

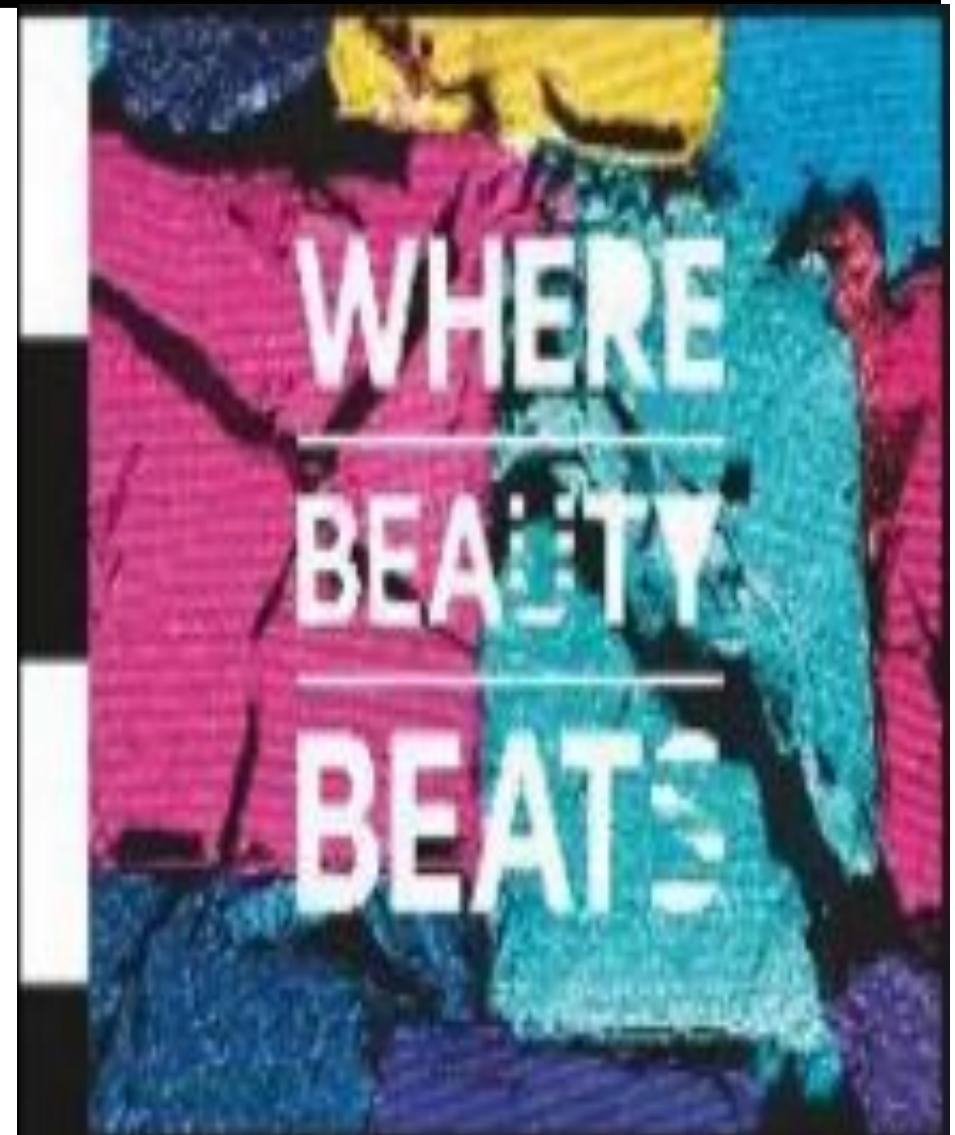
Supergoop! Performance Analysis at Sephora



FADILA UTAMI | 08/12/2025 | PORTFOLIO PROJECT (DEEPP) | [LINKEDIN](#)

Executive Summary

This analysis examines the drivers of Supergoop!'s product ratings and online sales contribution at Sephora using 2023 product and customer review data. It focuses on ratings, review sentiment, and pricing indicators to support data-driven recommendations for improving product performance.



ABOUT DATASET

This dataset was collected from **Sephora's online platform in March 2023 and captures an integrated view of product information and customer reviews within its digital catalog.



DARCI MODEL

DARCI	Stakeholder	How They Use the Analysis Results
Decision Maker	Merchandising Manager	Uses insights to decide product improvement priorities and brand strategy
Accountable	Head of Merchandising	Accountable for category performance and business outcomes
Responsible	Data Analyst, Product Manager, Marketing Manager	Conduct analysis, interpret results, and translate insights into actions
Consulted	Digital Merchandiser, Customer Insights Team, Brand Team	Provide domain knowledge and technical input during analysis
Informed	Customer Service, E-commerce Operations, Sales & Finance Team	Receive analysis outcomes for operational alignment and reporting



Project Scope

Dataset Contents

This project uses two datasets from Sephora's e-commerce platform: product attributes and customer reviews, capturing both product characteristics and customer experience in the online retail environment.

Focus Areas

The analysis examines the impact of customer feedback and brand perception on product performance, with emphasis on ratings, review sentiment, recommendation behavior, pricing positioning, and brand-level performance, particularly for Supergoop!.



Problem Statement

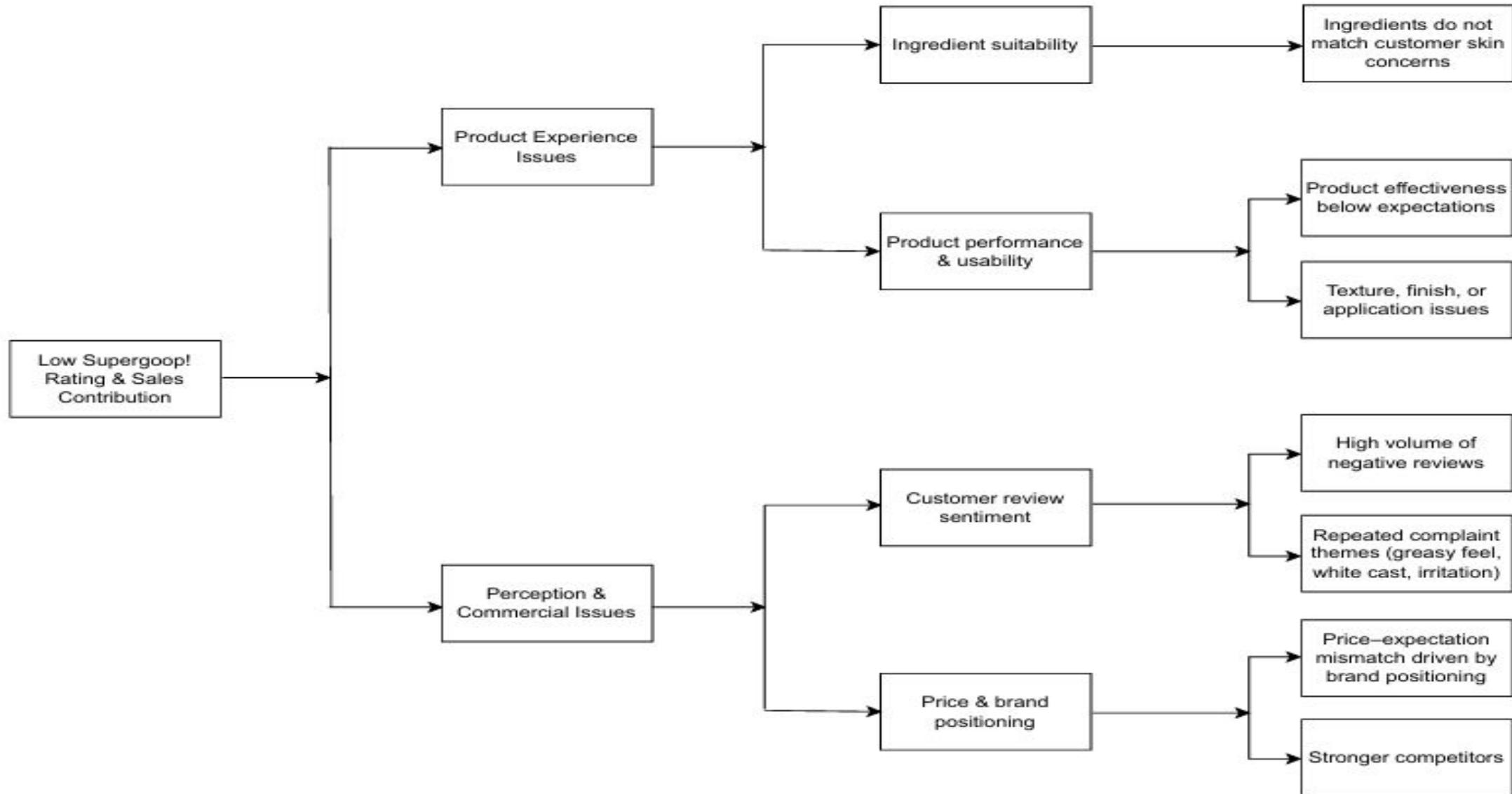
How can Sephora increase Supergoop!'s product ratings and online sales contribution by at least 10% using 2023 data insights?



Objectives

- Identify the key product attributes and customer review factors that influence Supergoop!'s average product ratings in order to understand the drivers behind customer satisfaction and dissatisfaction.
- Evaluate how customer ratings, review sentiment, and perceived product value relate to Supergoop!'s contribution to total online sales within Sephora's e-commerce platform.

ROOT CAUSE ANALYSIS (RCA)



HYPOTHESIS

Issue Branch	Possible Root Cause	Hypothesis
Product Experience Issues	Ingredients do not match customer skin concerns	Ingredients are not suitable for certain skin types, leading to irritation and reduced customer satisfaction.
	Product effectiveness below expectations	The product's perceived effectiveness does not meet customer expectations, contributing to lower ratings.
	Texture, finish, or application issues	Unfavorable texture or application experience negatively impacts usability and overall product perception.
	High volume of negative reviews	A high concentration of negative reviews amplifies unfavorable perceptions and discourages potential buyers.
	Repeated complaint themes (greasy feel, white cast, irritation)	Consistent complaint themes signal unresolved product experience issues that systematically lower ratings.
Perception & Commercial Issues	Price-expectation mismatch driven by brand positioning	The price paid does not align with expectations created by the brand's positioning, reducing perceived value.
	Stronger competitors	Competing products provide higher perceived value at similar price points, weakening Supergoop!'s competitiveness.

Metrics & Prioritize Analysis

Possible Root Cause	Hypothesis	Prioritization	Metrics	Metrics Reasoning
Ingredients do not match customer skin concerns	Ingredients are not suitable for certain skin types, leading to irritation and reduced customer satisfaction.	High – Direct impact on product experience and ratings; frequently cited in negative reviews.	1. % reviews mentioning irritation/sensitivity 2. Avg rating by skin type	A high share of irritation-related keywords and lower ratings for sensitive skin types indicate ingredient mismatch issues.
Product effectiveness below expectations	The product's perceived effectiveness does not meet customer expectations, contributing to lower ratings.	High – Strongly correlated with low ratings; reflects core product value.	1. % low-rating reviews mentioning “ineffective” 2. Avg rating for effectiveness-related reviews	Frequent mentions of low effectiveness in low-star reviews confirm unmet performance expectations.
Texture, finish, or application issues	Unfavorable texture or application experience negatively impacts usability and overall product perception.	High – Tangible usage issue; repeatedly highlighted by customers.	1. Frequency of texture-related keywords (greasy, white cast) 2. Avg rating of texture-related reviews	High keyword frequency combined with lower average ratings validates usability-driven dissatisfaction.
High volume of negative reviews	A high concentration of negative reviews amplifies unfavorable perceptions and discourages potential buyers.	Medium-High – Reinforces poor perception but often driven by underlying product issues.	1. % 1-2 star reviews 2. Negative review ratio	A large proportion of low-star reviews signals widespread dissatisfaction rather than isolated incidents
Repeated complaint themes (greasy feel, white cast, irritation)	Consistent complaint themes indicate unresolved product experience issues that systematically lower ratings.	High – Indicates structural issues; not random feedback.	1. Top recurring complaint keywords 2. Keyword concentration ratio	High concentration of recurring complaint keywords confirms persistent and unresolved experience problems.
Price-expectation mismatch driven by brand positioning	The price paid does not align with expectations created by the brand's positioning, reducing perceived value.	High – Directly affects perceived fairness and willingness to recommend.	1. Avg rating by price tier 2. % reviews mentioning “overpriced / not worth it”	Lower ratings at higher price tiers and frequent price-related complaints confirm perceived value mismatch.
Stronger competitors	Competing products offer higher perceived value at similar price points, weakening Supergoop!'s competitiveness.	Medium – Relative impact depends on competitive benchmarks.	1. Avg rating by brand at similar price points 2. Rating gap vs competitors	Higher competitor ratings at comparable prices indicate weaker perceived value for Supergoop!.

MILESTONE 2

Google_Colab

Understand the Dataset Structure

- The analysis uses two primary tables: a **Product** dataset containing **8,494 products** and a **Review** dataset with **1,094,411 records** before cleaning.
- The tables are connected through a **product-level identifier**, forming a **one-to-many relationship** (one product corresponds to multiple reviews).
- This data structure enables both **product-level analysis** and **review-driven insights** after data preparation.

SEPHORA

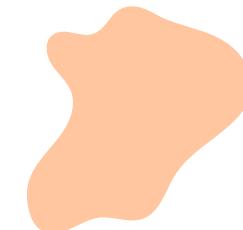
What are you looking for?



FREE SHIPPING
NO MINIMUM SPEND



Data Cleaning



Before

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8494 entries, 0 to 8493
Data columns (total 27 columns):
 #   Column           Non-Null Count  Dtype  
 ---  -- 
 0   product_id      8494 non-null   object 
 1   product_name    8494 non-null   object 
 2   brand_id        8494 non-null   int64  
 3   brand_name      8494 non-null   object 
 4   loves_count     8494 non-null   int64  
 5   rating          8216 non-null   float64
 6   reviews         8216 non-null   float64
 7   size            6863 non-null   object 
 8   variation_type  7050 non-null   object 
 9   variation_value 6896 non-null   object 
 10  variation_desc  1250 non-null   object 
 11  ingredients     7549 non-null   object 
 12  price_usd       8494 non-null   float64
 13  value_price_usd 451 non-null   float64
 14  sale_price_usd 270 non-null   float64
 15  limited_edition 8494 non-null   int64  
 16  new             8494 non-null   int64  
 17  online_only     8494 non-null   int64  
 18  out_of_stock    8494 non-null   int64  
 19  sephora_exclusive 8494 non-null   int64  
 20  highlights       6287 non-null   object 
 21  primary_category 8494 non-null   object 
 22  secondary_category 8486 non-null   object 
 23  tertiary_category 7504 non-null   object 
 24  child_count      8494 non-null   int64  
 25  child_max_price  2754 non-null   float64
 26  child_min_price  2754 non-null   float64
dtypes: float64(7), int64(8), object(12)
memory usage: 1.7+ MB
```



Data Cleaning Product

After

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8494 entries, 0 to 8493
Data columns (total 26 columns):
 #   Column           Non-Null Count  Dtype  
 ---  -- 
 0   product_id      8494 non-null   object 
 1   product_name    8494 non-null   object 
 2   brand_id        8494 non-null   int64  
 3   brand_name      8494 non-null   object 
 4   loves_count     8494 non-null   int64  
 5   rating          8494 non-null   float64
 6   reviews         8494 non-null   float64
 7   size            8494 non-null   object 
 8   variation_type  8494 non-null   object 
 9   variation_value 8494 non-null   object 
 10  ingredients     8494 non-null   object 
 11  price_usd       8494 non-null   float64
 12  value_price_usd 8494 non-null   float64
 13  sale_price_usd 8494 non-null   float64
 14  limited_edition 8494 non-null   bool   
 15  new             8494 non-null   bool   
 16  online_only     8494 non-null   bool   
 17  out_of_stock    8494 non-null   bool   
 18  sephora_exclusive 8494 non-null   bool   
 19  highlights       8494 non-null   object 
 20  primary_category 8494 non-null   object 
 21  secondary_category 8494 non-null   object 
 22  tertiary_category 8494 non-null   object 
 23  child_count      8494 non-null   int64  
 24  child_max_price  8494 non-null   float64
 25  child_min_price  8494 non-null   float64
dtypes: bool(5), float64(7), int64(3), object(11)
memory usage: 1.4+ MB
```

Executive Summary

- Performed data type validation and converted key binary columns (**limited_edition**, **new**, **online_only**, **out_of_stock**, **sephora_exclusive**) from integer to boolean to ensure accurate analysis.
- Formatting and standardization issues were identified in categorical attributes, particularly **size**, **variation_type**, and **variation_value**.
- The **size** column shows inconsistent formatting for identical values due to variations in spacing, separators, and mixed measurement units.
- The **variation_type** and **variation_value** columns contain mixed concepts and formats, which may impact the precision of product variation analysis.
- Minor typographical and capitalization inconsistencies were found in **variation_desc**, confirmed by a reduction in the number of unique categories after normalization.
- A cleaned dataset copy (**df_product_dc**) was created to preserve data integrity and support further analysis.

Before

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1094411 entries, 0 to 1094410
Data columns (total 19 columns):
 #   Column           Non-Null Count  Dtype  
 ---  -- 
 0   Unnamed: 0        1094411 non-null   int64  
 1   author_id         1094411 non-null   object  
 2   rating            1094411 non-null   int64  
 3   is_recommended    926423 non-null    float64 
 4   helpfulness       532819 non-null    float64 
 5   total_feedback_count 1094411 non-null   int64  
 6   total_neg_feedback_count 1094411 non-null   int64  
 7   total_pos_feedback_count 1094411 non-null   int64  
 8   submission_time    1094411 non-null   object  
 9   review_text        1092967 non-null   object  
 10  review_title      783757 non-null   object  
 11  skin_tone          923872 non-null   object  
 12  eye_color          884783 non-null   object  
 13  skin_type          982854 non-null   object  
 14  hair_color          867643 non-null   object  
 15  product_id         1094411 non-null   object  
 16  product_name       1094411 non-null   object  
 17  brand_name         1094411 non-null   object  
 18  price_usd          1094411 non-null   float64 
dtypes: float64(3), int64(5), object(11)
memory usage: 158.6+ MB
```

After

```
<class 'pandas.core.frame.DataFrame'>
Index: 503216 entries, 0 to 1094339
Data columns (total 18 columns):
 #   Column           Non-Null Count  Dtype  
 ---  -- 
 0   author_id         503216 non-null   object  
 1   rating            503216 non-null   int64  
 2   is_recommended    503216 non-null   bool   
 3   helpfulness       503216 non-null   float64 
 4   total_feedback_count 503216 non-null   int64  
 5   total_neg_feedback_count 503216 non-null   int64  
 6   total_pos_feedback_count 503216 non-null   int64  
 7   submission_time    503216 non-null   datetime64[ns]
 8   review_text        503216 non-null   object  
 9   review_title      503216 non-null   object  
 10  skin_tone          503216 non-null   object  
 11  eye_color          503216 non-null   object  
 12  skin_type          503216 non-null   object  
 13  hair_color          503216 non-null   object  
 14  product_id         503216 non-null   object  
 15  product_name       503216 non-null   object  
 16  brand_name         503216 non-null   object  
 17  price_usd          503216 non-null   float64 
dtypes: bool(1), datetime64[ns](1), float64(2), int64(4), object(10)
memory usage: 69.6+ MB
```



Data Cleaning Review

Executive Summary

- Data types were standardized to ensure analytical accuracy. The **is_recommended** field was converted from float to boolean, and **submission_time** was converted from object to datetime to support recommendation analysis and time-based insights.
- Typographical and categorical inconsistencies were identified and corrected in **review_title**, **eye_color**, and **skin_tone**, mainly caused by variations in capitalization, punctuation, and naming conventions.
- Missing values were handled using meaningful defaults. The **helpfulness** field was filled with 0 to represent no user feedback. Categorical attributes (**skin_tone**, **eye_color**, **skin_type**, **hair_color**) were filled with "**Unknown**", while free-text fields were filled with empty strings to preserve text integrity without introducing analytical bias.
- Duplicate checks identified **225 duplicated reviews**, primarily caused by repeated **author_id**. These records were removed to prevent reviewer-level bias and ensure accurate aggregation.
- After the cleaning process, the dataset contains **503,216 unique reviews** with consistent data types and no missing values, making it reliable for exploratory data analysis (EDA), sentiment analysis, and downstream modeling.
- A cleaned dataset copy (**df_review_dc**) was created to preserve data integrity and allow flexible reuse for further analysis without altering the raw dataset.



EDA

The goal of EDA in our Supergoop analysis is to deeply **understand the data, identify key patterns and anomalies, and ensure data quality**. This foundation allows us to make informed decisions, build accurate models, and uncover meaningful insights about Supergoop's performance.

For more info:

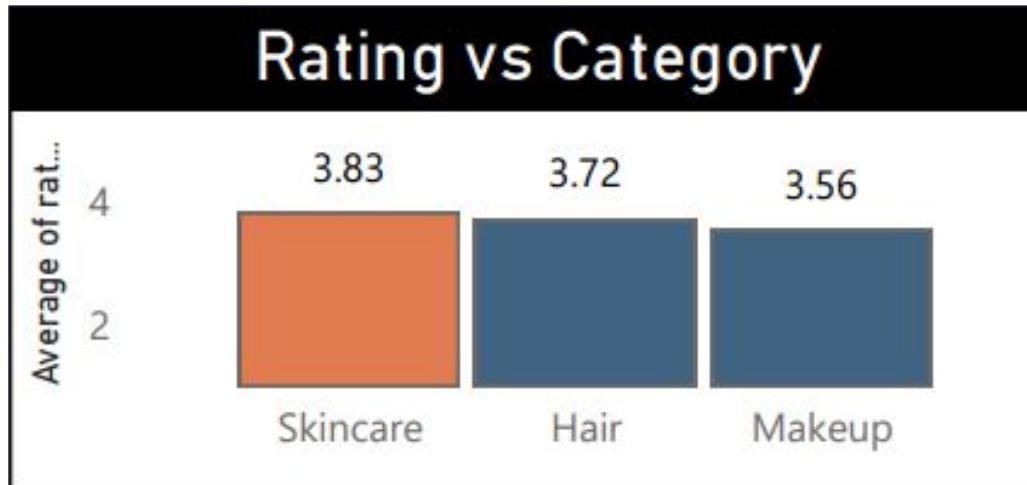
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Distribution Analysis

Avg Rating	% Positive Reviews	Total Reviews	Avg Price	Love Count
4.08	76%	536	\$21	14M

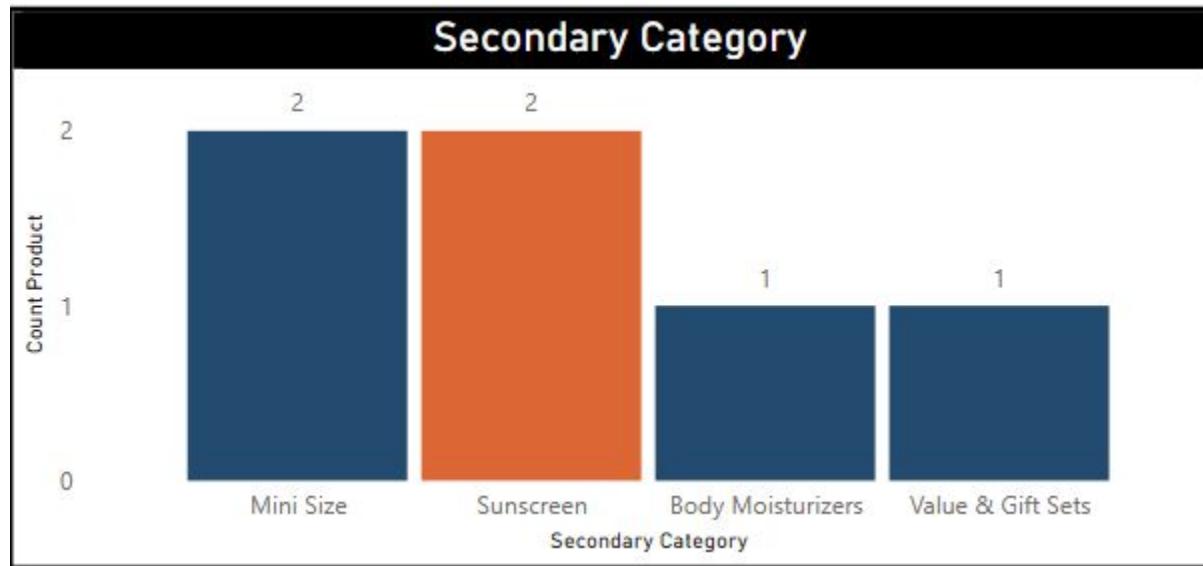
- **Average Rating:** As of 2023, Supergoop maintains a strong average rating of 4.08, reflecting consistent customer satisfaction.
- **Positive Reviews:** With 76% of reviews classified as positive, the majority of customers are satisfied, reinforcing a positive brand image.
- **Total Reviews:** As of 2023, Supergoop has accumulated 536 reviews, indicating solid customer engagement and brand trust.
- **Average Price:** The average product price is \$21, positioning Supergoop within an accessible price range for consumers.
- **Love Count:** With 14 million loves, Supergoop demonstrates strong customer appreciation and loyalty.

Comparison Analysis



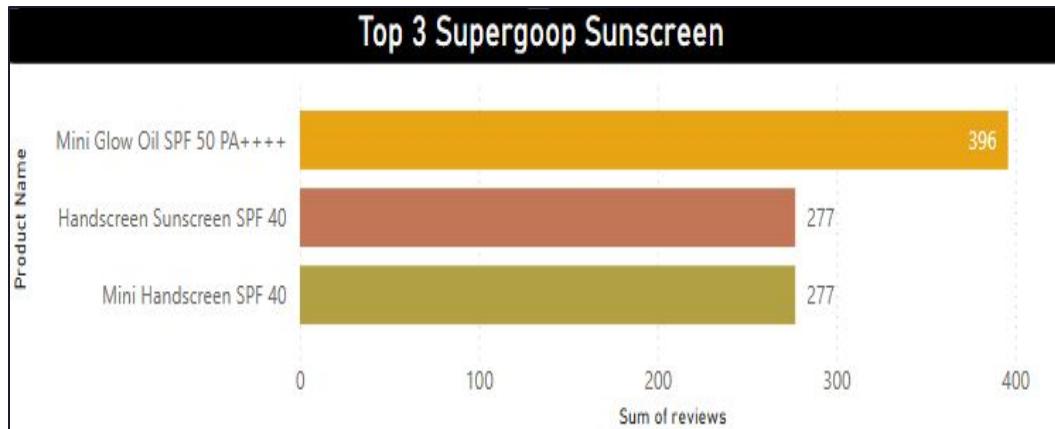
Skincare presents the highest rating at 3.83, supported by 1,072,486 reviews. This indicates Skincare as the most stable category in customer satisfaction, suggesting a strategic focus here could enhance ratings and sales growth.

Comparison Analysis



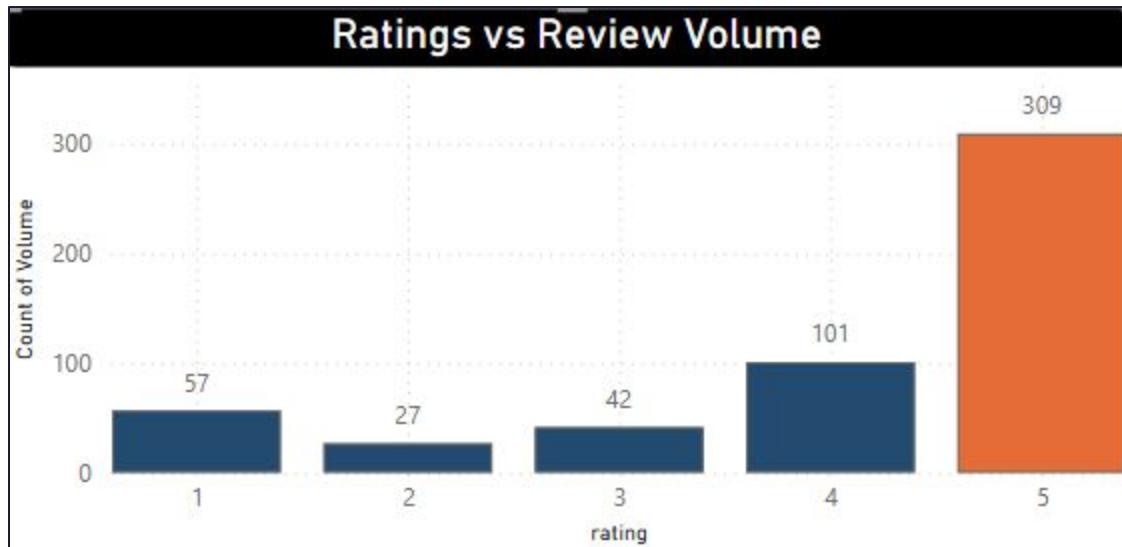
Mini Size and Sunscreen have the same product count, indicating balanced distribution; this aims to improve both ratings and online sales contribution

Comparison Analysis



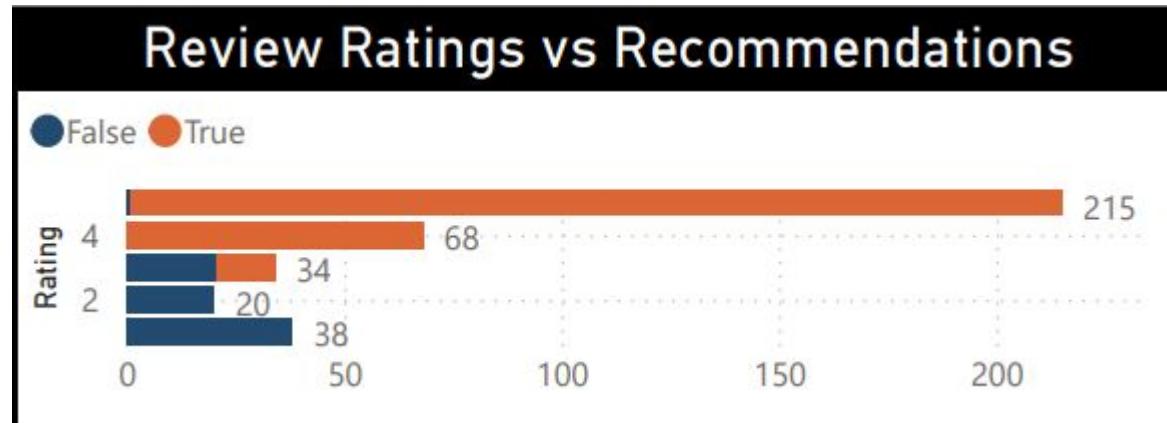
- The top three Supergoop Sunscreen products dominate by review count, with Mini Glow Oil SPF 50 PA++++ having the highest (396).
- Sunscreen is prioritized as all top-reviewed products reflect the greatest customer interest. Improving Sunscreen quality has direct potential to increase ratings and sales.

Rating & Review Behavior



- Products with high ratings (4–5) dominate review volume, especially rating 5, which has the most reviews.
- This pattern indicates that customer satisfaction positively correlates with engagement, where positive experiences drive more reviews and can boost trust and online sales.

Rating & Review Behavior



- The highest number of loves is linked to 4-star products, indicating that users often favorite items before assigning the highest rating.
- Interestingly, 5-star products receive fewer loves, suggesting that although perfect ratings are given, user engagement through loves tends to peak at strong but not perfect ratings.

Engagement & Popularity



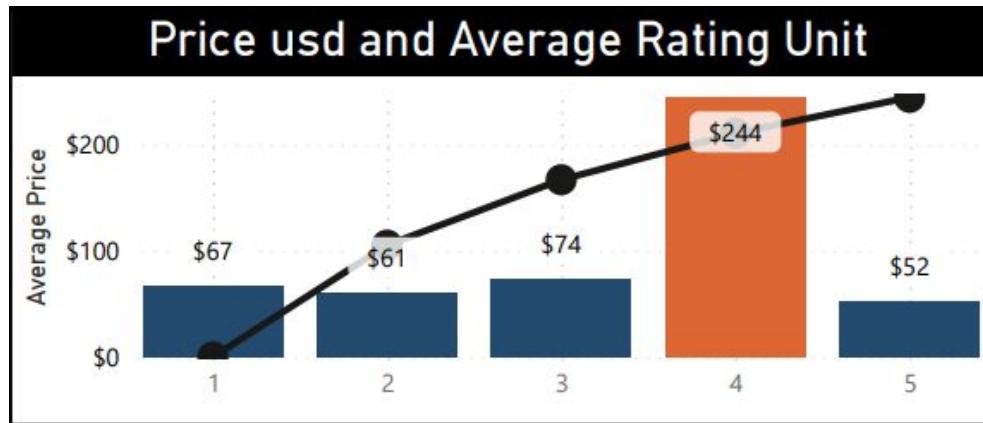
- The highest number of *loves* is linked to **4-star products**, indicating that users often favorite items before assigning the highest rating.
- Interestingly, **5-star products** receive fewer *loves*, suggesting that although perfect ratings are given, user engagement through *loves* tends to peak at strong but not perfect ratings.

Engagement & Popularity



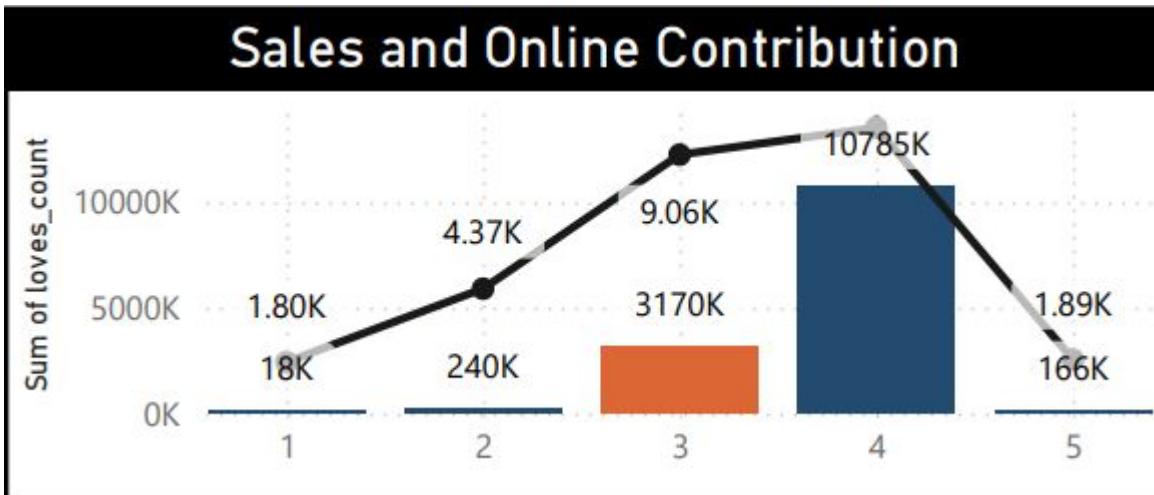
- The number of reviews remained relatively stable from 2014 to 2022, with moderate fluctuations each year.
- In 2023, there is a significant spike, with reviews tripling compared to previous years, indicating a surge in customer engagement or a possible campaign or product launch that dramatically increased attention.

Price & Sales Impact



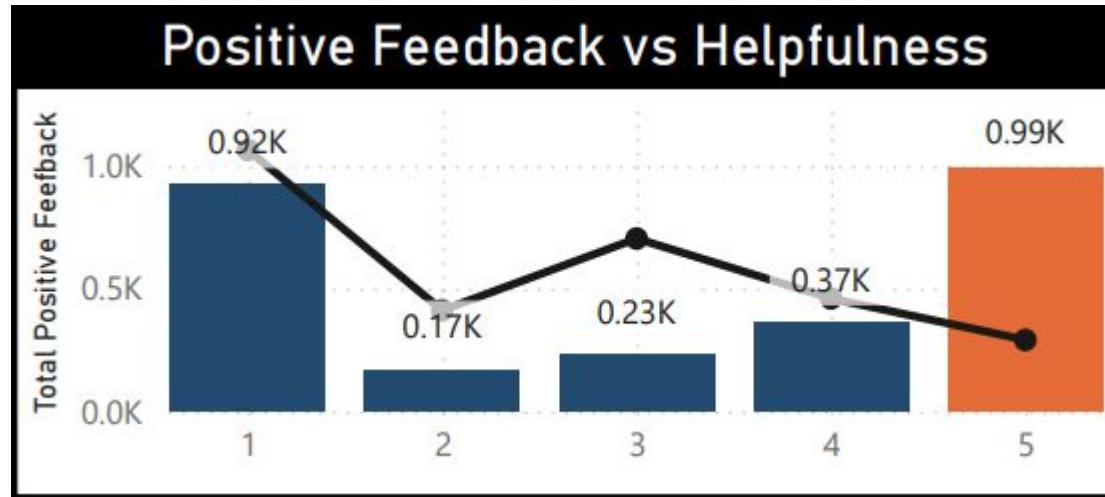
- Products with a **4-star rating** have the highest average price at **\$244**, indicating that premium products tend to receive strong but not perfect ratings.
- Interestingly, **5-star products** show a much lower average price of **\$52**, suggesting that perfect satisfaction is not necessarily associated with higher-priced items.

Price & Sales Impact



- Products with a **4-star rating** have the highest number of *loves*, showing strong customer engagement and a positive contribution to sales.
- Although **5-star ratings** indicate the highest satisfaction, the number of *loves* decreases sharply, suggesting that 4-star products drive more engagement than perfect ratings.

Price & Sales Impact



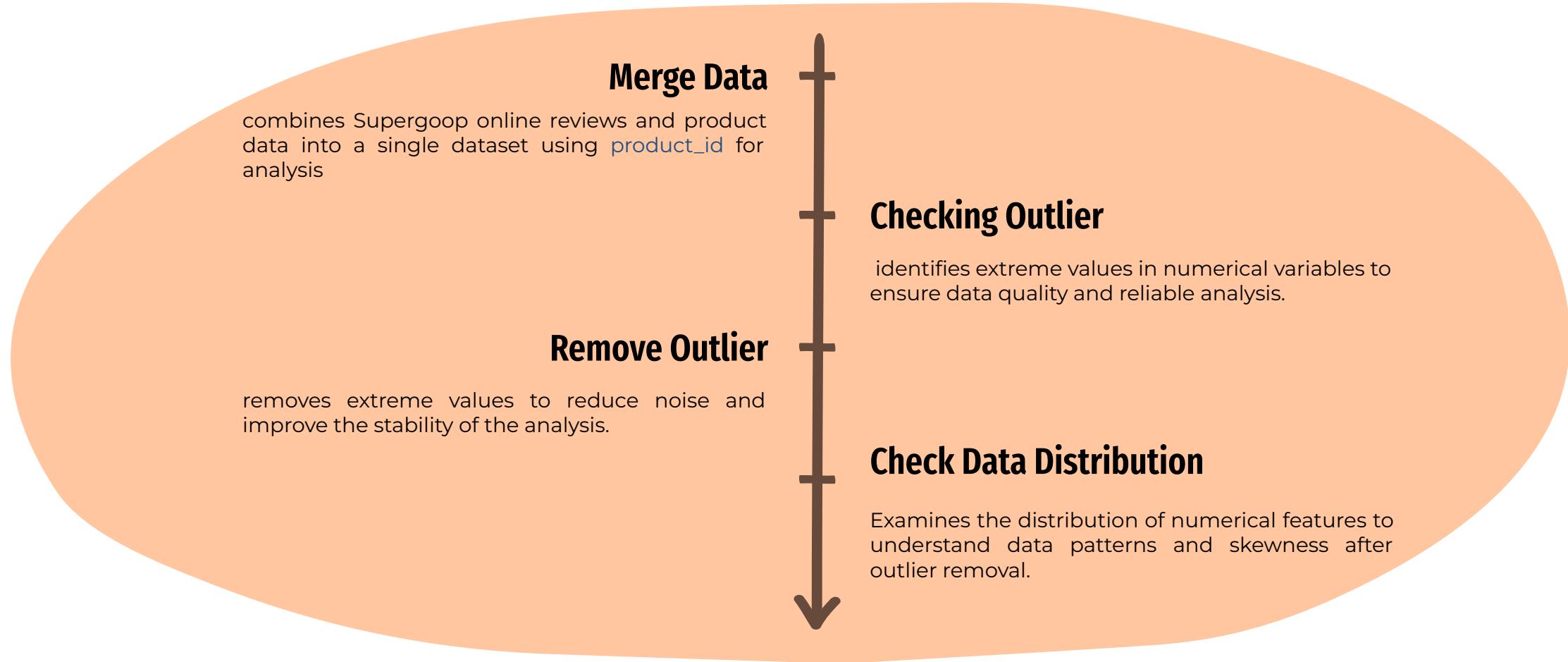
- High positive feedback on rating 1 signals a reputational risk; visible negatives must be mitigated.
- Rating 5 strong feedback shows satisfaction; improving ratings 2, 3, and 4 reduces risk and stabilizes trust.



Summary Insight

- **KPI Overview:** An average rating of 4.08 and a 76% positive review rate indicate strong customer satisfaction and a positive brand perception.
- **Product and Category Performance:** Categories such as Skincare and Sunscreen stand out, reflecting strong customer preferences and higher overall performance.
- **Rating and Review Behavior:** Higher ratings (4 and 5 stars) are strongly associated with positive feedback, while lower ratings generally indicate lower customer satisfaction.
- **Engagement and Popularity:** Certain products, such as the Mini Glow Oil SPF 50, demonstrate higher engagement and popularity, highlighting strong customer interest.
- **Price and Sales Impact:** An average price of \$21 positions Supergoop within an accessible price range, which positively influences sales performance.
- **Positive Feedback and Helpfulness:** Positive reviews tend to receive higher helpfulness scores, indicating that well-received reviews also provide greater value to other customers.

Next Steps After EDA



Preparing Data

	price_usd_y	rating_x	reviews	positive_ratio	negative_ratio
1	36.0	5	124.0	0.0	0.000000
2	36.0	5	124.0	0.0	0.999999
3	36.0	5	124.0	0.0	0.000000
5	36.0	5	124.0	0.0	0.000000
6	36.0	5	124.0	0.0	0.000000
7	36.0	5	124.0	0.0	0.999999

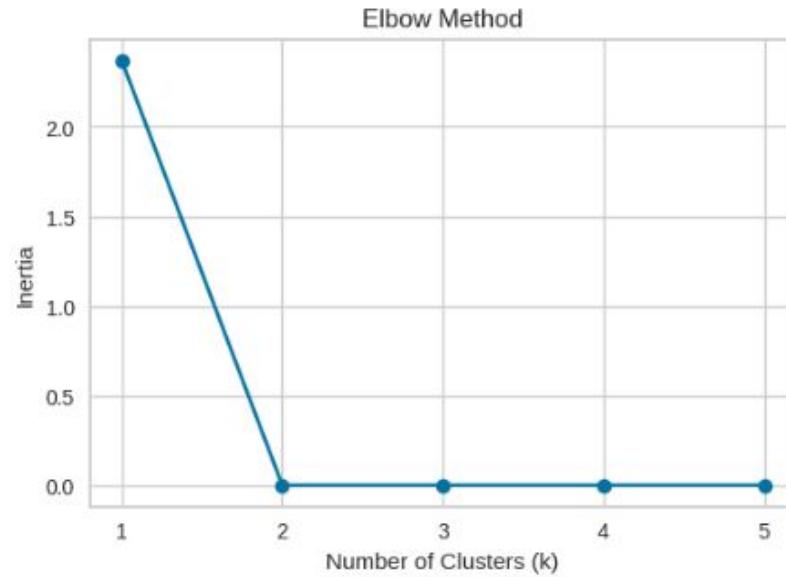
The data shows minimal variation in pricing, ratings, and review counts, with most differentiation coming from extreme positive or negative sentiment ratios. As a result, clustering will primarily capture sentiment-based patterns rather than product-level differences.

Robust Scaler

	price_usd_y	rating_x	reviews	positive_ratio	negative_ratio
count	6.0	6.0	6.0	6.0	6.000000
mean	0.0	0.0	0.0	0.0	0.444444
std	0.0	0.0	0.0	0.0	0.688530
min	0.0	0.0	0.0	0.0	0.000000
25%	0.0	0.0	0.0	0.0	0.000000
50%	0.0	0.0	0.0	0.0	0.000000
75%	0.0	0.0	0.0	0.0	1.000000
max	0.0	0.0	0.0	0.0	1.333333

The scaled data indicates that most reviews exhibit typical behavior, while a small subset of users is highly active and influential. This contrast makes user segmentation through clustering a relevant and meaningful approach for further analysis.

Elbow Method



The elbow method indicates an optimal number of clusters at $k = 2$, suggesting a clear separation driven by user sentiment. This result confirms that negative feedback is the primary factor differentiating products, rather than pricing or popularity.



Descriptive Statistic

Cluster 0

Products with no negative sentiment, indicating a generally positive or neutral customer experience.

Cluster 1

Products dominated by negative sentiment, suggesting customer dissatisfaction despite similar pricing and ratings.

Overall Insight:

User sentiment, especially negative feedback, is the key factor differentiating products and should be the main focus to improve ratings and online sales.



Cluster Interpretation

- Not all Supergoop products generate the same level of customer engagement, some receive minimal feedback, while others attract significant customer attention.
- Products with high customer attention and positive sentiment play a critical role in shaping brand perception and purchase decisions.
- Well-rated but low-visibility products represent untapped opportunities to increase online sales through improved exposure and promotion.
- Focusing on these key product segments allows Sephora to implement more targeted and effective strategies to improve product ratings and drive overall sales growth.



Insight and Recommendation

Objective 1

- **Insight:** Product ratings are mainly influenced by customer sentiment, especially negative feedback.
- **Recommendation:** Reduce negative reviews by addressing key customer pain points to improve ratings.

Objective 2

- **Insight:** Products with positive sentiment drive sales, while well-rated but low-visibility products have growth potential.
- **Recommendation:** Increase visibility and promotion of high-performing and underexposed products to boost online sales.



Appendix

- Contains **8,000+ beauty products** with rich attributes, including prices, brands, ingredients, ratings, and product features.
- Includes approximately **1 million user reviews** covering **2,000+ skincare products**, enabling in-depth customer behavior and sentiment analysis.
- Provides both **structured and unstructured data**, making it suitable for a wide range of analytical methods.
- Enables exploration of **pricing patterns, product performance, and market trends**.
- Supports **customer-level insights**, such as preferences, key satisfaction drivers, and review sentiment.
- Offers a **holistic foundation** for both product-focused and consumer-focused exploratory data analysis (EDA).



Supergoop! Performance Dashboard

All

SEPHORA
BEAUTY PASS



For more info:

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