

2023 BAS Annual Case Competition

Team 15:

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Agenda

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graph LR; A[Historical Trend Model] --> B[Claims Data Model]; B --> C[Comparison With XGBoost Model];
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Historical
Trend Model

Claims Data
Model

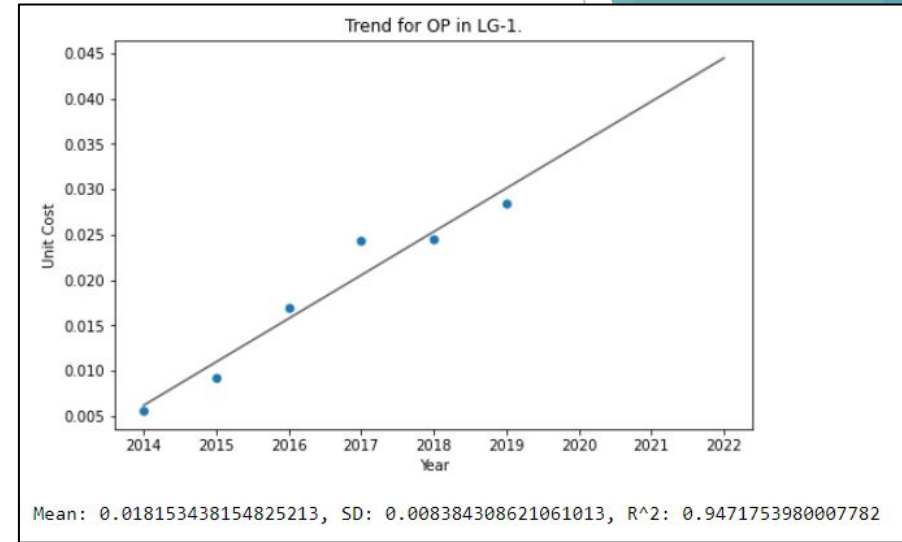
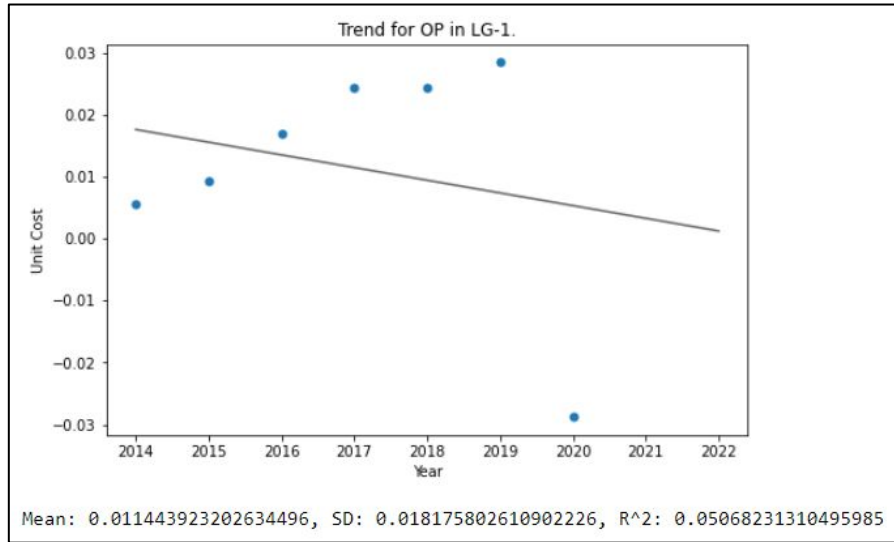
Comparison
With
XGBoost Model

Historical Trend Model

Manual Trend with Linear Regression

1

Finding the Underlying Trend



- ▶ The trend for the year 2020 is clearly an outlier, and removing it reveals a strong underlying trend.
- ▶ Using the regression model, we can estimate the percentage change in unit cost for outpatient care in the LG-1 group to be: **4.4%**

Finding the Underlying Trend

Removing Outliers

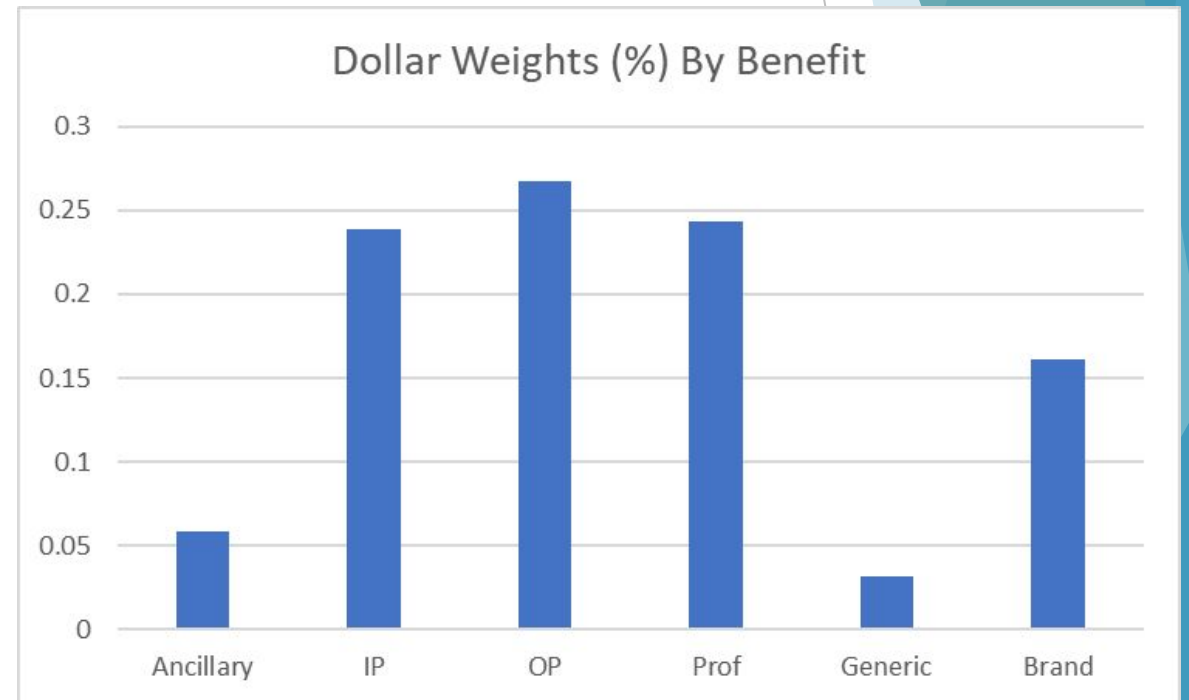
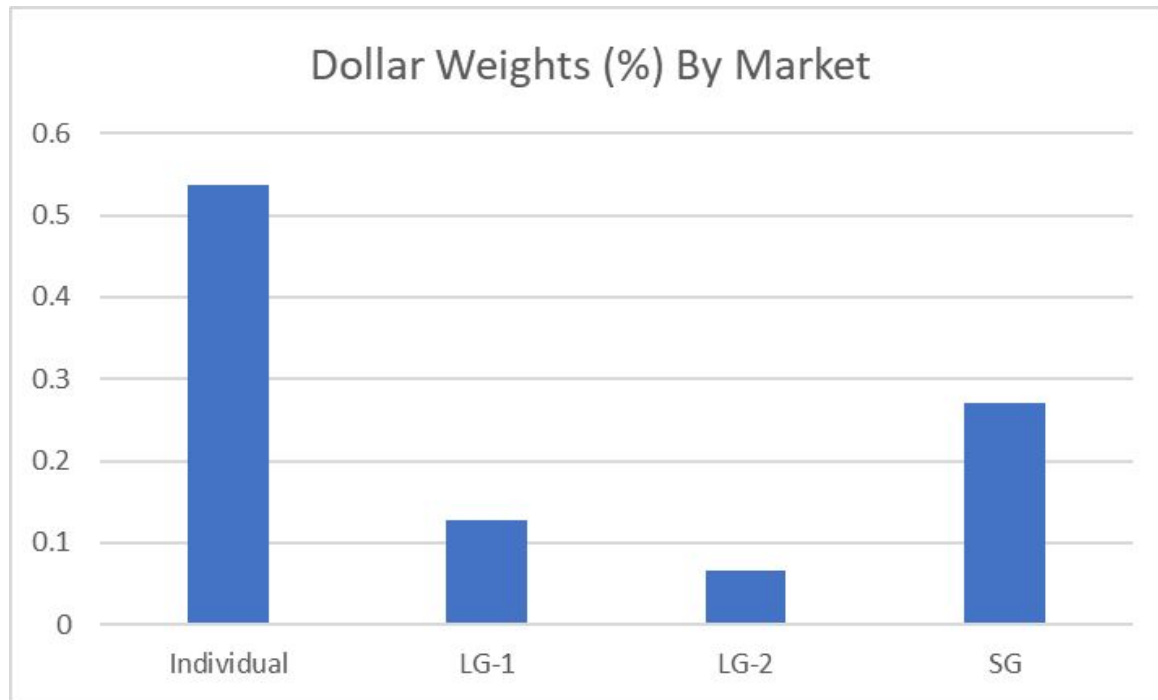
- ▶ Remove 2020 only
 - ▶ Inpatient
 - ▶ Outpatient
 - ▶ Generic
 - ▶ Brand
- ▶ Remove 2019 and 2020
 - ▶ Professional
 - ▶ Ancillary

Predicting 2022

- ▶ $R^2 > 0.65$
 - ▶ We will assume that the trend is changing over time.
 - ▶ Use the **Linear Regression Model** to predict the 2022 trend.
- ▶ $R^2 < 0.65$
 - ▶ We will assume with that the trend is not changing over time, and the variance is simply caused by random noise.
 - ▶ Use the **Mean** to predict the 2022 trend.

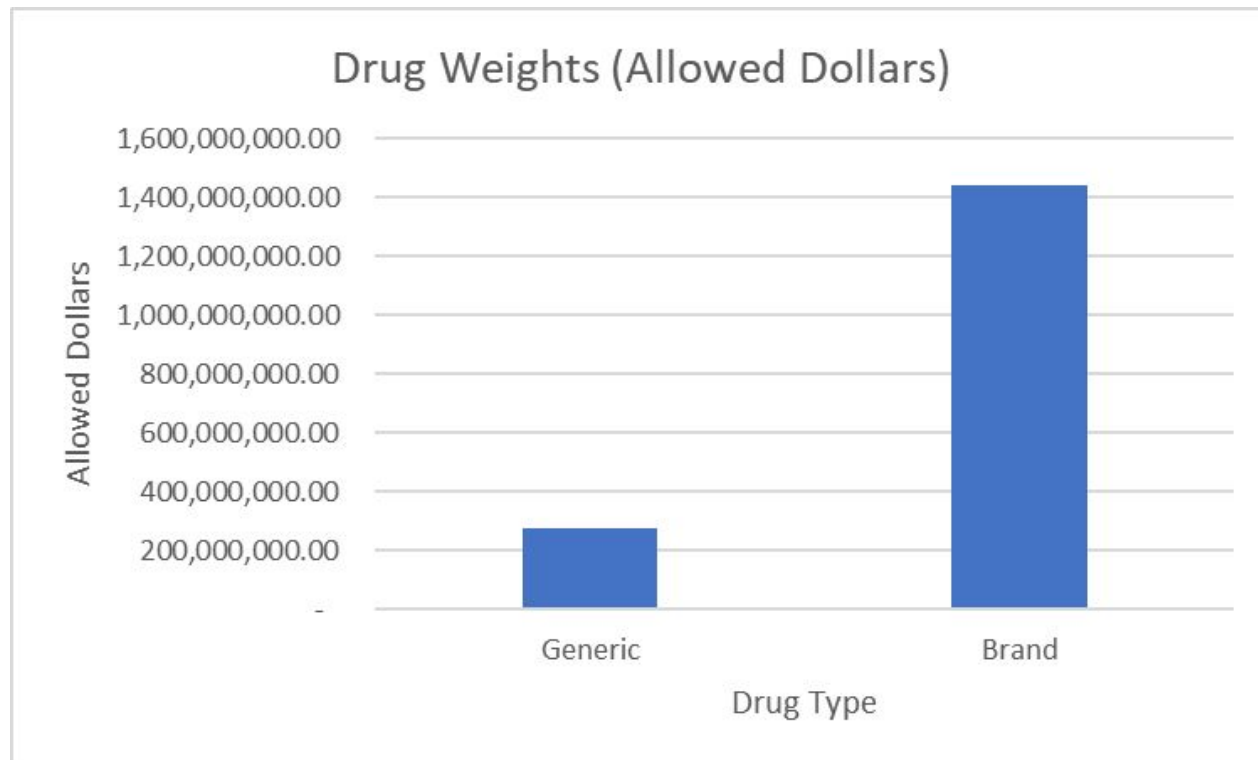
Dollar Weights

- ▶ Use 2021 claims data to determine the percentage of total allowed dollars that each group or benefit is responsible for.



Drug Weights

- ▶ Using the same method, we can combine the Generic and Brand drug data into one “Drugs” category.



Generic	0.162448105
Brand	0.837551895

Event Trends

- ▶ Increased usage of flu vaccines raises brand drug utilization by 5% in Jan/Feb.
 - ▶ We have assumed that this trend stopped after February, and have annualized this to a 0.87% increase for the year.
- ▶ New contract with PBM will decrease unit cost of brand drugs by 2% and generic drugs by 7% for the second half of 2022.
 - ▶ We have annualized this to a decrease of 1% and 3.5% respectively for the entire year.
- ▶ COVID concerns caused patients to defer non-emergency medical treatment in 2021.
 - ▶ We have assumed that all deferred medical treatment in 2021 will be carried out in 2022.
 - ▶ This causes a utilization decrease in 2021 and utilization increase in 2022 for inpatient (9.2%), outpatient (1.4%), professional (0.8%), and ancillary services (17.3%).

Final Results: Utilization

Projected Annualized 2022 Increase: **9.9%**

- Underlying: **2.1%**
- Event: **7.7%**

Sorted by LOB

LG-1	11.9%
LG-2	7.5%
SG	7.8%
Individual	10.9%

Sorted by Benefit

Inpatient	22.4%
Outpatient	4.7%
Professional	5.9%
Ancillary	36.3%
Drugs	(1.1%)

Final Results: Unit Cost

Projected Annualized 2022 Increase: **5.4%**

- Underlying: **5.7%**
- Event: **(0.3%)**

Sorted by LOB

LG-1	7.6%
LG-2	3.2%
SG	6.5%
Individual	4.5%

Sorted by Benefit

Inpatient	6.0%
Outpatient	4.0%
Professional	5.6%
Ancillary	4.2%
Drugs	6.4%

Claims Data Model

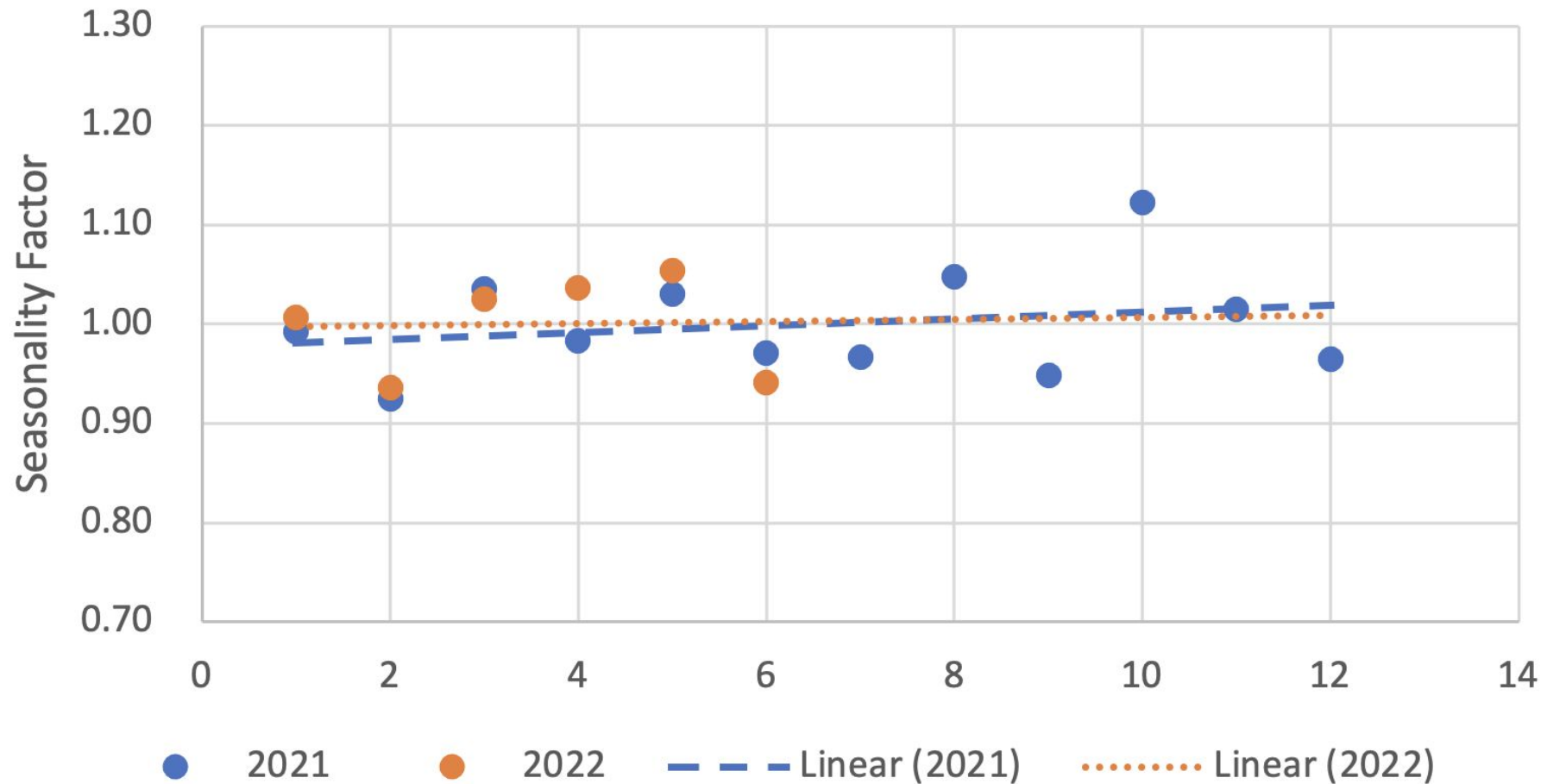
Experience Trend with Seasonality Adjustments

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Seasonality

$$\text{Seasonal factor} = \frac{\text{Utilization per month}}{\text{Total Utilization in a year}/12}$$

Seasonality Factors for 2021 and 2022



2021: Allowed Dollars

Line of Business	Allowed Dollars
Individual	4,811,942,781
LG-1	1,135,538,524
LG-2	583,874,813
SG	2,422,356,915
Total	8,953,713,033

Benefit Type	Allowed Dollars
Inpatient	2,136,017,691
Outpatient	2,390,579,833
Professional	2,181,930,644
Ancillary	525,987,660
Drugs	1,719,197,205
Total	8,953,713,033

2022: Allowed Dollars (Predicted)

Line of Business	Allowed Dollars
Individual	4,890,925,346
LG-1	1,186,391,548
LG-2	687,993,467
SG	2,550,649,568
Total	9,315,959,927

Benefit Type	Allowed Dollars
Inpatient	2,232,417,756
Outpatient	2,440,920,985
Professional	2,220,349,121
Ancillary	634,081,114
Drugs	1,788,190,951
Total	9,315,959,927

2021: Utilization/K

$$\text{Util/K} = \frac{\text{Utilization} * 12000}{\text{Total Member Months}}$$

Benefit Type	Underlying	Event	Deferred %	Actual
Inpatient	230	(19)	9.2	211
Outpatient	4,824	(67)	1.4	4,758
Professional	16,803	(133)	0.8	16,670
Ancillary	6,353	(937)	17.3	5,416
Drugs	11,582	-	-	11,582
Total	39,792	(1,156)	-	38,636

2022: Utilization/K

$$\text{Util/K} = \frac{\text{Utilization} * 12000}{\text{Total Member Months}}$$

Benefit Type	Underlying	Event	Actual
Inpatient	235	19	255
Outpatient	5,292	67	5,358
Professional	17,525	133	17,658
Ancillary	6,110	937	7,047
Drugs	11,653	12	11,665
Total	40,815	1,168	41,984

Comparing Results With XGBoost Model

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XGBoost Model

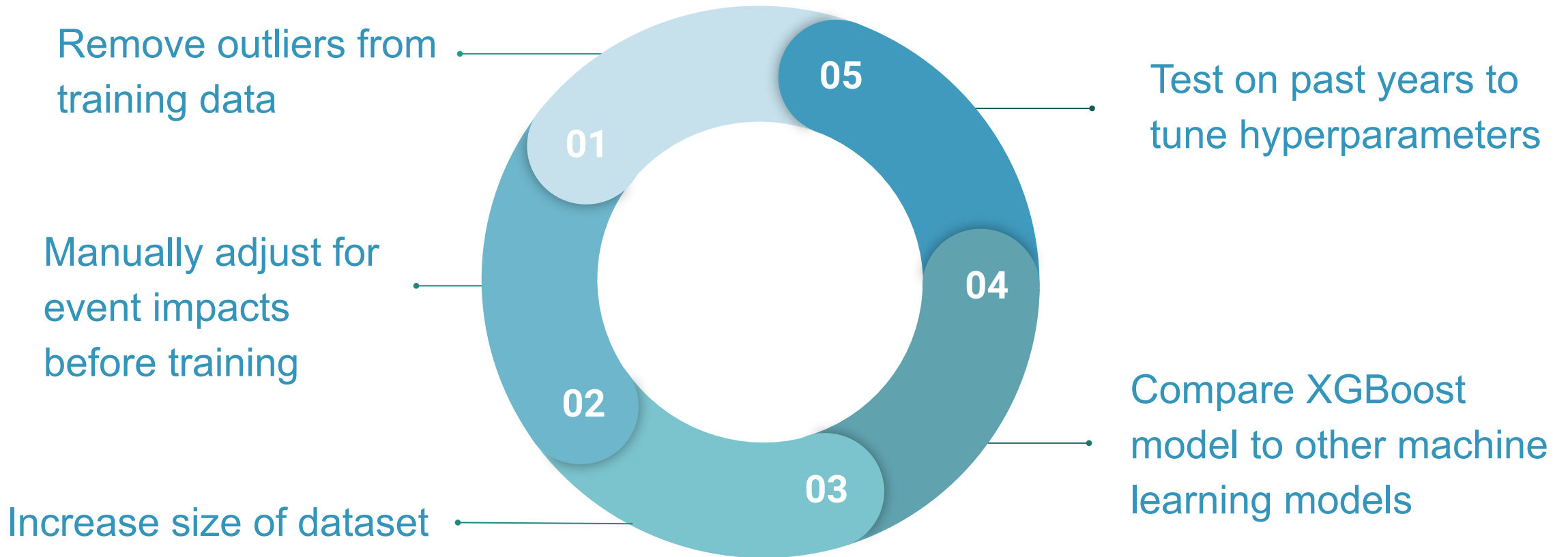
Pros:

- ▶ Efficient, flexible, and portable
- ▶ Wide variety of tuning hyperparameters

Cons:

- ▶ Sensitive to outliers, especially for small datasets
- ▶ Requires careful tuning of hyperparameters

Recommendations



Final Trend Prediction Comparison

Market	XGBoost Prediction (6 months)
LG-1	4.0%
LG-2	9.4%
SG	7.0%
Individual	11.0%

XGBoost Prediction (adjusted)	Historical Model Prediction	Claims Model Prediction
7.8%	20.4%	7.0%
13.2%	10.9%	22.2%
10.8%	14.8%	8.0%
14.8%	15.9%	2.0%

Thank You!

Appendix

Market	2021 Allowed dollars January - June	2022 Allowed dollars January - June	Percentage change in Allowed Dollars
LG-1	2,397,478,593	2,445,462,673	6.98%
SG	554,504,865	593,195,773	7.99%
LG-2	281,419,603	343,996,734	22.24%
Individual	1,181,002,337	1,275,324,784	2.00%