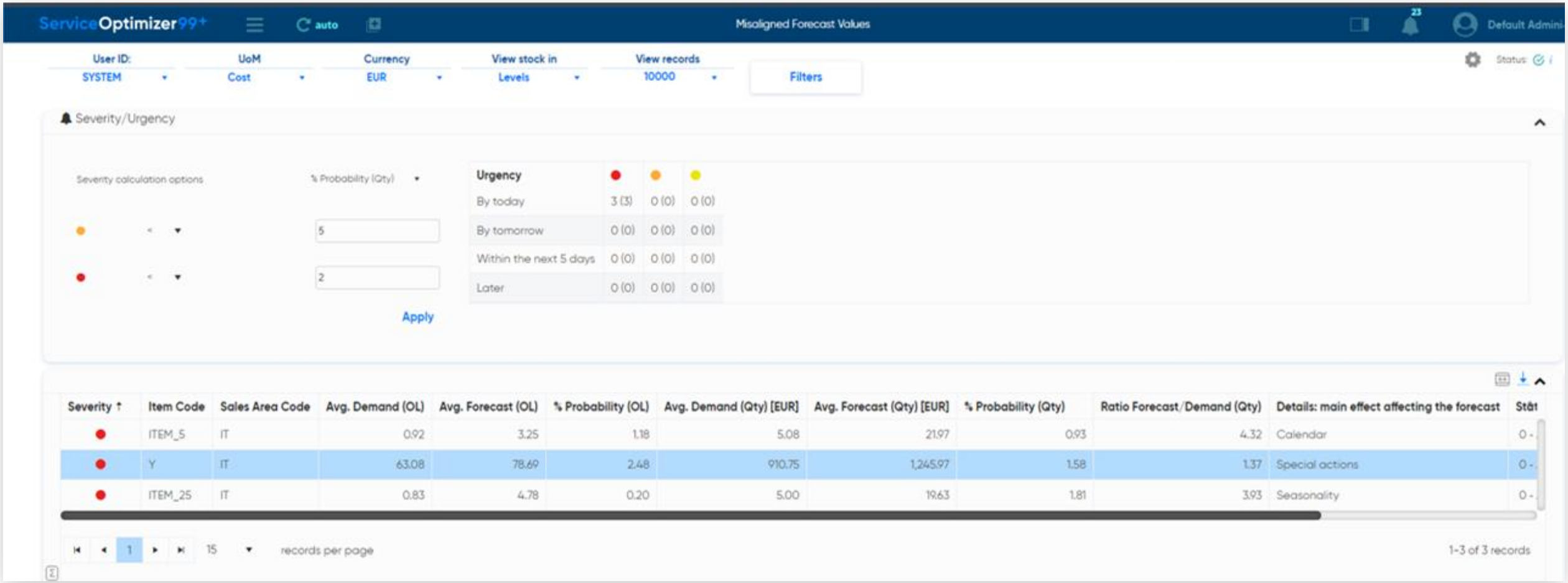
- To satisfy business requirements, SO99+ uses many functionalities to calculate the statistical forecast
- When these functionalities work together, it can be difficult to understand the intricacies of the system outputs

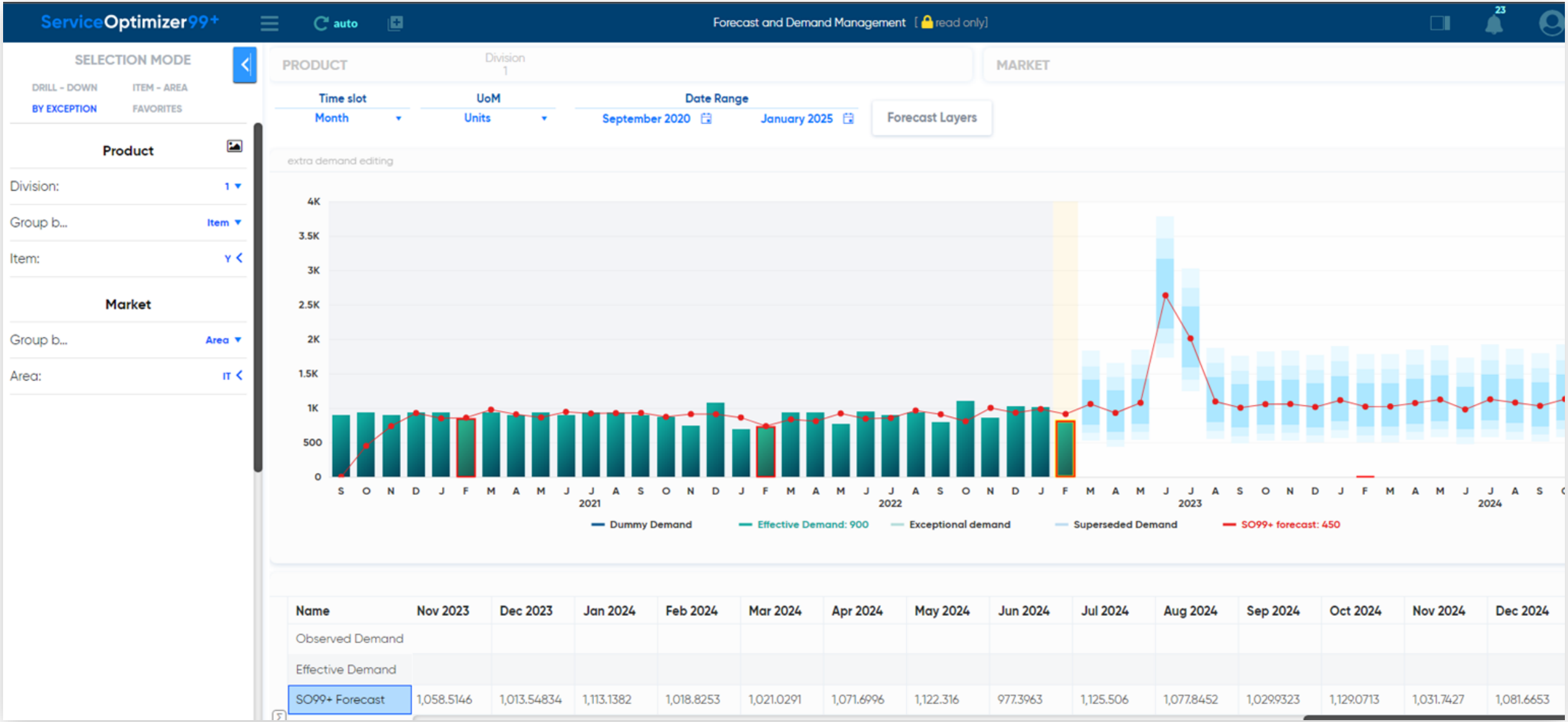
Solution

- A new report captures all the Item/Area combinations for which the forecast has a high probability of being wrong

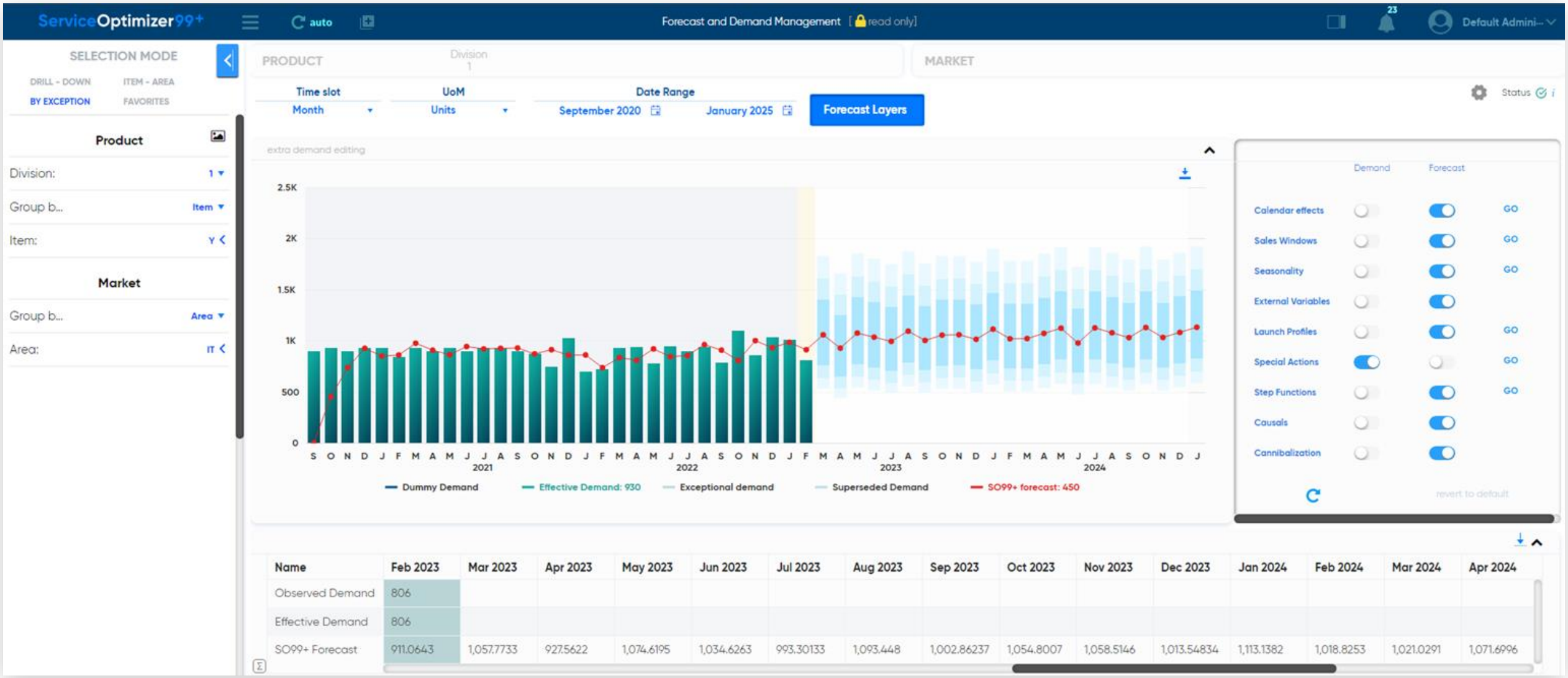
Benefits

- Users trust the system more since they can better understand what happens behind-the-scenes
- Improved stability over time, as identified problems can be fixed before they disrupt the model





Name	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	Oct 2024	Nov 2024	Dec 2024
Observed Demand														
Effective Demand														
SO99+ Forecast	1,058.5146	1,013.54834	1,113.1382	1,018.8253	1,021.0291	1,071.6996	1,122.316	977.3963	1,125.506	1,077.8452	1,029.9323	1,129.0713	1,031.7427	1,081.6653



Name	Feb 2023	Mar 2023	Apr 2023	May 2023	Jun 2023	Jul 2023	Aug 2023	Sep 2023	Oct 2023	Nov 2023	Dec 2023	Jan 2024	Feb 2024	Mar 2024	Apr 2024
Observed Demand	806														
Effective Demand	806														
SO99+ Forecast	911.0643	1,057.7733	927.5622	1,074.6195	1,034.6263	993.30133	1,093.448	1,002.86237	1,054.8007	1,058.5146	1,013.54834	1,113.1382	1,018.8253	1,021.0291	1,071.6996

Lost Sales Enhancements

Challenge

- Supply uncertainty is becoming more and more common, increasing the number and length of stock-outs
- The effect of lost sales is not the same for all customers. Some customers are willing to wait, while others will walk away
- Demand cleansing activities for such situations can be tedious and time consuming.

Solution

A more flexible “Automatic dummy demand creation during stock-out periods” functionality:

- Lost Sales Management by Area
- Calculate Lost Sales on Commercial Forecast
- Considers Minimum Sales Lots for stock-outs

Benefits

- Improves quality and stability of forecasts
- Breaks the vicious cycle of negative trends creating future stock outs
- Automated cleansing frees up planners’ time to work on more value-added tasks

Lost Sales Enhancements

Name	Dec 2021	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023
Observed Demand	503	199	144	148	185	229	84	226	336	179	189	436	408	44
Effective Demand	503	199	144	148	185	229	84	226	263	179	189	372	408	44

Lost Sales Enhancements

Name	Dec 2021	Jan 2022	Feb 2022	Mar 2022	Apr 2022	May 2022	Jun 2022	Jul 2022	Aug 2022	Sep 2022	Oct 2022	Nov 2022	Dec 2022	Jan 2023
Observed Demand	503	199	144	148	185	229	84	226	336	179	189	436	407999969	44
Effective Demand	503	199	144	148	185	229	84	226	263	179	189	372	530.400452	283.87146

Flexible Forecast Aggregation

Better Decisions, Faster

Challenge

- Demand forecasting at Item/Area level can be too granular for certain industries and the system may have delays identifying trends

Solution

- A revised forecasting process structure enables the forecast to be executed at any desired aggregation level, maintaining visibility at the item/area level

Benefits

- Improved quality and stability of the forecast at the atomic level when demand is too fragmented and behaviors happening at higher levels cannot be caught by the standard forecasting algorithm
- Delivers better performance for the forecast calculation process

Better Decisions, Faster

Use known future customer orders to improve forecasts

Challenge

- It is common to receive customer pre-orders months/days in advance, flowing recurring pre-book patterns
- SO99+ uses these future orders only to drive replenishment and adjust forecasts until these customer orders become historical demand

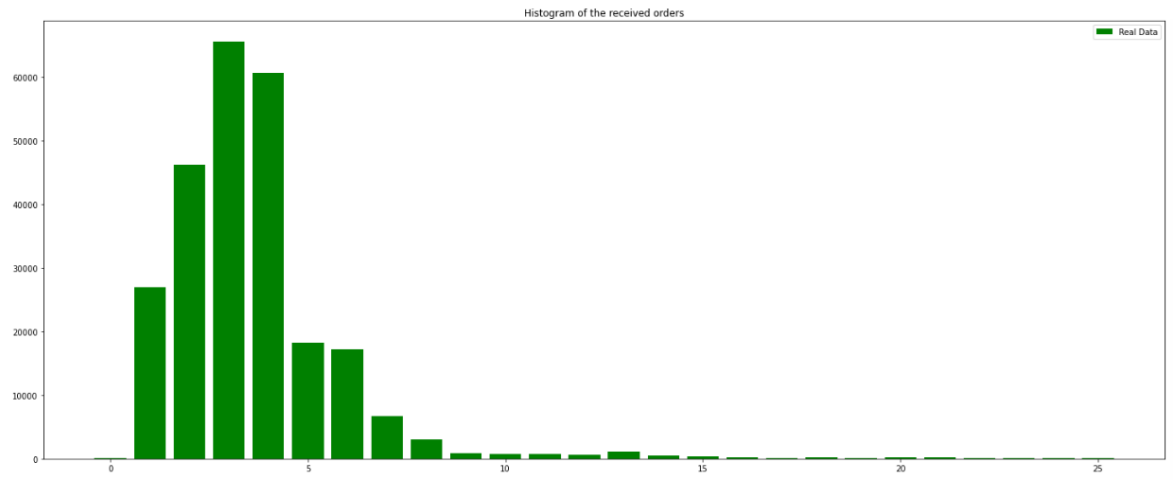
Solution

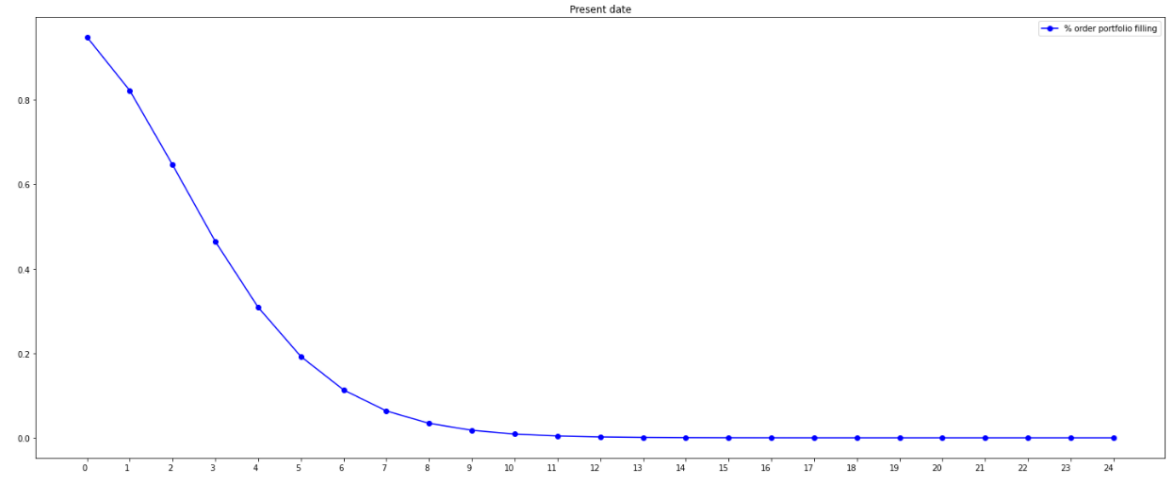
- A new re-forecasting algorithm uses customer orders within a frozen horizon (for placing future orders) to understand if the standard statistical forecast needs to be adjusted, shortening user reaction time when the market deviates from its expected behaviour

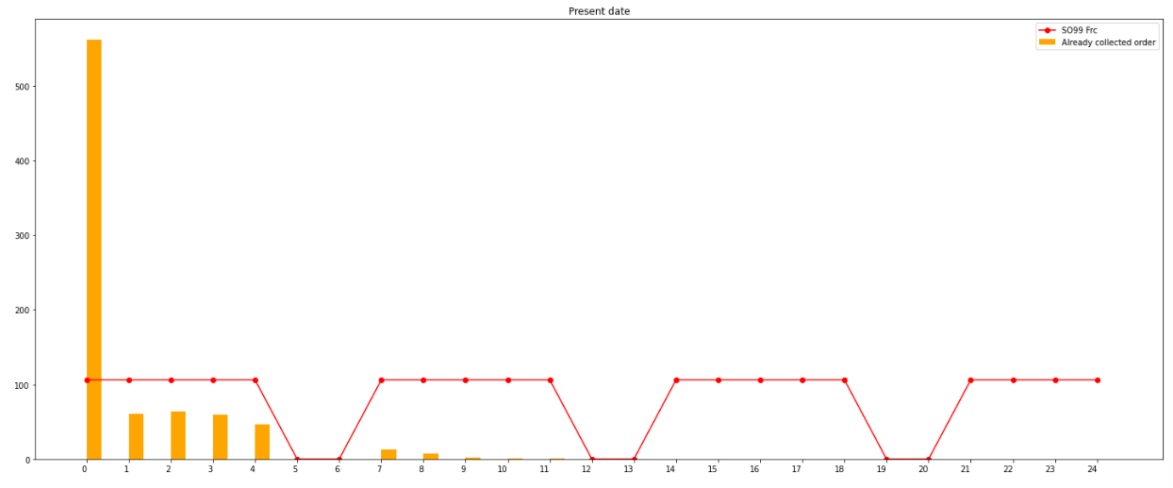
Benefits

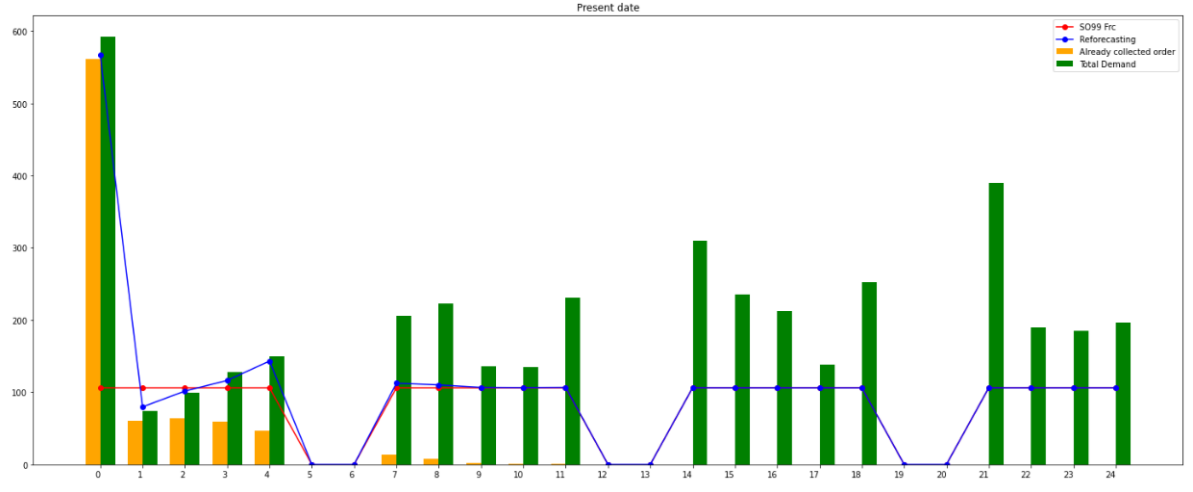
- Improved short/medium-term forecasts because users can react sooner to market changes

Use known future customer orders to improve forecasts









Automatic Machine Learning (ML) parameters

Challenge

- Defining the right hierarchy level used by the ML engine is time-consuming, mostly spent on manual trial-and-error

Solution

- The new automatic selection of the product and market hierarchy levels feature makes the system autonomous in detecting the optimal hierarchy for Seasonality and Daily Sales Profiles clustering engines

Benefits

- Ensures higher-quality clustering results and, therefore, improved forecast accuracy
- Simplifies and shortens the implementation process

NPI - New Dashboard

Challenge

- Users, and consultants, often **struggle when setting up ML** engines
- Selecting the **right attributes** to properly feed the system is hard
- ML **model validation** is hard
- If you **do not trust** the model, you will not trust the results

Solution

- A **new type of dashboard** that allows users to:
- **Monitor** model issues (e.g. overfitting) or issues with features
- **Explore** feature data to better understand the features and their respective issues
- **What-if capabilities** to see how the prediction would change when altering features
- A **Model Explanation** that allows users to better interpret the results

Benefits

- **More transparency** in the model engenders more trust in the overall system
- **Easier setup** and **monitoring**
- **Higher forecast quality** for the launch of new products

NPI - New Dashboard

Division: E

Split Value: F

Model Summary | "What if" Prediction | Explore Data | Model Explanation | Feature Interactions

Model Summary
Helps you detect issues with your current model

Product Hierarchy	Market Hierarchy	Last Fit Time	Last Predict Time	# Train data rows	Overfit Measure
Item	Area	2022-12-05 16:13:37	2022-12-05 16:13:37	5600	1.27

Global Status

Feature Status

Model Recency
Model was trained recently; we consider a model that is older than 180 days to be an old model.

Overfit Measure
The model is moderately overfitting. To measure overfit, we consider the ratio between test and training error: a ratio above 1.5 represents a high overfit; a ratio above 1.25 and below 1.5 represents a moderate overfit.

Suggestion
Check feature warnings and consider removing features. You might also want to run automatic feature selection.

Data Size
Dataset size is adequate; we consider it likely that a training dataset with less than 20 rows would be better processed manually than with a machine learning method such as NPI.

NPI - New Dashboard

Division: E

Split Value: F

Model Summary | "What if" Prediction | Explore Data | Model Explanation | Feature Interactions

"What if" Prediction

Explains the prediction for specific future launches and allows you to experiment with other feature values

Select a Product: ITEM_100

Select a Market: AREA_1

What If Results

Update Features

LSTPRICE: 13.24 − +

ITGood_0: ITATTR0_4

ITGood_1: ITATTR1_5

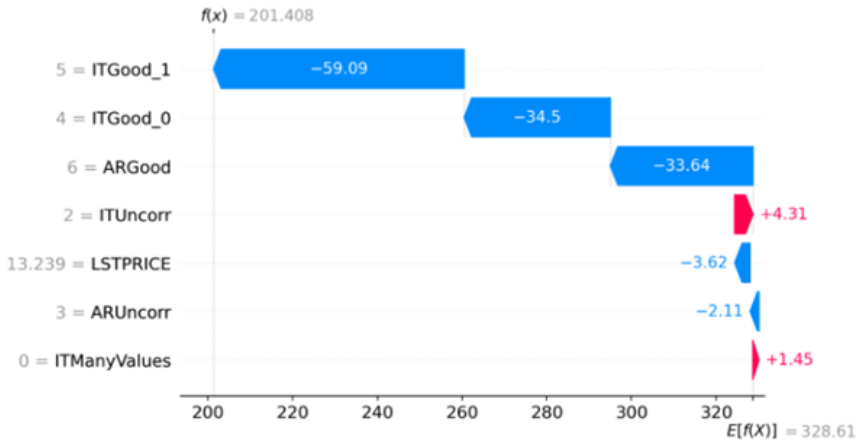
ITManyValues: ITATTR2_302

ITUncorr: ITATTR3_2

ARGood: ARATTR0_6

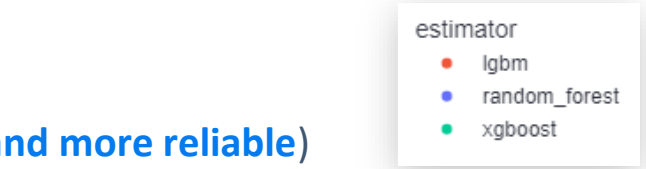
ARUncorr: ARATTR1_3

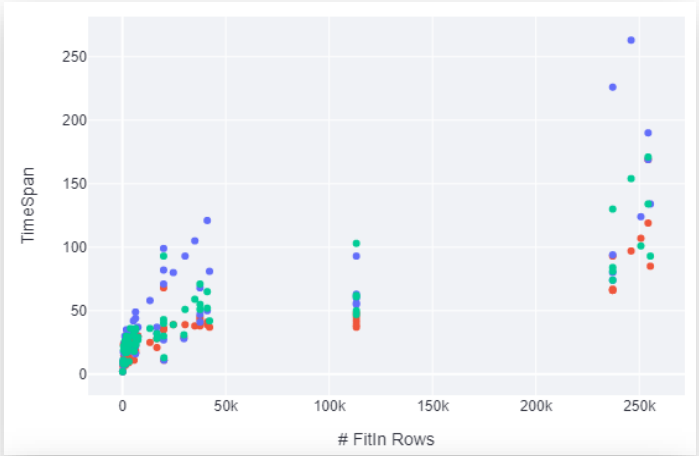
Waterfall Plot

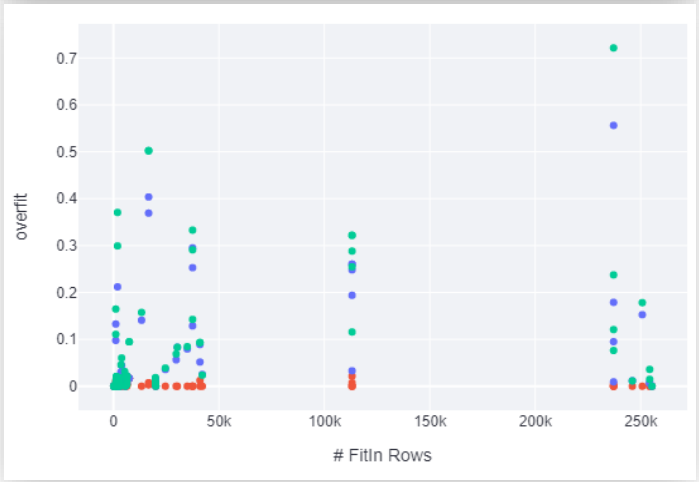


Light Gradient Boosting Machine

We constantly review and upgrade our engines to use the latest technology.
In v8.60, support for a new estimator **Light Gradient Boosting Machine** (**faster and more reliable**) has been added. It is now the default for our NPI and Causal engine, and it is available for the other ML engines.







Causals Engine - Enhancements

Challenge

- Users have additional external variables aka **causal factors** (e.g. economic indicators, evolution of product prices, competitor activity tracking) that they think are **related to demand**
- Users need to be able to see if they are related and – if so – how can they be used to **improve the forecast**
- Further, they have to understand if there is a **lag** between a causals factor and its effects on demand

Solution

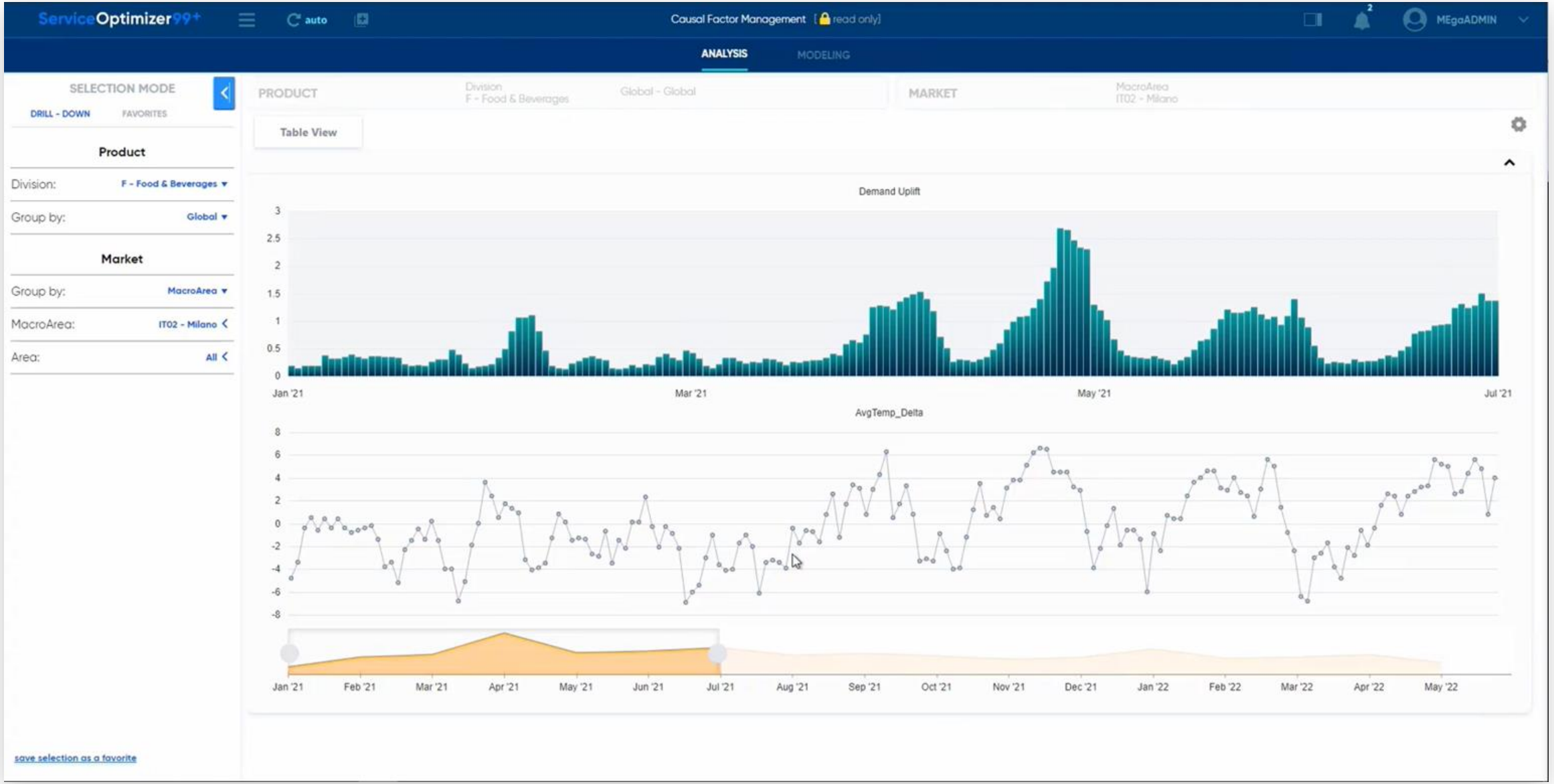
Our Causals engine (ported to Web Client in v8.50) allows users to:

- **Explore** causal factors
- Use causal factors to **impact the forecast**
- Identify the **correct lag automatically**

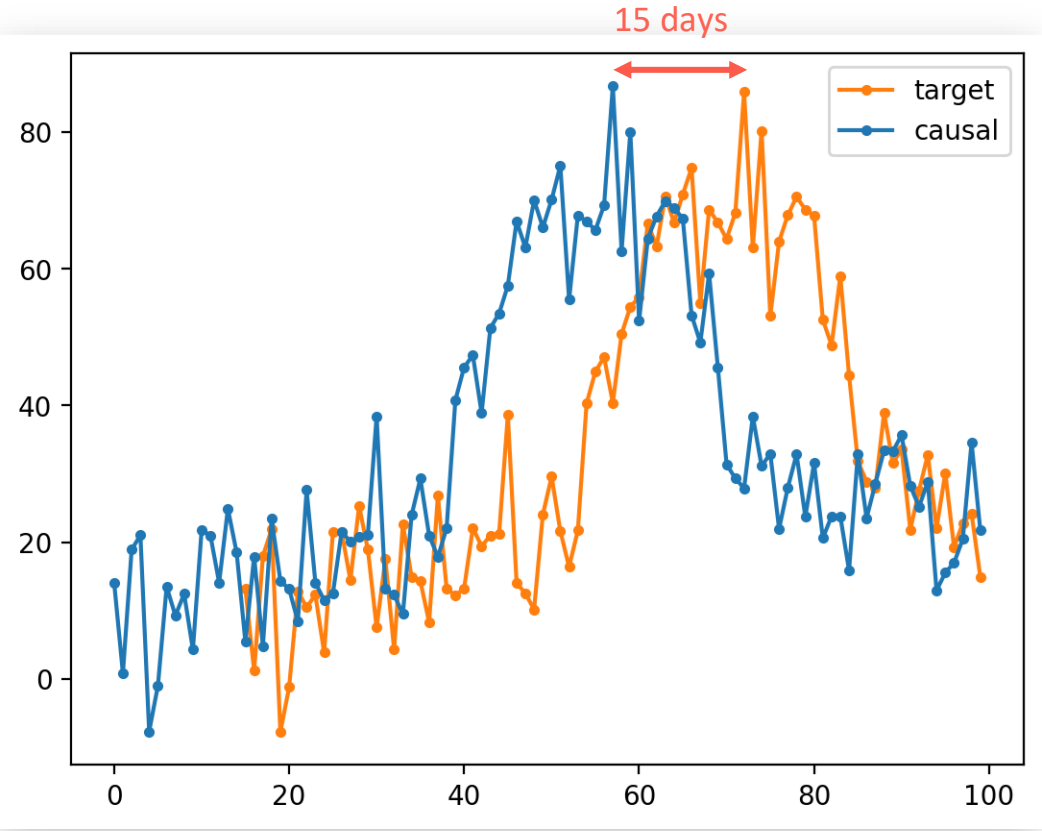
Benefits

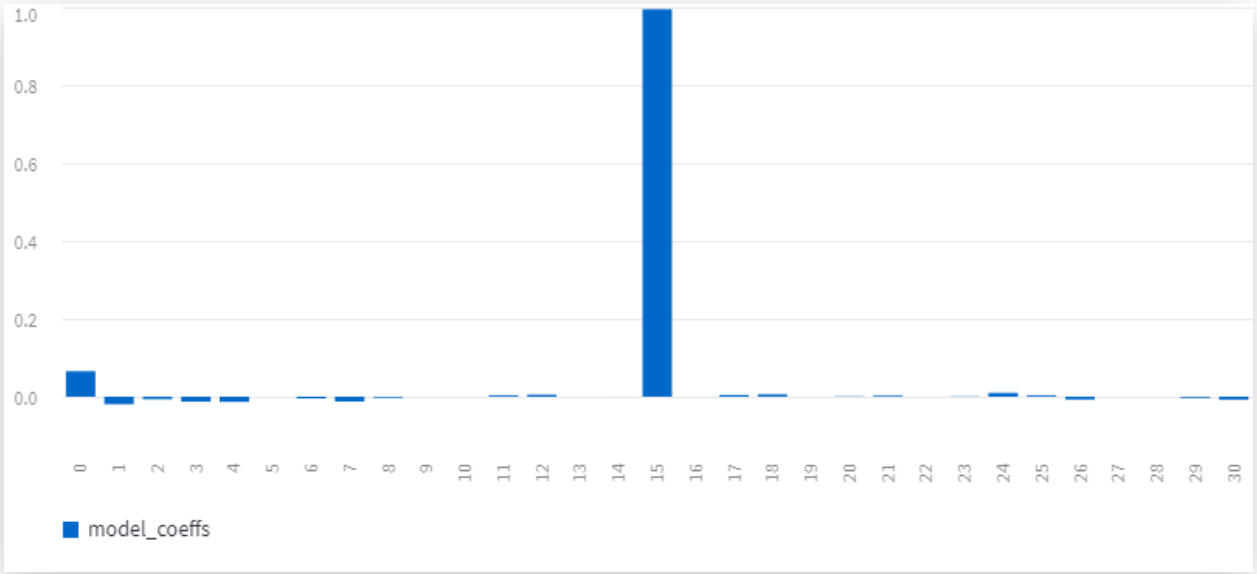
- Possibility to **explore casual factors** side-by-side with the demand
- **Improved forecasts** using information from causal factors
- Automatic identification of **correct lag** between causal factors and their effect on demand

Causals Engine – Web Client



Causals Engine - Lag Analysis





Uses **LASSO regression** to find the optimal lag(s)

Coming Soon

Back-Testing – New Dashboard

Challenge

- SO99+ **engines are powerful but** complex and have **many parameters**
- **Comparing forecasts** with different settings is **time consuming**
- With budget and time constraint, achieving an **optimal result** is often **not feasible**

Solution

- A **back-testing engine** is now (as of v8.60) an integrated functionality
- Allows consultants to **easily configure simulations** and to store the results of each simulation at their desired hierarchy level for later comparison and analysis
- In a next version, **a new dashboard** will be available to easily analyse the results of a single back-test or to compare multiple back-testing runs

Benefits

- **Faster implementation** process through easier model validation
- **Improved forecast accuracy**
- **Easily compare forecasts** with and without machine learning
- **Facilitate the upgrade to new versions** by comparing forecasts between versions

Coming Soon

Back-Testing – New Dashboard

Division

F - Food & Beverages

BacktestId	Descr	Timeslot	Aggregation product hierarchy	Aggregation market hierarchy	# records
EXP0	Benchmark backtest	Monthly	Item	Area	16800
EXP1	Legacy	Monthly	Item	Area	16800
EXP2	Introducing Causals	Monthly	Item	Area	16800

Metric Tables and Plots

Show error KPIs and plot charts

Lags: 1 × 2 ×

Error metrics: WMAPE - Weighted Mean Absolute Percent Error

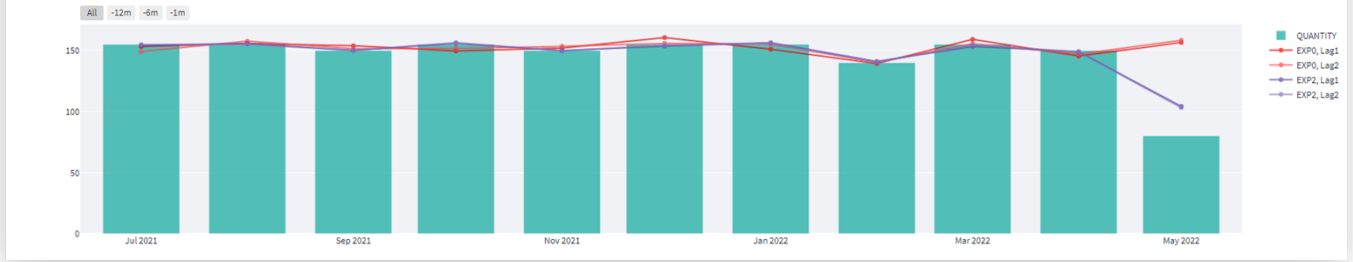
Family ▸ Item

				EXP0 - Benchmark backtest		EXP2 - Introducing Causals	
Group	Item	Area	Demand weight	Lag 1	Lag 2	Lag 1	Lag 2
FF (80)			41.85%	13.38%	16.65%	8.25%	11.79%
IC (80)			39.51%	8.39%	10.10%	8.63%	11.38%
IC01 (20)			9.88%	8.22%	10.05%	8.58%	11.18%
IC02 (20)							11.47%

Columns ▷ Filters

Plot selection

Item: SP02, Area: UK01S



Recap - Demand

- Improved Alerts
- Use Known Future Customer Orders to Improve Forecasts
- Lost Sales Enhancements
- Flexible Forecast Aggregation Level
- Auto ML Tuning
- NPI Dashboard 
- LightGBM
- Causal Enhancements
- Back-Testing Dashboard 

toolsgroup/Engage.

Thank You

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