

# JC Penney Customer Review Analysis: Data Science Approach

## Executive Summary

This report presents a comprehensive analysis of JCPenney's e-commerce review data, encompassing data manipulation in Python, as well as data analysis underpinned by visualisation techniques. Using data sets comprising 39,063 customer reviews across 7,982 products collected from 5,000 users, the methodology follows the standard of CRISP-DM (Cross-Industry Standard Process for Data Mining) to extract useful and actionable insights.

This analysis reveals a critical point in the customer satisfaction matrix of JCPenney: while 58.8% of written reviews received the lowest ranking (0-1), the sentiment analysis performed on the same reviews illustrates 89.8% positive sentiment. The 31.1% gap shows a clear misalignment between customer ratings and what they express in their comments, hinting at a design flaw instead of a product quality issue. The findings of this analysis showcase the imperative need to perform both qualitative and quantitative research to capture accurate customer insights, which directly impact the company's vendor relationships, inventory, and strategic investments.

### 1. Business Understanding

In retail, understanding customer satisfaction is critical for inventory decisions, essentially what products to stock, as well as for pricing strategy, marketing effectiveness and customer retention. The fundamental pillar is understanding how to reliably measure customer satisfaction to optimise such decisions. Arguably, star ratings (0-5) can only provide partial information, as users can apply inconsistent standards when assigning numeric values. The value of written reviews and text is the foundation of such analysis.

### 2. Data Understanding and Preparation

The analysis integrated five data sets: 39,063 reviews, 7,982 products, 5,000 customers, as well as two JSON-formatted files. Before analysis, the following three issues were identified during the quality assessment:

**Negative Prices:** 44 products displayed negative prices. Data entries were converted to positive values, recovering otherwise unusable data. This was identified via systematic data quality checks and negative values were converted into positive using `abs()` function.

**Duplicate Customers:** One customer (Username: dqft3311) appeared twice with different demographic information (DOB and State). Both records were removed to maintain integrity, lowering the dataset to 4,998.

**Data Completeness:** 2,166 products do not have price information. No additional duplicates were detected either in the Review or Product dataset.

### 3. Visualisation and Analysis

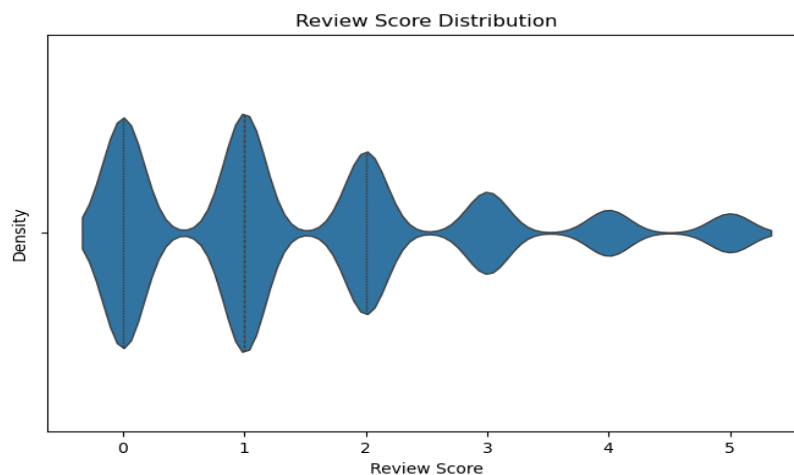
#### Distribution Analysis – Visual Table & Violin Plot

The analysis of the Review’s dataset revealed how users rated the products that they purchased:

Rating	Count	Percentage
0-1	22,952	58.8%
2-3	12,064	30.8%
4-5	4,147	10.6%

This dataset presents a striking bimodal distribution. At first glance, this pattern indicates wide customer dissatisfaction. See Fig 1 (Violin Chart below – Review Score Distribution).

Fig. 1 – Review Score Distribution



JCPenney executives might deduce that the products they are selling are not of good quality and customer feedback is rather poor, which could lead to vendor replacements and product improvements.

Though this analysis is truly incomplete if the qualitative data is not taken into consideration.

#### 3.1 Sentiment Analysis – Text Driven (Pie Chart)

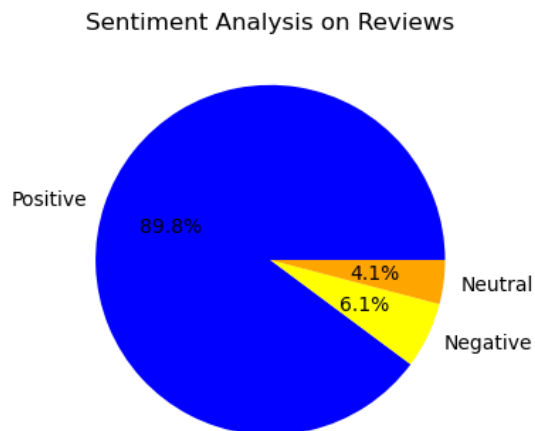
This approach was selected because of the following:

- Such analysis focuses on reviews and text specifically.
- Capture nuance, as it automatically recognises positive words, like *excellent quality* and negative approaches, such as *poor material* as well as punctuation emphasis.

Deploying VADER (Valence Aware Dictionary and sEntiment Reasoner) sentiment analysis (below Fig 2.) to study the written text reviews it appears that:

- 89.8% of the data provided can be considered as positive sentiment (35,097 Reviews)
- 4.1% present neutral sentiment (1,115 Reviews)
- Just 6.1% show negative sentiment (2,811 Reviews)

*Fig. 2 – Sentiment Analysis on Reviews*



It is crucial to highlight that the same dataset has been analysed by looking at it from two different angles, namely a violin plot and sentiment analysis. The exact same customers expressing low ratings (0-1) are writing positive reviews. The 31.1% gap between positive sentiment and low ratings shows a clear misalignment between customer intent and what the rating system records. If JCPenney solely relies on the 58.8% low-rating figure, the company might incorrectly remove inventory, terminate vendors' contracts and initiate campaigns to improve its products. Thanks to the sentiment analysis performed, 89.8% show positive sentiment, which validates the hypothesis that customers are satisfied.

### **3.2 Root Cause Analysis – Interface Hypothesis**

The extreme divergence between the review scores and sentiment illustrated above implies design and presentation flaws in the submission rating system. The plausible problems could be as follows:

- Inverted Rating Scale: The star rating system may be displayed counter-intuitively, which could cause customers to click on a low rating when satisfied and wanting to leave a high score.
- Interface Scaling Problems: Since users may prefer to leave feedback on a mobile phone, they might give lower ratings due to the placement of the rating scale on mobile devices.

Analysis of the dataset shows that a 31.1% gap between low review scores and positive sentiment remains stable across every price range and product category taken into account. No irregularities relating to product quality or user behaviors have been detected in the given subgroups, which suggests that this is not an issue linked to specific products or price segments. In fact, this pattern points to a platform-wide issue affecting the review process itself. If this gap had been isolated to certain price points or products, it would indicate either price sensitivity across buyers or reluctance to provide high ratings in selected categories. Though the data visualisation above shows pronounced bimodal distribution in review scores, highlighting this gap. Two peaks in the score distribution support the conclusion that user experience is not driving this output; rather, the user interface may be responsible. Addressing this root cause on a platform level is fundamental, as target actions towards individual groups would not address this issue.

### **3.3 Reasons behind the two performed tests**

#### **→ Violin Plot Analysis (Ratings Focused)**

This test shows 58.8% low ratings (0-1), which suggests a broad dissatisfaction with products and can lead to inventory cuts, false crisis, and vendor losses.

#### **→ Sentiment Chart (Text Focused)**

The results of this test reveal that 89.8% of the reviews in the dataset present positive sentiment, suggesting a high level of customer satisfaction with their purchases.

To sum up, by performing both analyses, namely Violin Plot Analysis and Sentiment Analysis, a disconnection gap of 31.1% has been identified. This suggests a clear front-end issue, as the ratings given by the users do not match the positive sentiment data extracted by the review data set analysed.

### **4. Recommendations & Business Actions**

The next paragraph focuses on the recommendations for the retail company.

#### **i. Redesign Review Interface**

Firstly, given the outcomes of the data analyses above, JCPenney should revisit its review rating interface. The datasets underpin compelling evidence, especially the 31.1% gap between low scores and extremely positive review sentiment analysis, which indicates that majority of satisfied users are invertedly submitting low rating scores. JCPenney should lead live user testing sessions analysing in real time how its users interact with the rating scales on desktops and mobile devices. Such sessions, which could be benchmarked against

other retail leaders like Walmart and Amazon, would highlight any issues triggered by the rating of scales, symbols, or unclear areas on the front-end platform.

## **ii. Root Cause Analysis**

Secondly, JCPenney should establish a dedicated team to investigate the reasons behind the striking discrepancy between high customer sentiment and low ratings. This target research could focus on a sample of reviews that express positive sentiment but give low ratings, aiming to determine whether customers are downgrading their rating due to issues like packaging, shipping or other frustrations, despite being satisfied with the actual product. Adopting a root cause investigation will unveil the recurring issues and complaints that are linked with low scores.

## **iii. Dual-Metric Analytics**

Lastly, dashboards and reports should be updated to display both qualitative sentiments as well as quantitative ratings, which would offer a dual-metric view of the company. In fact, campaigns, products, and vendors should be evaluated not only by the numerical scores obtained from user reviews, but also by the alignment (or misalignment) of data captured in the written reviews. This technique will empower JCPenney to spot areas that require adjustments, interventions or support, but also meaningful opportunities for market position. By adopting the above steps, the company can ensure that the collected data can be a strategic asset, as it provides actionable insights that can lead to improved products, higher customer satisfaction, and ultimately higher revenue.

## **5. Conclusion**

To conclude, this data analysis revealed a critical insight that poses a risk to conventional satisfactory measurement: relying on numeric data scores can be misleading and a risky approach. Having used sentiment analysis by VADER, this report unlocked the authentic customer perceptions, as it revealed that 89.8% are satisfied users, unlike what the violin chart had initially unveiled. This paradox can be related to several flaws in the process of submitting ratings, as customers who are keen to express their satisfaction are recorded as unsatisfied due to the poor design of the front-end platform. While 27% of products lacked price information, this did not impact the sentiment analysis, as review data was complete for all 39,063 records. By implementing audits within the platform's back end and refining the feedback interface, JCPenney can minimise missed opportunities and costly errors. Through the integration of both quantitative and qualitative strategies, the company will enhance its vendor relationship management and develop a holistic understanding of its daily customers.