Louis Vuitton : Machine Learning Forecast

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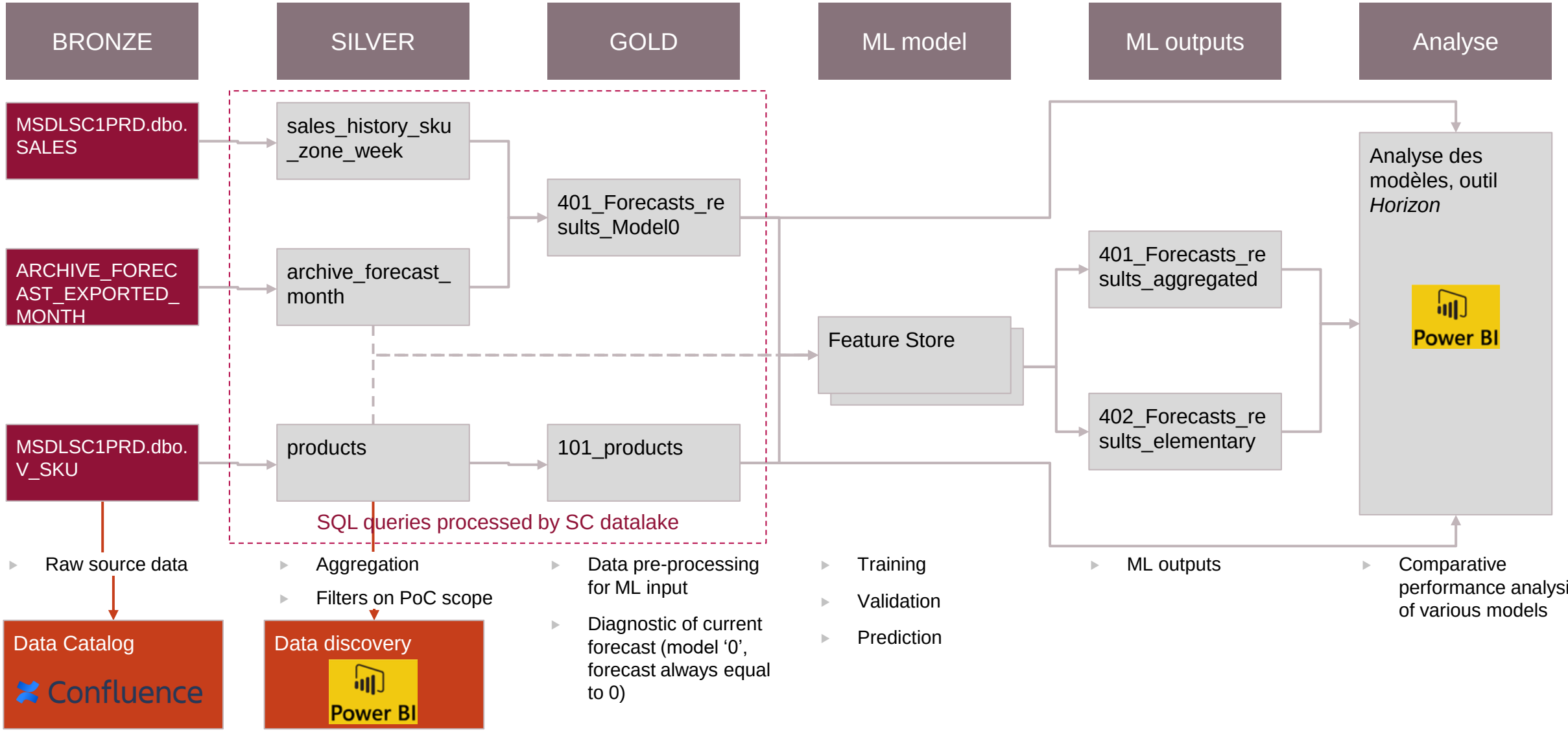
Agenda

- **Data collection overview**
- Diagnostic of iForecast performance
- Next steps
- Appendix

A ce stade, nous avons mis en place un flux de données partiel jusqu'au niveau « GOLD » et connecté notre PowerBI '*Horizon*' au datalake SC

Non-exhaustive



Agenda

Data collection overview

Demo of Horizon Power BI

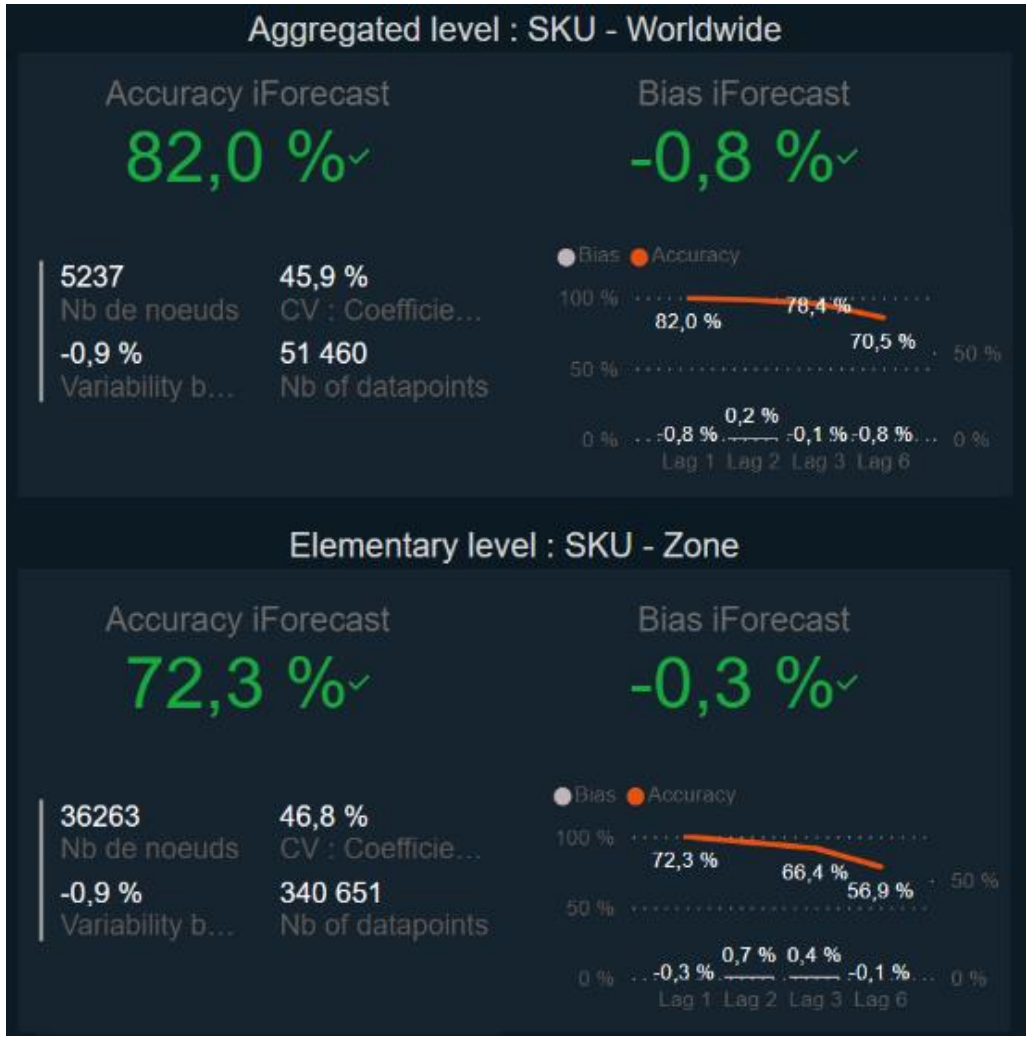
Diagnostic of iForecast performance

Next steps

Appendix

Performance overview

Performance at Month level, for the period Jan 2021 – Jan 2022



- The performance is measure by comparing the VVF Forecast (Validated Realistic Forecast) to the actual Sales (including RETURN_QTY). The accuracy is calculated using the WAPE metric (*see appendix*)
- The « Elementary level » is the current forecast grain employed in the iForecast application; while the « aggregated level » is the sum of all Zones (aka FORECAST_LEVEL)
- The overall performance is at best-in-class level for the luxury goods industry, with an accuracy above 80% at SKU level for the demand signal sent to production workshops. The biais is also close to 0 for all lags
- The performance only degrades by 3.5 pts between lag 1 and lag 3 months (at the aggregated level)

Applied filters :

- MANAGEMENT_MODE = ‘SALES FCST’
- Product Age (nb of months after MIN_LAUNCH_DATE) > 3
- MILESTONE <> ‘ARCHIVE’ or ‘NP TO COME’ (current SKU milestone)
- UNIVERSE = LEATHER GOODS, ACCESSORIES, JEWLERY, WATCHES

Analysis at Month level
Scenario 1

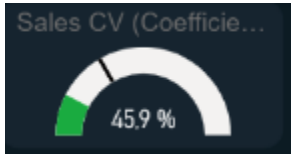
Sales characteristics

- Significant seasonality effect for year-end (+75% versus rest of year), for all *Universes*
  - Seasonality profile may differ depending on the zone (particularly CHINA, with Sales correlated to CNY event more than with Christmas)
- Drop in sales in spring 2020 (march, april, may) due to COVID-19
- Growing trend overall for *Fine Jewelry* (< 1% of Sales volume), and *Watches* (to a lesser extent)

Performance by ABC/XYZ class

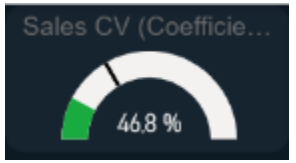
Performance by SKU Class, Jan 2021 – Jan 2022, Lag 1 Month

Aggregated level {SKU}



ABC Class	X	Y	Z
A			
Accuracy Validated	88,1 %	86,1 %	81,4 %
Bias	-0,7 %	-1,6 %	-3,5 %
Nb of Nodes	131	272	237
% of Sales	19%	35%	26%
CV	18,0 %	25,5 %	54,7 %
% of datapoints with Sales	100 %	100 %	99 %
B			
Accuracy Validated	79,8 %	77,9 %	67,5 %
Bias	6,0 %	1,8 %	5,9 %
Nb of Nodes	114	444	750
% of Sales	2%	7%	9%
CV	18,9 %	28,3 %	63,0 %
% of datapoints with Sales	100 %	100 %	97 %
C			
Accuracy Validated	68,7 %	64,7 %	44,3 %
Bias	-7,6 %	1,4 %	1,6 %
Nb of Nodes	75	474	2213
% of Sales	0%	1%	2%
CV	17,6 %	26,2 %	61,6 %
% of datapoints with Sales	69 %	70 %	77 %

Elementary level {SKU, Zone}



ABC Class	X	Y	Z
A			
Accuracy Validated	80,1 %	78,2 %	72,7 %
Bias	-0,5 %	-1,4 %	-3,2 %
Nb of Nodes	1161	2395	2101
% of Sales	19%	35%	26%
CV	34,2 %	39,1 %	56,6 %
% of datapoints with Sales	99 %	98 %	95 %
B			
Accuracy Validated	65,0 %	63,7 %	53,7 %
Bias	6,3 %	2,4 %	6,9 %
Nb of Nodes	984	3818	6340
% of Sales	2%	7%	9%
CV	37,9 %	46,2 %	58,5 %
% of datapoints with Sales	94 %	91 %	84 %
C			
Accuracy Validated	45,0 %	37,8 %	13,6 %
Bias	-2,6 %	3,5 %	8,3 %
Nb of Nodes	490	3020	14104
% of Sales	0%	1%	1%
CV	28,5 %	40,0 %	45,6 %
% of datapoints with Sales	47 %	52 %	40 %

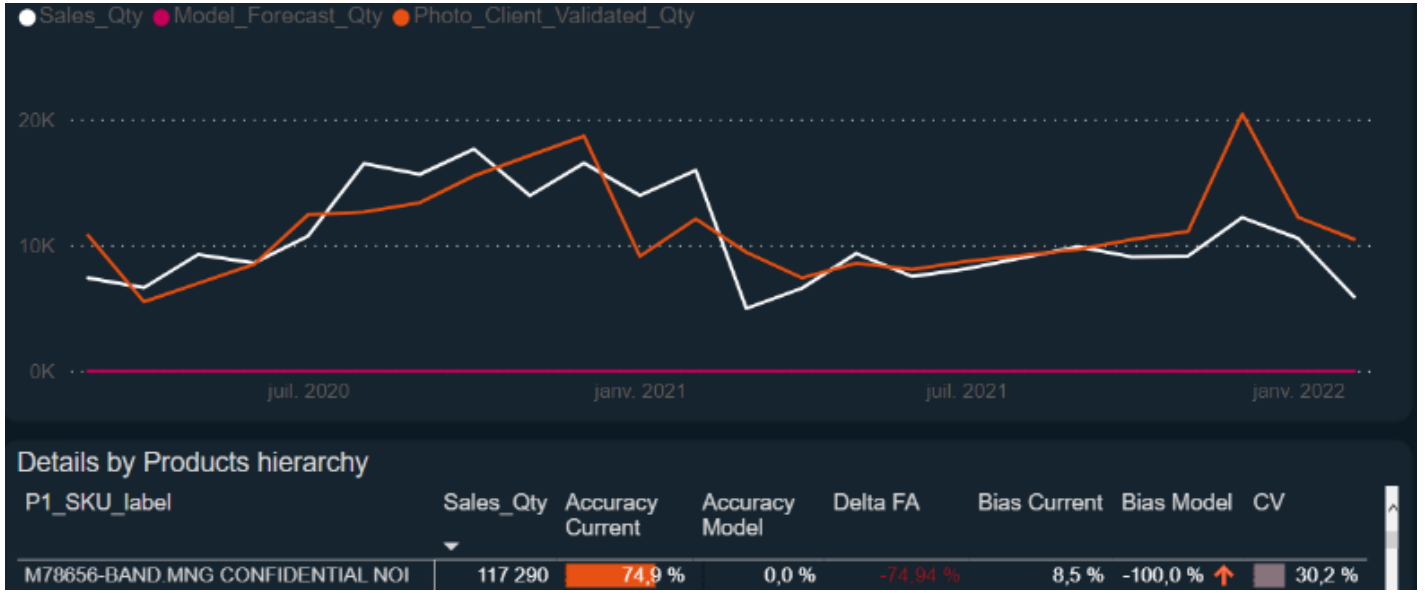
- The timeseries show a low level of variability by month, both at the aggregated and Zone level
- The threshold between class Y and Z is well below 40%, which is normally the mark for timeseries considered as ‘stable’
- Hopefully, the ML model will bring added performance to the bottom-right classes in the matrix

Focus on best-sellers of 2021 by Universe

Janv 2021 – Jan 2022, lag 1 month

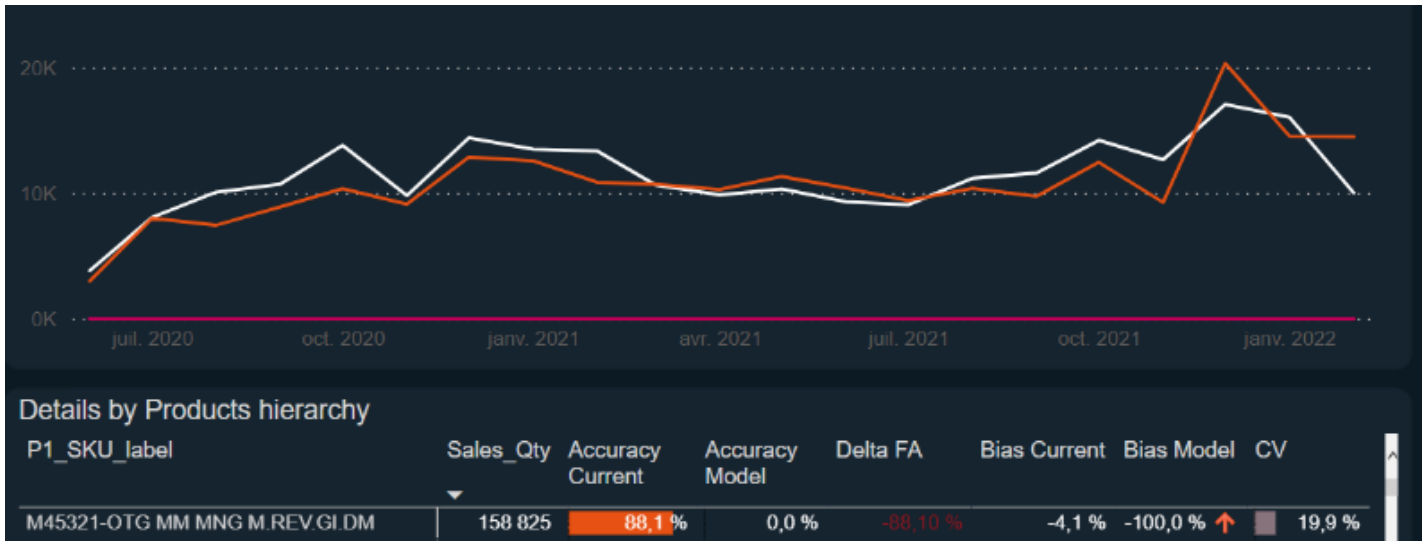
Best-seller ACCESSORIES

M78656-BAND.MNG
CONFIDENTIAL NOI



Best-seller LEATHER GOODS

M45321-OTG MM MNG
M.REV.GI.DM



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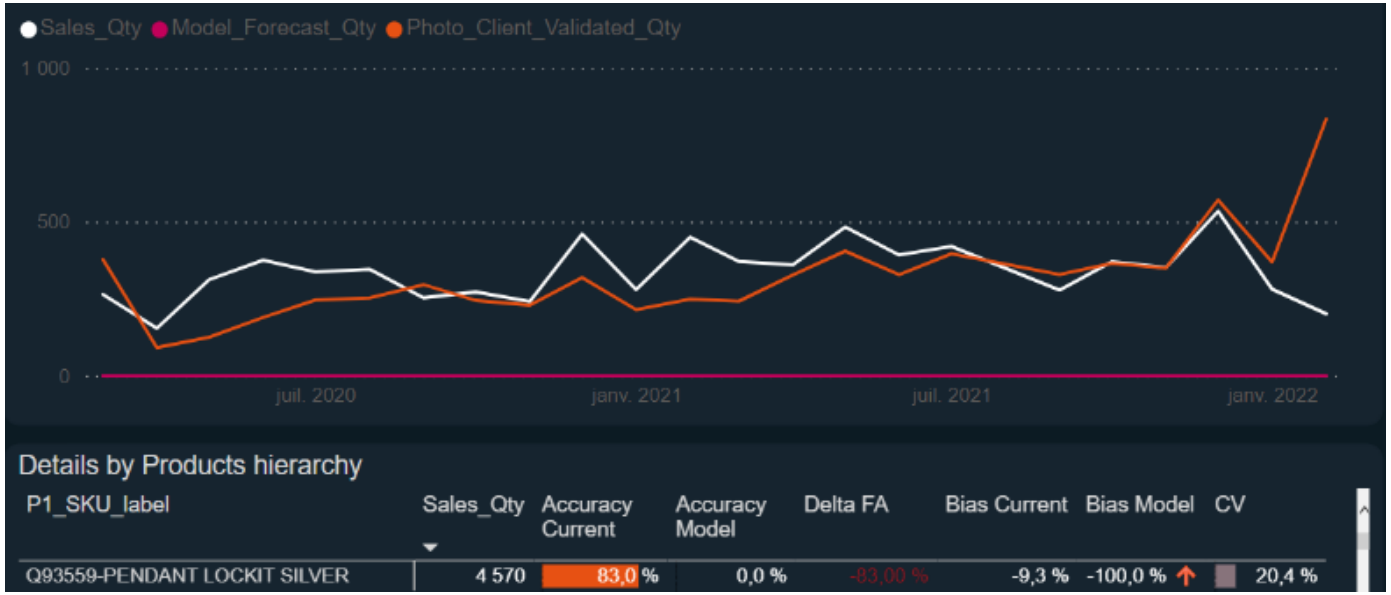
Focus on best-sellers of 2021 by Universe

Janv 2021 – Jan 2022, lag 1 month

Best-seller FINE JEWELRY

Q93559-PENDANT
LOCKIT SILVER

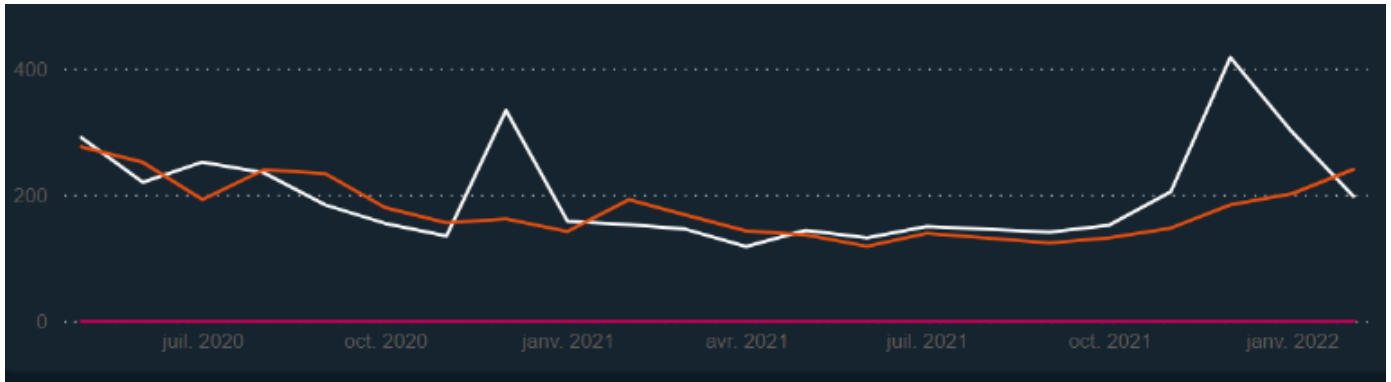


Details by Products hierarchy

P1_SKU_label	Sales_Qty	Accuracy Current	Accuracy Model	Delta FA	Bias Current	Bias Model	CV
Q93559-PENDANT LOCKIT SILVER	4 570	83,0 %	0,0 %	-83,00 %	-9,3 %	-100,0 %	20,4 %

Best-seller WATCHES

QAB120-V2
EARP.HO.WHI

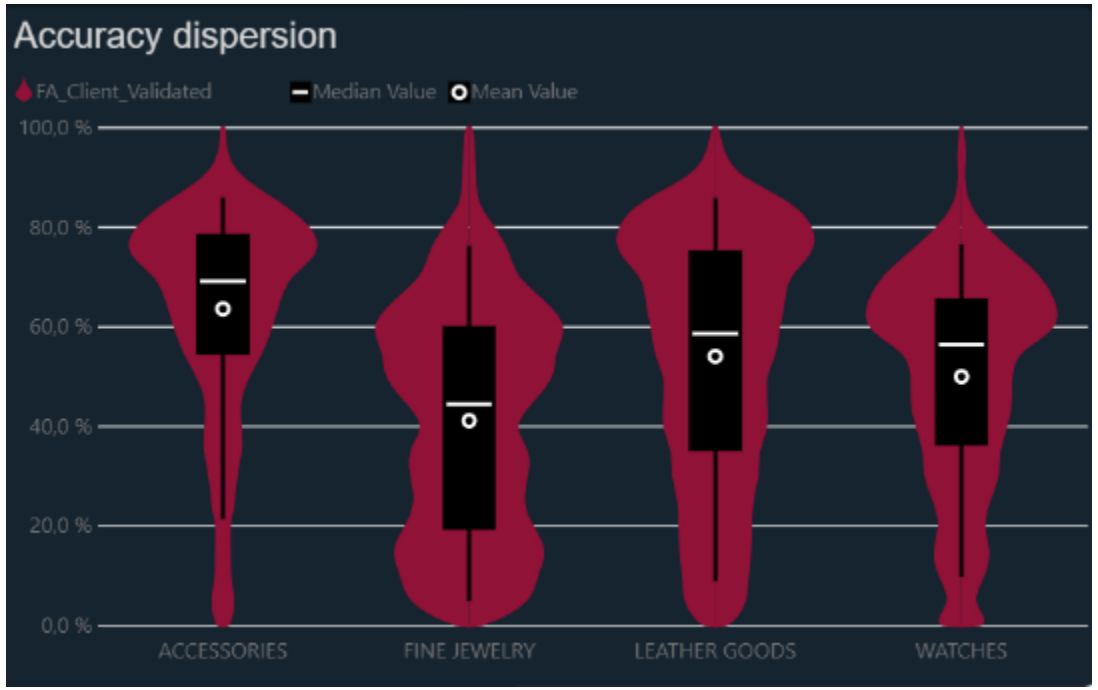


Details by Products hierarchy

P1_SKU_label	Sales_Qty	Accuracy Current	Accuracy Model	Delta FA	Bias Current	Bias Model	CV
QAB120-V2 EARP.HO.WHI	2 217	74,7 %	0,0 %	-74,69 %	-17,5 %	-100,0 %	45,4 %

Performance by Product Hierarchy reveals more potential for improvement on Leather Goods and Jewelry

Performance by Universe Class, March 2020 – Jan 2022, lag 1 month

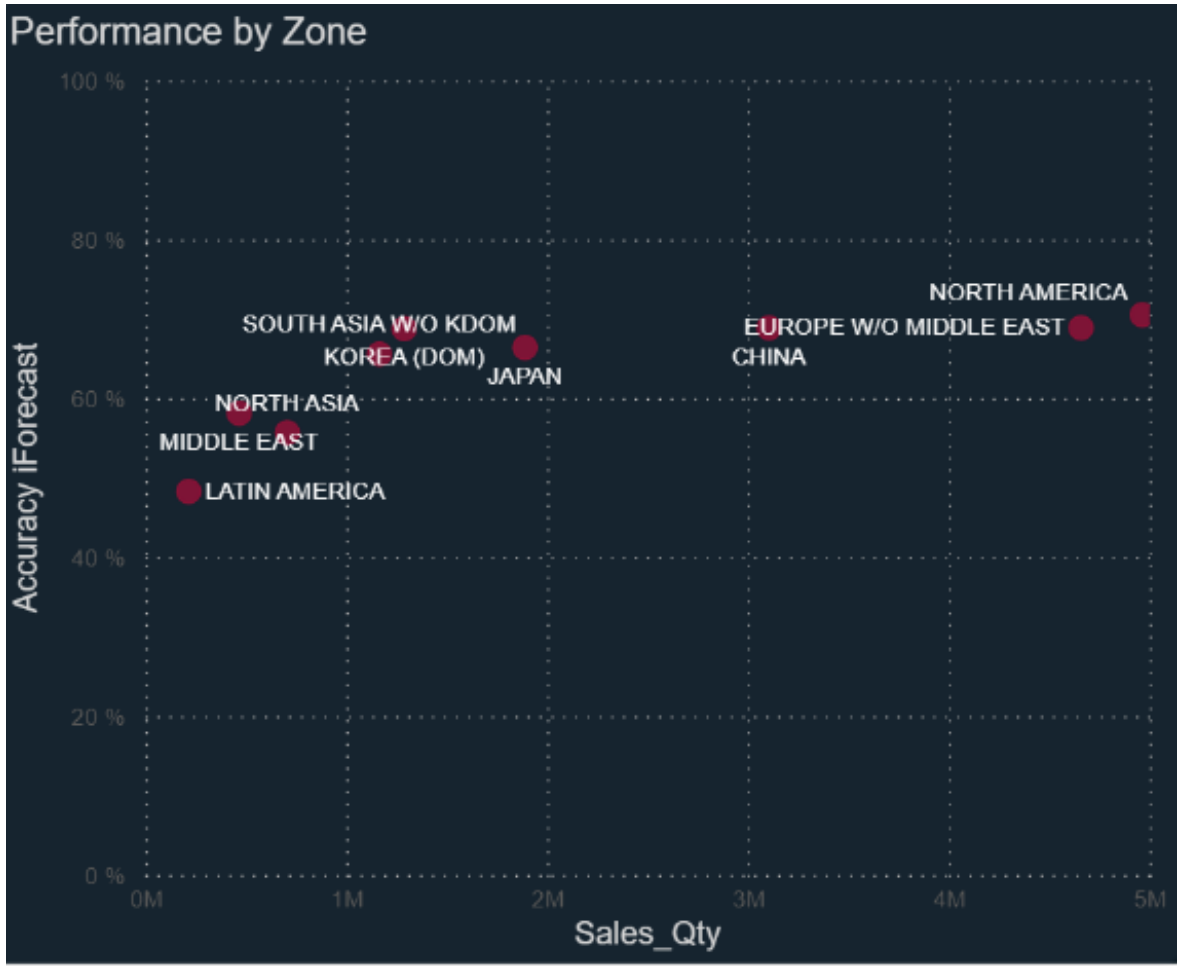


P7_Universe	% of Sales Qty	Accuracy Current	Bias Current	CV	Nb of nodes
LEATHER GOODS	**72,5%**	**80,2 %**	**-1,9 %**	**55,3 %**	**2705**
CITY BAGS AND BUSINESS	35,7%	81,0 %	-2,0 %	54,8 %	1390
LG ACCESSORIES	32,7%	79,5 %	-1,8 %	57,1 %	1051
TRAVEL	4,1%	77,9 %	-1,0 %	50,1 %	242
PERFUME ACCESSORIES	0,0%	63,4 %	8,1 %	52,3 %	22
ACCESSORIES	**26,3%**	**76,2 %**	**2,2 %**	**54,7 %**	**1297**
TEXTILES	8,0%	73,3 %	2,1 %	78,4 %	154
BELTS	6,9%	77,8 %	1,6 %	56,0 %	582
FASHION JEWELRY	3,8%	77,4 %	4,7 %	48,4 %	180
LEATHER BRACELETS	3,1%	79,3 %	2,0 %	44,7 %	90
FANCY ACCESSORIES	2,0%	80,2 %	0,3 %	50,4 %	64
EYEWEAR	1,8%	72,3 %	0,1 %	45,3 %	145
TIES	0,5%	76,5 %	5,3 %	44,7 %	33
GIFTING OBJECTS	0,3%	61,0 %	11,1 %	46,6 %	49
FINE JEWELRY	**0,6%**	**63,4 %**	**-2,6 %**	**47,1 %**	**1143**
FINE JEWELRY	0,6%	63,4 %	-2,6 %	47,1 %	1143
WATCHES	**0,5%**	**61,0 %**	**0,7 %**	**59,8 %**	**376**
WATCHES ACCESSORIES	0,3%	56,4 %	-3,9 %	56,5 %	248
WATCH CONNECTED OBJECTS	0,1%	68,1 %	7,7 %	105,5 %	39
WATCHES	0,1%	64,2 %	3,7 %	49,1 %	89
Total	**100,0%**	**78,9 %**	**-0,8 %**	**53,8 %**	**5521**

- Note : For the purpose of the graph above, accuracy is computed while capping the error at 100%
- Although *Leather Goods* show a WAPE above 80%, its MAPE is close to 55%, explained by a wide distribution of nodes between 0 and 100% accuracy

There is a significant difference in accuracy between the Zones, with the high-volumes zones showing a better performance

March 2020 – Jan 2022, lag 1 month



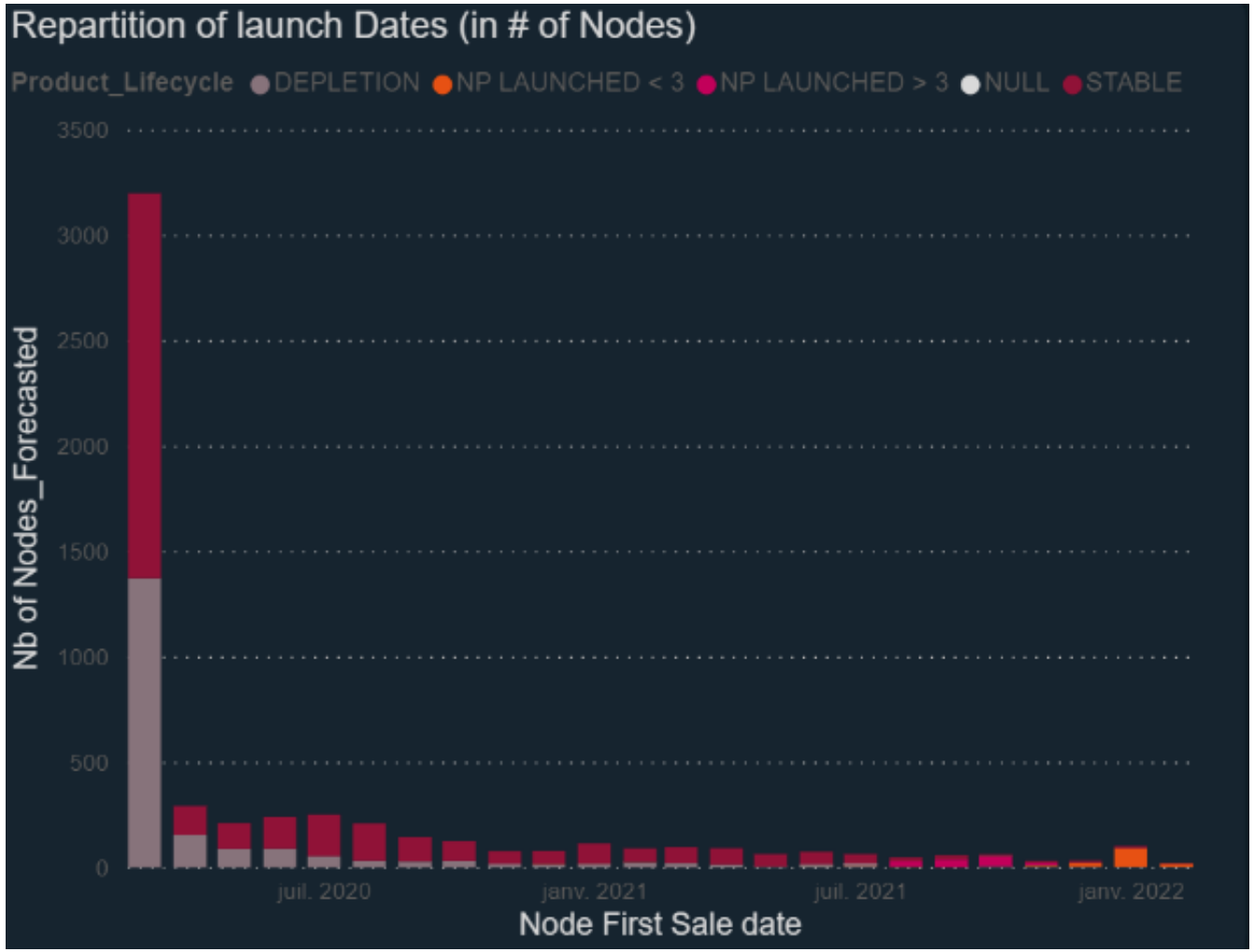
Details by Products hierarchy

G3_Forecast_Level	% of Sales Qty	Accuracy Current	Bias Current	CV	Nb of nodes	% of datapoints with Sales
NORTH AMERICA	26,9%	70,3 %	-4,1 %	66,0 %	5343	69 %
EUROPE W/O MIDDLE EAST	25,3%	68,8 %	3,8 %	56,0 %	5555	67 %
CHINA	16,8%	68,8 %	-1,1 %	49,2 %	5162	67 %
JAPAN	10,2%	66,3 %	1,3 %	43,8 %	5448	64 %
KOREA (DOM)	7,0%	68,7 %	-2,2 %	44,7 %	4318	60 %
SOUTH ASIA W/O KDOM	6,3%	65,5 %	-0,4 %	52,2 %	5091	67 %
NORTH ASIA	3,8%	55,5 %	-2,1 %	46,3 %	4725	60 %
MIDDLE EAST	2,5%	58,0 %	3,5 %	49,2 %	4476	57 %
LATIN AMERICA	1,2%	48,1 %	-1,9 %	52,4 %	4009	60 %
Total	**100,0%**	**67,7 %**	**-0,4 %**	**51,3 %**	**44127**	**64 %**

- Although the CV is quite stable between the zones, the average Sales by node shows a 1 to 25 ratio between North America and Latin America
- While the worldwide bias is close to 0, there can be a imbalance at zone level of up to +/- 4%, for instance between North America and Europe
- *Note* : Accuracy is measured here at Zone level (‘elementary’)
- As a rule of thumb, there is a linear relationship between the Accuracy and log(Sales_Qty), with a slope of 0,2

We observe significant rate of New Products Introduction

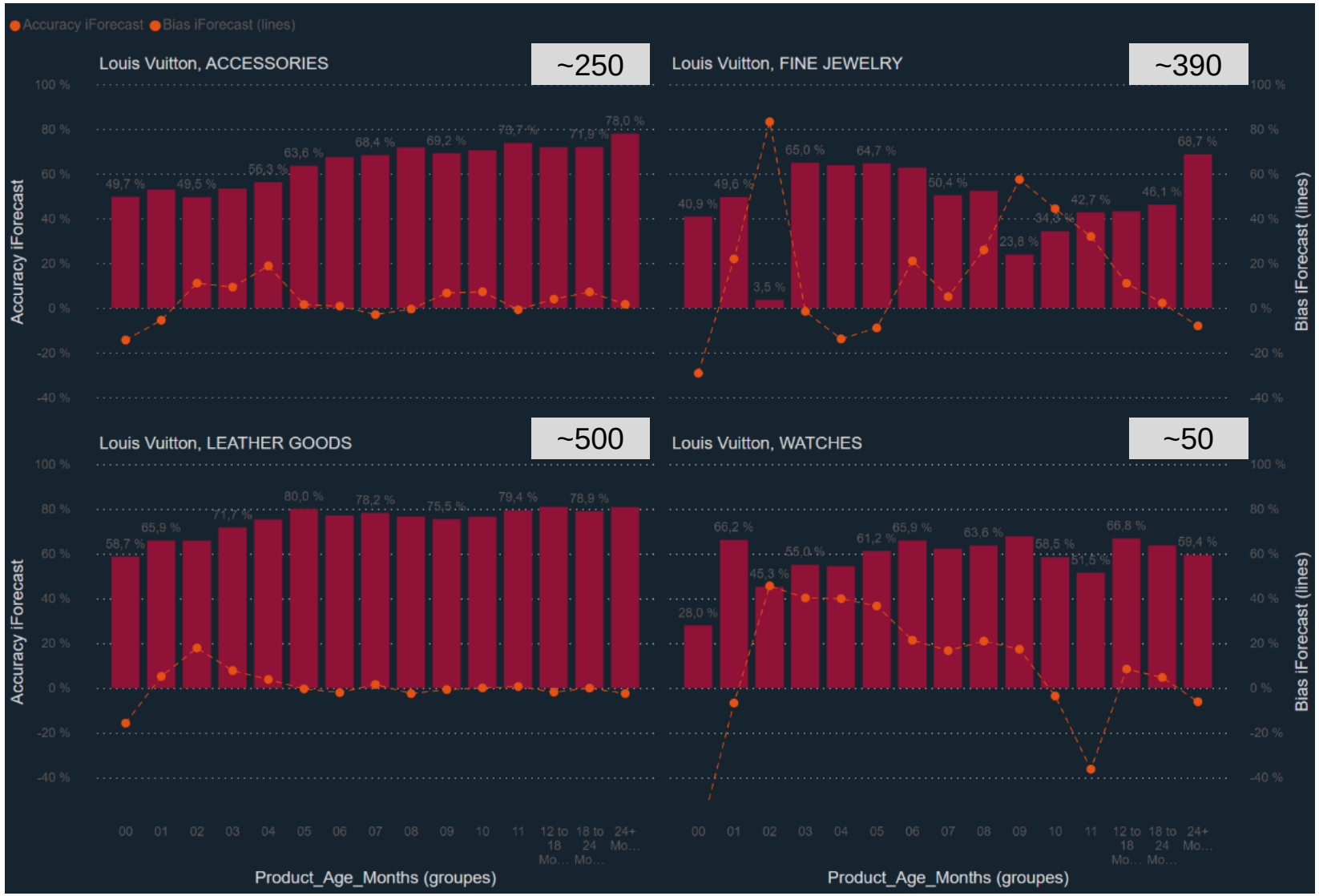
Period studied : March 2020 -> Jan 2022



- Out of 5759 SKUs with a least one Sale on the period studied (23 months), 2500 were launched during this same period
- This amounts to ~20% of the catalogue range renewed every year
- The number of active permanent SKUs appears to be growing overall (2500 in 2020, 3000 in 2022)

It takes more than 3 month after launch for the forecast to reach its target perf.

Performance by Product Age, March 2020 – Jan 2022, lag 1 month



~XYZ

Average number of nodes over which the accuracy and biais are calculated

- For Leather Goods and Accessories, the Accuracy tends to increase as the product age increases
- It seems to reach a plateau at month 5 after Launch Date, both in terms of accuracy and Bias
- Bias can be unbalanced for the first full 3 months, with a tendancy to over-forecast this initial period

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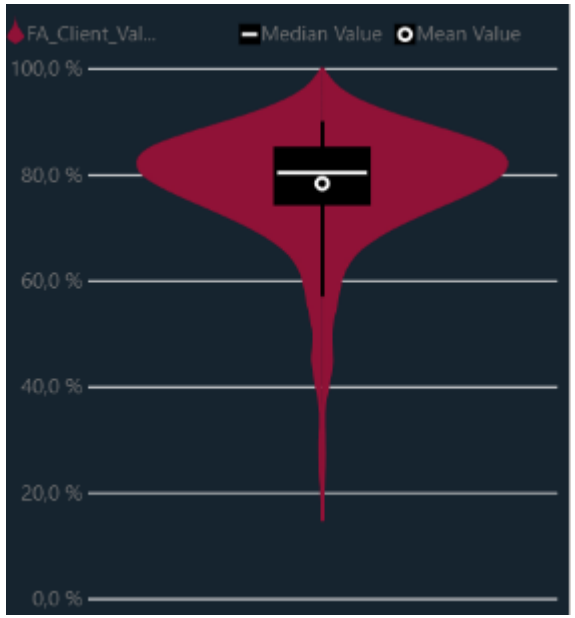
Constrained SKUs have a slight accuracy gap compared to the other SKUs, they represent

Performance by Constraint Type, March 2020 – Jan 2022, lag 1 month

Details by Products hierarchy

CONSTRAINT_TYPE	% of Sales Qty	Accuracy Current	Bias Current	CV	Nb of nodes	% of datapoints with Sales
⊞	70,1%	77,2 %	0,4 %	54,3 %	5320	80 %
⊟ Controlled	16,4%	82,1 %	-2,0 %	40,8 %	163	100 %
⊞ LEATHER GOODS	15,4%	83,0 %	-2,2 %	37,1 %	149	100 %
⊞ ACCESSORIES	1,0%	67,3 %	0,1 %	81,1 %	14	100 %
⊟ Capped	13,5%	83,7 %	-5,2 %	43,6 %	38	100 %
⊞ LEATHER GOODS	13,5%	83,7 %	-5,2 %	43,6 %	38	100 %
Total	100,0%	78,9 %	-0,8 %	53,8 %	5521	81 %

Accuracy dispersion

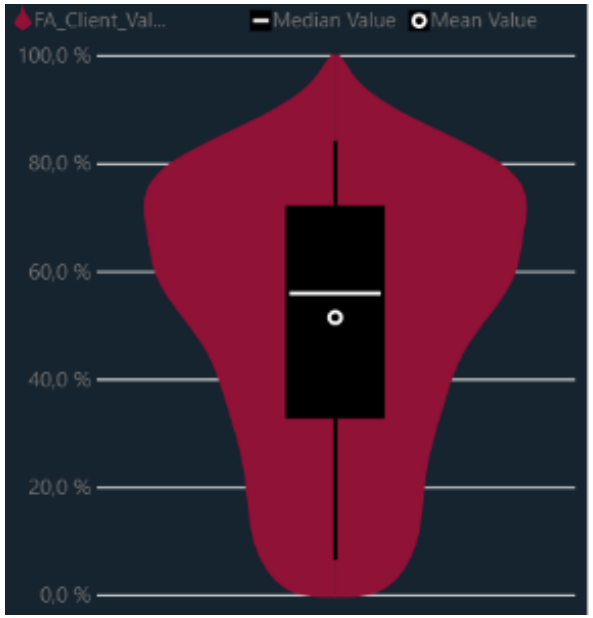


Left :

Capped & Controlled SKUs

Right :

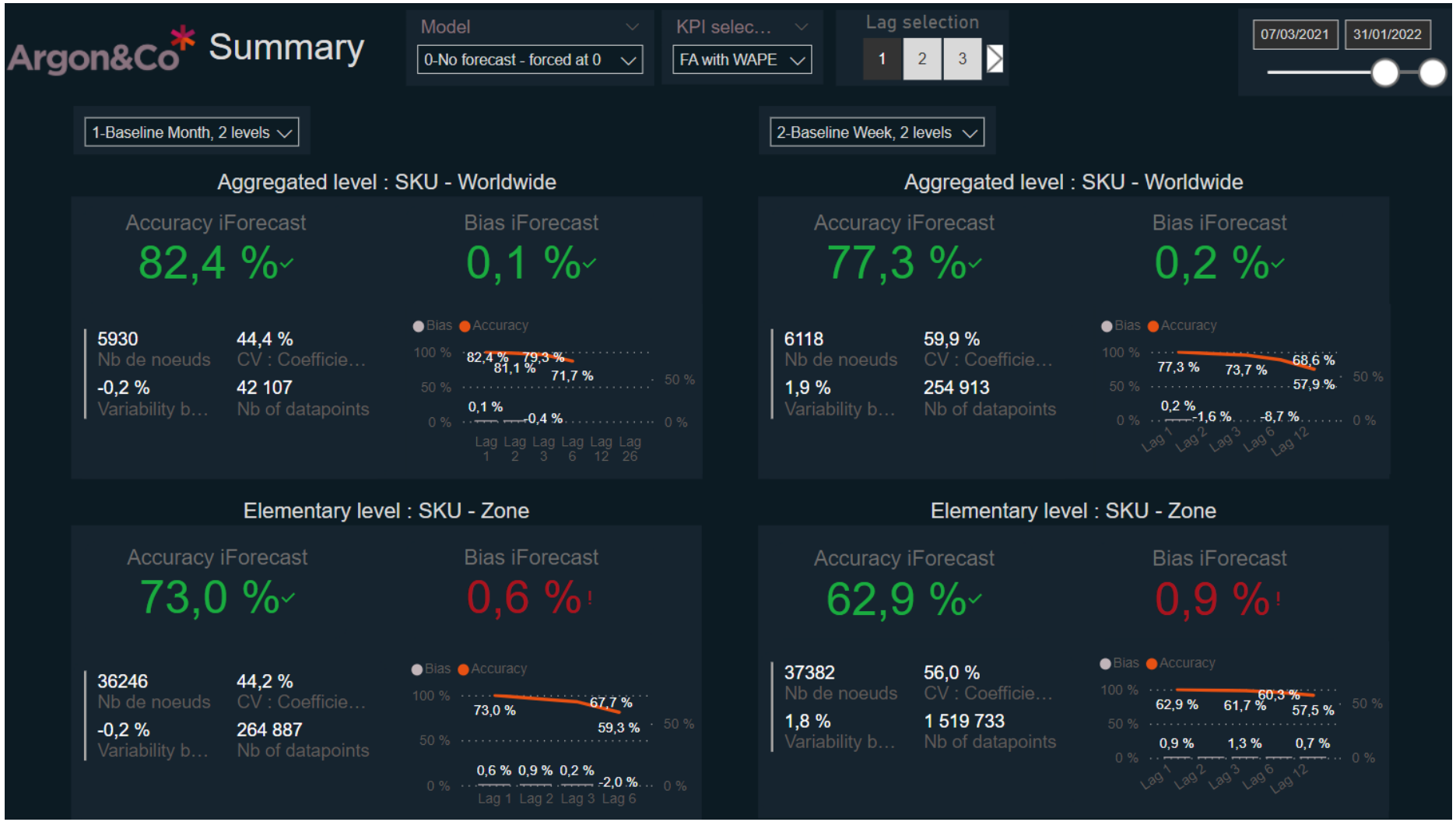
All other SKUs



- *Capped* or *Controlled* SKUs mainly beoing to the « A » Class
- While their accuracy is nearing 82% on average, they are only 4% above the average for other class A SKUs
- These constrained SKUs represent 3,6% of SKUs but account for 30% of sales volumes

Analysis at Week level
Scenario 2

Disaggregation at weekly levels decreases the global accuracy by 5pts



- The daily weights mechanism currently allows to disaggregate the monthly forecast down to a weekly forecast
- After disaggregation, the Accuracy at zone level is 10 pts lower, while the worldwide accuracy is 5 pts lower
- The timeseries stability (see CV metric) stays relatively similar (45% at Month level)

Note : Weekly forecast archives are only available from March 2021 while Monthly archives are available from February 2020

The disaggregation at week level creates a bigger performance variation for Z classes

Performance by SKU Class, March 2021 – Jan 2022, Lag 1 Month, Aggregated level (by SKU)

ABC Class		X	Y	Z
A				
	Accuracy VVF	88,2 %	86,6 %	82,0 %
	Bias	0,8 %	-0,1 %	-3,1 %
	Nb of Nodes	119	280	242
	% of Sales	17%	35%	27%
	CV	17,7 %	24,9 %	52,7 %
	Var scenario 2 vs 1	-3,1 %	-4,5 %	-7,8 %
B				
	Accuracy VVF	80,2 %	78,3 %	68,8 %
	Bias	6,9 %	2,8 %	4,5 %
	Nb of Nodes	118	437	750
	% of Sales	2%	8%	9%
	CV	17,9 %	27,1 %	60,9 %
	Var scenario 2 vs 1	-0,9 %	-5,3 %	-9,6 %
C				
	Accuracy VVF	69,9 %	65,7 %	45,9 %
	Bias	-6,5 %	0,9 %	-0,4 %
	Nb of Nodes	58	455	2115
	% of Sales	0%	1%	1%
	CV	16,5 %	24,3 %	56,7 %
	Var scenario 2 vs 1	-33,5 %	-6,5 %	-13,4 %

- The weekly sales are harder to forecast from the Monthly level when the timeseries are more erratic : there is a greater variation of Accuracy between Scenario 1 and Scenario 2 for Z classes than for X classes
- Variability (CV) at week level stays relatively low, even for Z classes (max 60%)

Scenario 1 = Monthly forecast

Scenario 2 = Weekly forecast

Agenda

Data collection overview

Demo of Horizon Power BI

Diagnostic of iForecast performance

Next steps

Appendix