



# Business Case Duvel's stock policies



# The best pair forecast x stock policy

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- Based on the product I have been studying I can confirm that the pair **Statistical Forecast x Hybrid stock policy** is the best
- With this policy it will be cheaper to reach an higher service level

This is why

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# Forecasts available

2 forecasts available :

- Statistical Forecast
- Consensus Forecast by demand planners

Both have an issue from 2023-W36 to 2023-W39 with a forecast of 0 products

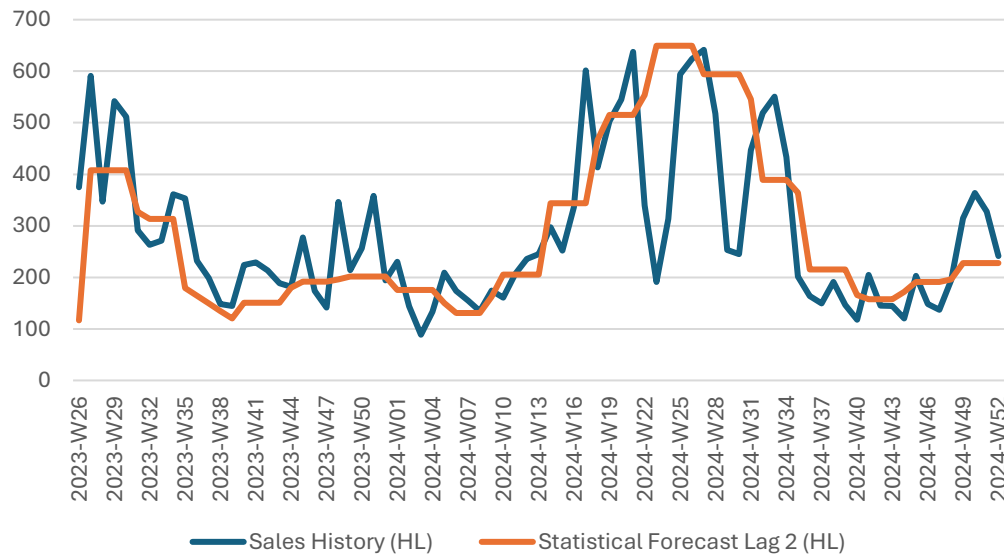
How to clear data ?

- Linear interpolation

$$V_t = \frac{V_{t-1} + V_{t+1}}{2}$$

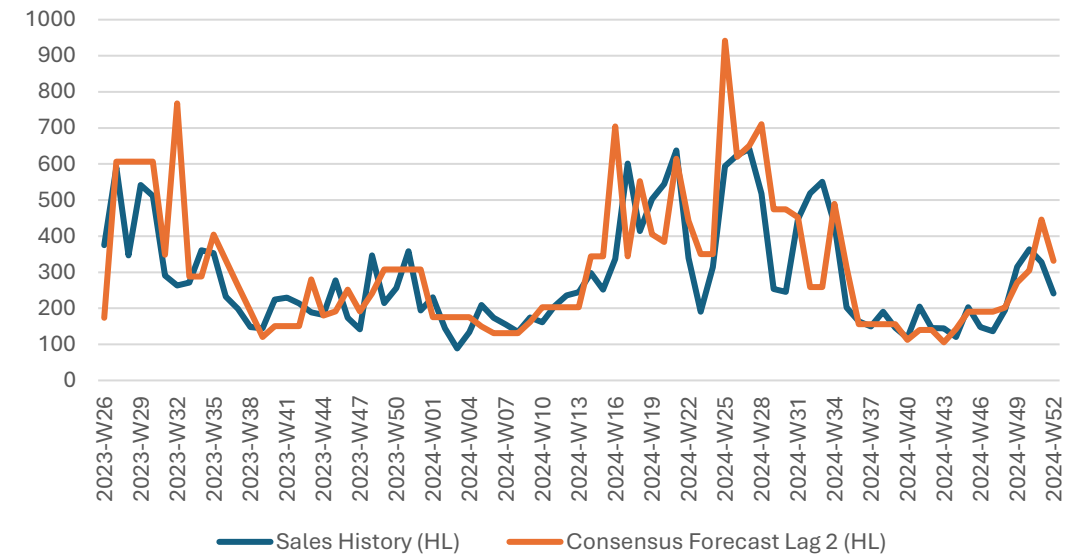
# Forecasts available - KPI

## Statistical Forecast vs Sales



Statistical forecast	Absolut	Relative
Bias	0,10274154	0,04%
MAE	81,7085935	28,45%
RMSE	119,900302	41,75%
MAPE		30,85%

## Consensus Forecast vs Sales

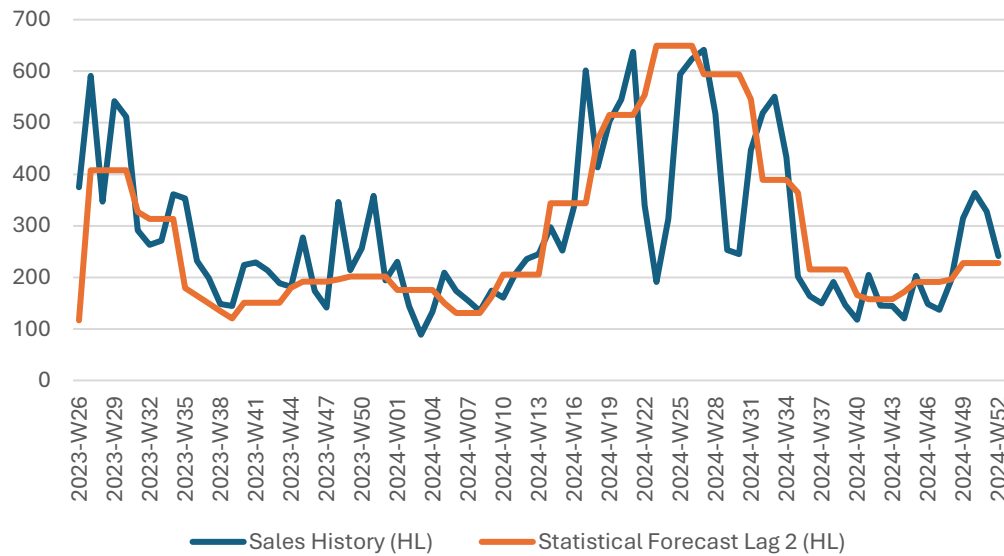


Consensus forecast	Absolut	Relative
Bias	25,6497092	8,93%
MAE	86,3010749	30,05%
RMSE	127,214678	44,30%
MAPE		30,87%

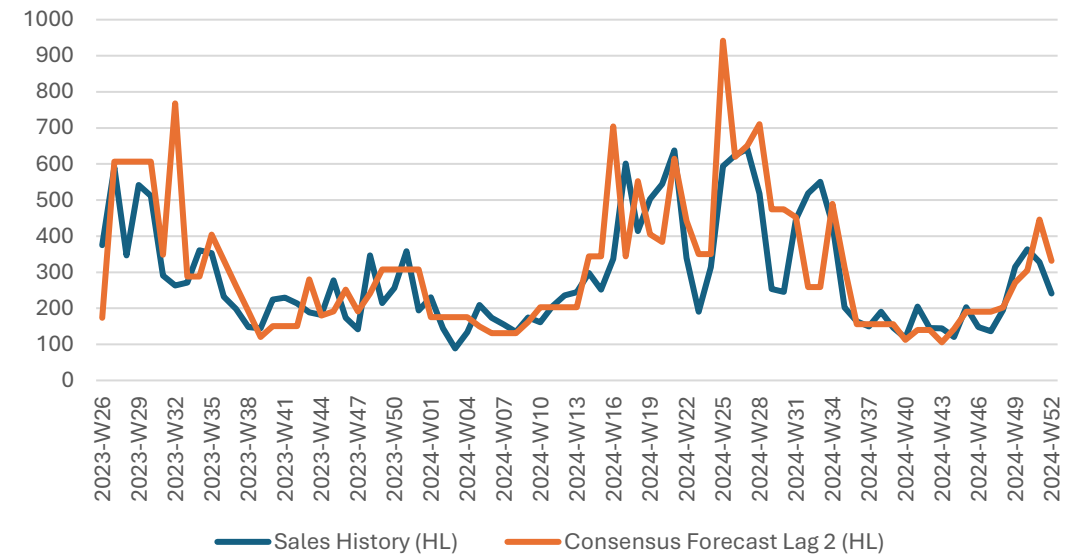
Bias % is high, maybe your demand planners are influenced by sales or supply planners ?

# Forecasts available - KPI

## Statistical Forecast vs Sales



## Consensus Forecast vs Sales



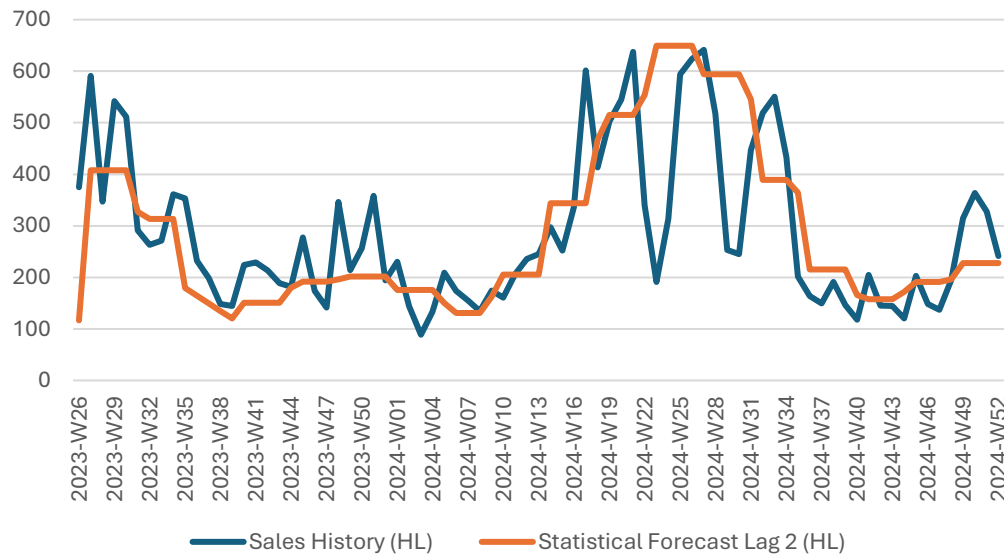
	Statistical Forecast	Consensus Forecast
<b> BIAS%  + MAE% + RMSE%</b>	<b>70,24%</b>	<b>83,28%</b>

This KPI computes the relative performance of 3 indicators : Bias, MAE, RMSE.

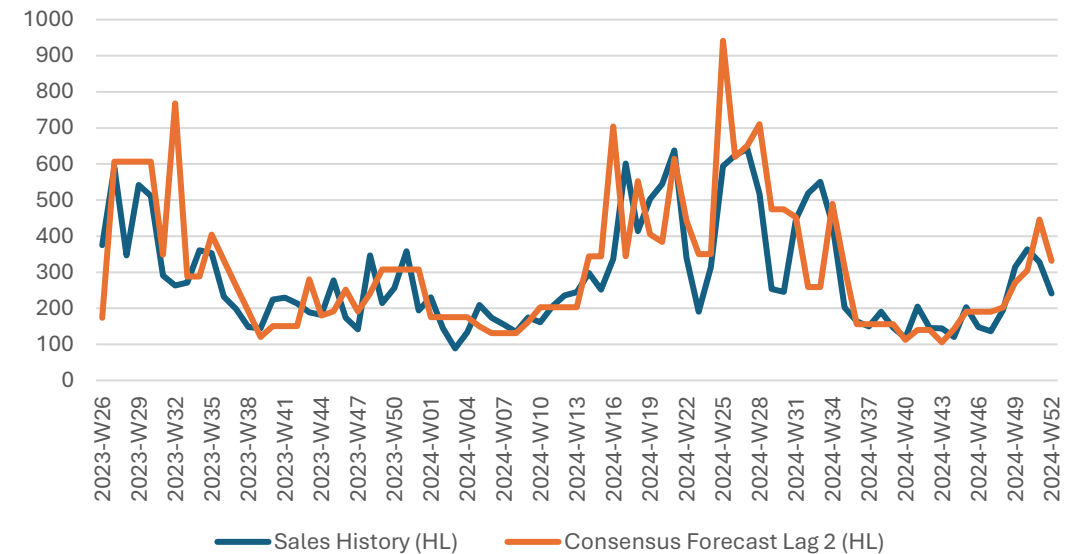
It rewards forecasts that are well-balanced across bias, general accuracy, and robustness to extreme errors, leading to a more comprehensive and fair comparison.

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## Statistical Forecast vs Sales



## Consensus Forecast vs Sales



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**Without any stock consideration, statistical forecast is better on this KPI. Let's see how these forecasts can influence stocks level and service level.**

# Stock Policies - Hypothesis

4 stocks policies to compare :

Policy	Up to level	Safety Stock	Variable
(R,S) static	Fixed as S	0	S
(R,S) hybrid	2 weeks of forecast	Fixed as s	s
(R,S) dynamic	2 weeks of forecast	X * 3rd week of forecast (X in [0,2])	X
Theoretical CSL	2 weeks of forecast	$S_s = z\sigma\sqrt{2}$ where $\sigma$ is the 12 weeks rolling RMSE	CSL service level (influence on z)

Review period : 1 week

Lead time : 1 week

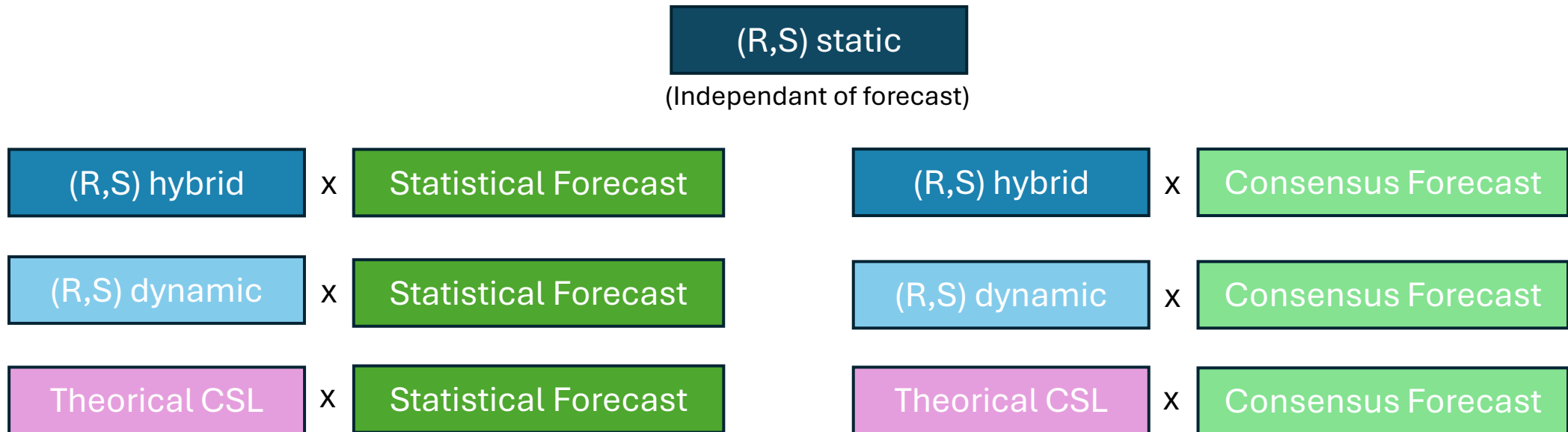
Including backorders for lost sales

Real demand of week W is computed as the sum of demand of W and lost sales of W-1 and lost sales of W are computed using the real demand of W



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7 pairs (Forecast x Stock policy) to compare :



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**How to compare them ?**

(R,S) static	(Independent of forecast)
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How to compare them ?

« Which one can achieve the highest service level at the cheapest cost ? »

**Service level metric chosen : fill rate**

With fill rate you measure the exact proportion of demand fulfilled thus aligning the metric closely with true customer experience and highlighting every shortfall precisely.

**Costs : handling costs + lost sales costs**

Choices of fixed, arbitrary values for handling costs and lost sales costs, aiming to determine the least expensive model by comparison rather than focusing on their actual costs.

Handling cost/unit : 2€  
Lost sales cost/unit : 10€

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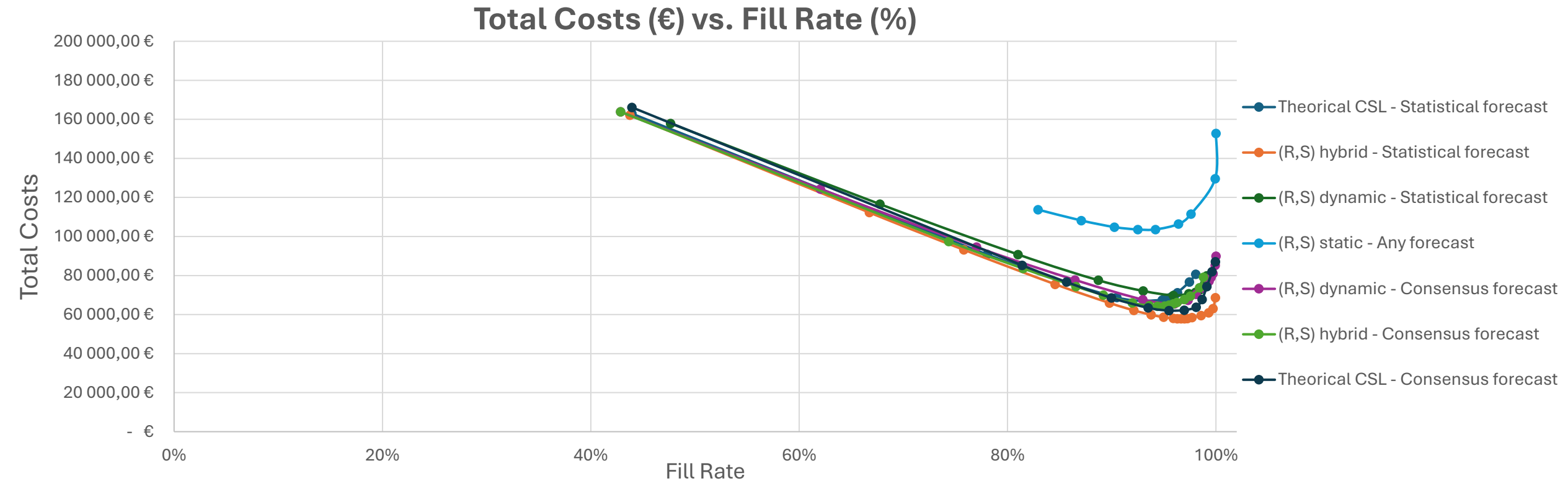
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# Forecasts x Stock Policies - Results



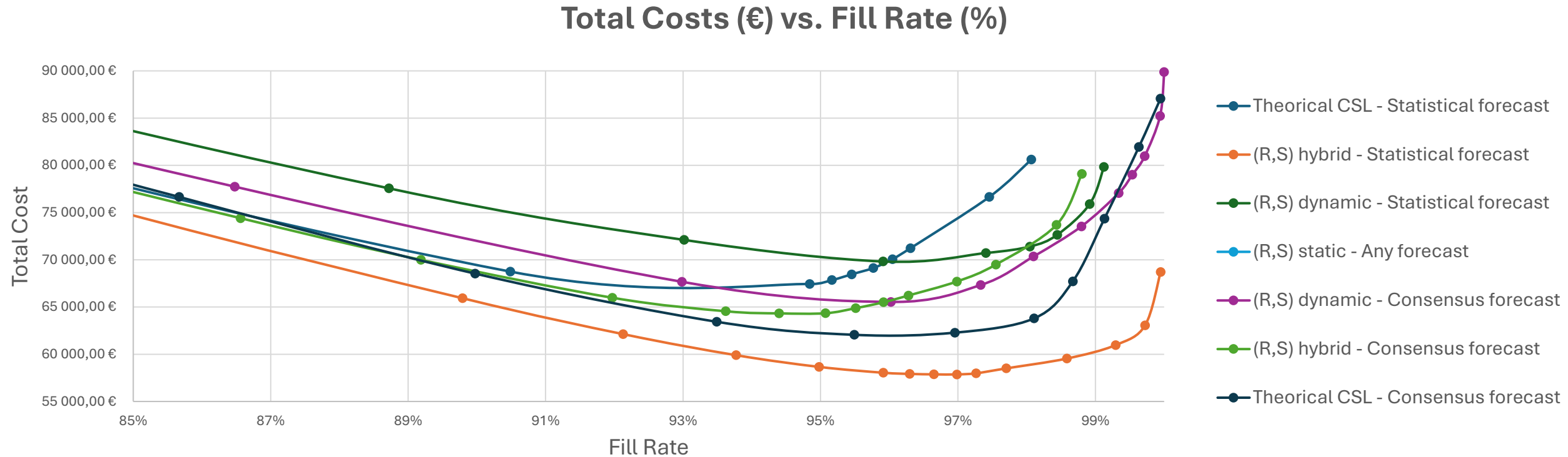
*How to read it ?*

For a given fill rate the best pair (forecast x stock policy) is the cheapest.

**First results :**

(R,S) static is by far the worst. Let's zoom in for a fill rate above 85% and a cost between 55k€ and 90k€ only.

# Forecasts x Stock Policies - Results



## Results :

**For all fill rates above 85%, (R,S) hybrid x Statistical forecast is the best.**  
**Consensus forecast isn't that bad as it comes in 2nd, 3rd and 4th pair.**

# Statistical forecast x (R,S) hybrid - Optimization

Now we know this model is the best. Let's optimize it.

**We want to know what fill rate achieved at the cheapest cost possible with this model.**

(We are still able to provide a 100% service level, but at high costs.)

Let's use Excel's solver.

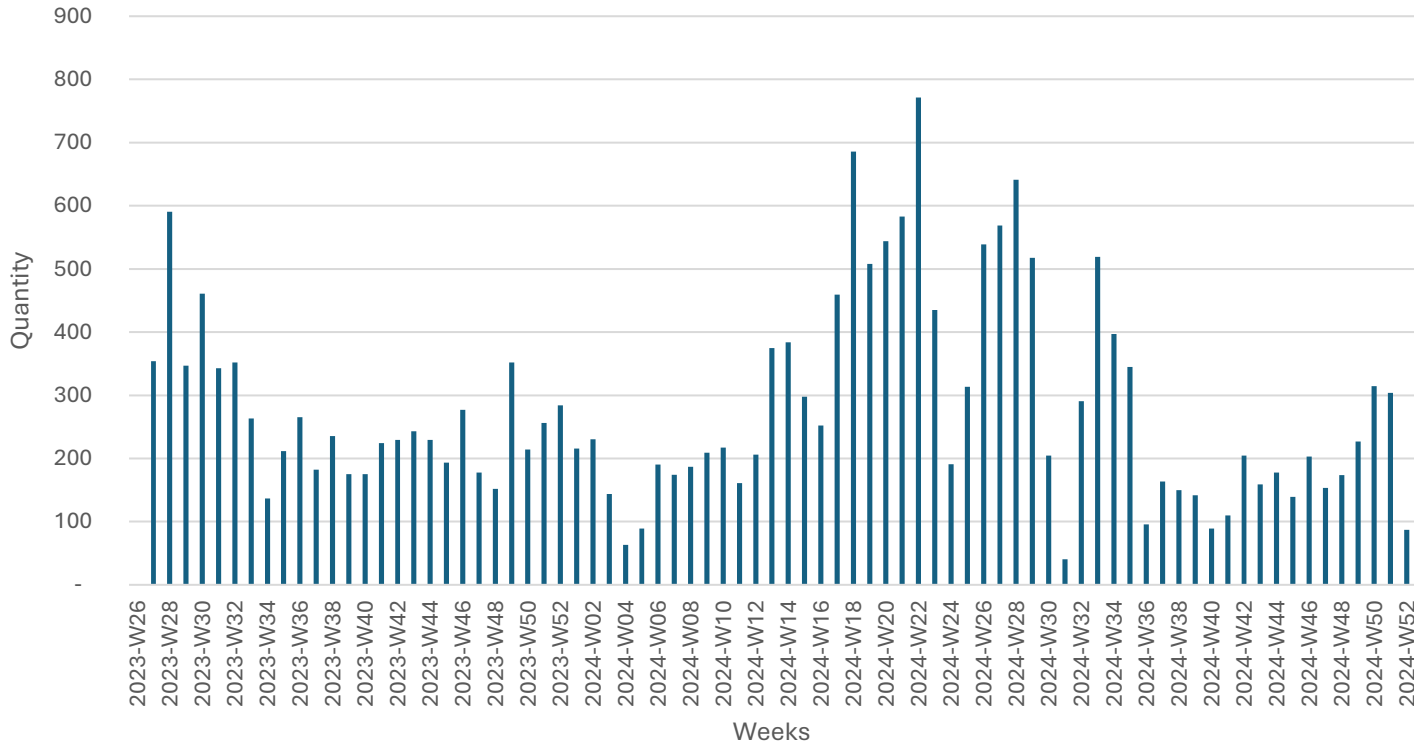
Optimized point is achieved with a **safety stock  $s = 163$  units**, and a up-to-level  $S = 2$  weeks of forecast.

With this model, **the fill rate is around 96.9%** (and the cost is around 57 850 €, still dependant of handling and lost sales costs hypothesis)

Let's have a look to the quantity per order required by this model.

# Statistical forecast x (R,S) hybrid – Order per quantity

Quantity per order (LT=1 week)



This model may be the cheapest solution to achieve the highest fill rate, it does not take production into account.

These data are the forecasted demands per week for production units and may need to be smoothed over the time to ensure that production can follow these orders (supply planners).