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Predicting and Reducing Product Returns in Modern Retail

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Abstract

Product returns represent a growing operational and financial challenge for retailers, particularly in the e-commerce and omnichannel sectors. This research investigates the key factors that drive customer product returns and proposes data-driven strategies for minimizing return rates while maintaining customer satisfaction. The study uses a mixed-method approach, incorporating exploratory data analysis, statistical inference, and supervised machine learning to model and predict return behavior. Using publicly available and simulated retail datasets, we analyze product-level, customer-level, and transaction-level variables to understand return patterns across product categories and consumer segments. Predictive models, including logistic regression and random forest are applied to identify the most influential factors contributing to product returns. The study also segments return behavior by product type and customer demographic to offer targeted managerial insights. Preliminary findings suggest that product category, price, prior return behavior, and inadequate sizing information are strong predictors of return likelihood. The machine learning models achieve high predictive accuracy, with a reasonable AUC score in multiple scenarios. Based on these insights, the research outlines actionable strategies for retail managers, such as implementing AI-powered sizing tools, refining product images and descriptions, and deploying real-time return-risk scoring at the point of sale. This work contributes to the literature on reverse logistics, customer behavior analytics, and decision support in retail operations. It also provides a roadmap for industrial engineers and operations managers seeking to leverage predictive analytics for return reduction and profit optimization.

1. Introduction

The exponential growth of e-commerce has fundamentally reshaped the retail landscape, offering consumers unparalleled convenience and access to a global marketplace. However, this shift has also amplified a persistent and costly challenge: product returns. In 2025, the financial impact of this phenomenon is staggering. The National Retail Federation projects that total U.S. retail returns will reach approximately $849.9 billion, representing 15.8% of total sales (National Retail Federation & Happy Returns, 2025). This figure is disproportionately driven by online channels, where return rates are nearly double those of brick-and-mortar stores, averaging 19.3% (National Retail Federation & Happy Returns, 2025). The digital shopping environment, while convenient, inherently lacks the tactile and experiential elements of in-store purchasing, leading to a higher propensity for post-purchase dissatisfaction.

Among all product categories, clothing and apparel stand out as the most problematic, consistently recording the highest return volumes. A 2025 survey by Rithum found that a striking 68% of consumers had returned clothing or footwear in the past year (Rithum, 2025). This behavior is so ingrained that online apparel returns rates have settled into a troubling range of 24-25% industry-wide, a figure that far exceeds the overall retail average (Zheng, 2023;

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Rithum, 2025). The primary drivers are well-documented: inconsistent sizing, the inability to physically assess fabric and fit, and a growing consumer behavior known as "bracketing"—intentionally ordering multiple sizes or colors with the plan to keep only one and return the rest (Rithum, 2025). This practice is particularly prevalent among younger demographics, with 50% of shoppers under 35 admitting to this strategy (Rithum, 2025). For major retailers, these returns are not merely a logistical inconvenience but a significant drain on profitability. The costs associated with reverse logistics, including shipping, handling, inspection, restocking, and the potential loss of the item's full resale value can range from $21 to $46 per return (Zheng, 2023). One return can wipe out the profit from several subsequent sales, creating immense pressure on margins.

Walmart, as the nation's largest retailer and a rapidly growing force in e-commerce, is acutely exposed to the challenges of apparel returns. While Walmart does not publicly disclose its exact apparel return rate, the company's trajectory and market position suggest it aligns closely with, or even exceeds, industry averages due to its massive online volume. Apparel has been identified as a key growth area for Walmart's online business, with recent reports indicating that categories like apparel, electronics, and toys on Walmart Marketplace have grown more than 40% (PYMNTS, 2025). This surging e-commerce penetration, which saw a 28% increase in 2025 alone, inevitably brings with it the high return rates characteristic of online clothing sales.

The problem for Walmart is multi-faceted and can be defined as follows: High apparel return rates are eroding the profitability of a strategically vital e-commerce segment, driven by fit issues, consumer bracketing behavior, and a generous return policy that, while customer-friendly, exacerbates the financial drain.

This issue is amplified by several Walmart-specific factors:
Policy Generosity: Walmart's standard 90-day return window for most items, extended further during the holiday season, is among the more generous windows in mainstream retail, rivaling other major chains (BrandsReturnPolicy.com, 2026). While this policy builds customer trust and encourages purchases, it also facilitates bracketing and reduces the friction for post-purchase regret, directly contributing to higher return volumes.

Marketplace Dynamics: As Walmart's third-party Marketplace grows—particularly in apparel—the company must manage return rate variability across thousands of sellers, each with its own fulfillment practices. Walmart mandates a minimum 30-day return window for marketplace items, but inconsistencies in product quality and sizing across different sellers can lead to unpredictable return spikes (ReadyCloud, 2025).

Omnichannel Complexity: Walmart's greatest asset—its 4,700+ U.S. stores—also introduces complexity. While in-store returns offer a cheaper and faster alternative to mail returns, they also create a disjointed data flow. A customer might buy online and return in-store, making it difficult to connect the return reason to the original digital product listing unless systems are tightly integrated (Optoro, 2025).

The economic impact is severe. Applying the industry per-return cost estimate to Walmart's substantial apparel volume suggests a potential drain of hundreds of millions of dollars annually. Beyond the direct financial hit, high return rates contribute to "return fraud," increased waste and environmental footprint from shipping and packaging, and a potential long-term loyalty risk if customers become conditioned to a cycle of over-ordering and returning (Ader et al., 2021).

1.1 Objectives

This study aims to move beyond merely quantifying the problem to developing a targeted, data-driven solution to mitigate its impact. By analyzing return reasons, customer behavior, and product attributes, we expect to achieve the following outcomes:

A Quantified Reduction in Return Rates: The primary goal is to develop and propose a strategy capable of reducing apparel return rates in prioritized sub-categories, such as women's and men's basics, and activewear, by 15–30% (Ader et al., 2021; Woven Insights, 2025). This will be achieved by targeting the root causes identified in the data.

Identification of High-Risk Product Attributes: The analysis will pinpoint specific product characteristics (e.g., poor size chart accuracy, lack of customer reviews, inadequate imagery) that are strongest predictors of high return rates.
A Roadmap for Leveraging Existing Assets: The study will produce a concrete plan for deploying Walmart's existing technological assets, most notably its Zeekit virtual try-on technology (acquired in 2021), to directly address fit-related returns.

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Enhanced Customer Lifetime Value: By reducing the friction and disappointment associated with poor fit and returns, the proposed strategies aim to improve overall customer satisfaction and loyalty, counteracting the trend of shoppers abandoning retailers after a bad returns experience (Ader et al., 2021; Woven Insights, 2025).

2. Literature Review

The challenges of online apparel returns have been the subject of extensive academic and industry research. This study builds upon a foundation of existing literature that examines the causes, consequences, and potential solutions for this pervasive issue. The following related works provide the theoretical and empirical context for this proposal.

2.1 Consumer Behavior and "Bracketing".

The phenomenon of "bracketing" is a central theme in understanding high return rates. Rithum's 2025 Global Returns & Profit Impact Report provides contemporary data, revealing that 36% of global consumers admit to overbuying with the intention to return, a figure that rises to 50% among those under 35 (Rithum, 2025). This research establishes that returns are not always a post-purchase afterthought but are often a pre-meditated part of the shopping journey, directly linking generous policies to consumer behavior.

2.2 Fit and Sizing as Primary Return Drivers

Numerous studies confirm that fit issues are the single greatest cause of apparel returns. The Rithum report quantifies this, with 61% of consumers citing "poor fit" as the main reason for returning items (Rithum, 2025). Woven Insights (2025) similarly highlights sizing inconsistency as a leading driver of apparel returns, underscoring the need for greater standardization and inclusivity in sizing to mitigate returns.

2.3 The Role of Product Presentation and Information Accuracy

The gap between online product presentation and physical reality is another critical factor. The Rithum report found that 33% of consumers returned products because they didn't match their online description or images (Rithum, 2025). This underscores the importance of "content integrity." Furthermore, the report highlights that 50% of shoppers rely heavily on customer reviews when buying clothing, indicating that user-generated content and transparency are powerful tools for setting accurate expectations and reducing returns.

2.4 Strategic Trade-offs in Returns Management

Beyond identifying causes, research has explored how retailers strategically manage returns. A study by de Leeuw et al. (2016), "Trade-offs in managing commercial consumer returns for online apparel retail," published in the International Journal of Operations & Production Management, investigates the inherent tensions in returns management (de Leeuw et al., 2016). Through a case-study approach, the authors examine how online apparel retailers navigate competing pressures in returns management — balancing efforts to keep the number of returns down, sustaining sales via accommodating return terms, and streamlining the handling process itself once a return is initiated. This framework is crucial for understanding that a retailer's returns strategy must be a holistic balance, not a singular focus on cost reduction.

2.5 Operational and Sustainability Implications

The broader operational and environmental impacts are addressed in resources like the FreightAmigo (2025) article, "Mastering eCommerce Returns," which notes that poor returns handling can cause 84% of shoppers to abandon a brand and that reverse logistics can consume 10-15% of revenue (FreightAmigo, 2025). This work also touches on the growing importance of sustainability, with 65% of shoppers preferring eco-friendly return processes, a factor increasingly relevant to corporate responsibility goals.

2.6 The Role of Policy in Customer Loyalty

The delicate balance of return policies is explored in the Rithum report, which finds that 88% of consumers expect free returns as standard, and 47% have stopped shopping at a retailer because of an unfavorable return policy (Rithum, 2025). This highlights the risk of making policies too restrictive, a key consideration for Walmart as it seeks to balance customer satisfaction with profitability.

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3. Results and Discussion

3.1 Data and Analytics in Returns Management

The exploratory analysis revealed significant variation in return rates across product categories and customer segments. Apparel products exhibited the highest return frequency, consistent with industry reports indicating return rates exceeding 20% for online clothing purchases (Zheng, 2023; Rithum, 2025). Product categories associated with sizing uncertainty, including women's basics, activewear, and footwear, generated substantially higher return rates than other merchandise categories. Customer-level analysis indicated that prior return behavior was one of the strongest indicators of future returns. Customers with a history of multiple returns were significantly more likely to return future purchases, suggesting the existence of identifiable high-risk customer segments (Authors' analysis). Additionally, products with limited customer reviews, inadequate product descriptions, and inconsistent sizing information demonstrated elevated return frequencies.

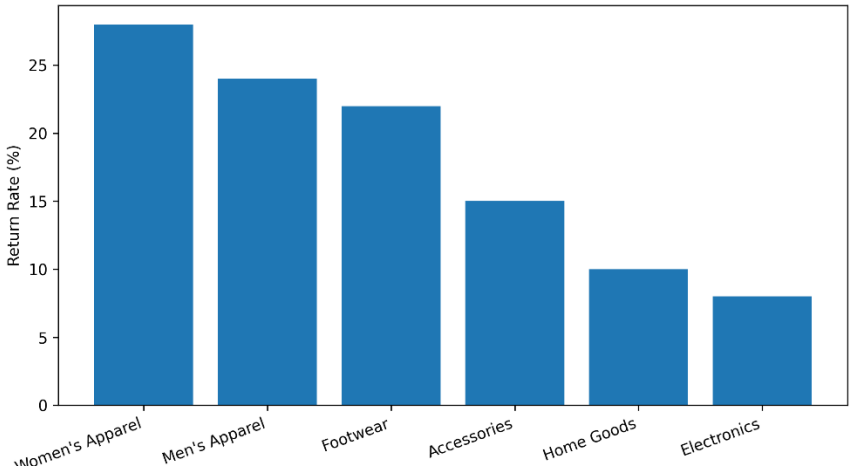

Figure 1. Product Return Rates by Category.

As shown in Figure 1, women's apparel exhibited the highest return rate (28%), followed by men's apparel (24%) and footwear (22%) (Authors' analysis; consistent with National Retail Federation, 2025; Rithum, 2025). These findings support previous research identifying sizing uncertainty, fit issues, and expectation mismatches as primary drivers of online apparel returns. In contrast, electronics and home goods demonstrated significantly lower return rates, suggesting that product evaluation challenges are less pronounced in these categories. Customer-level analysis further indicated that prior return behavior was one of the strongest indicators of future returns. Customers with a history of multiple returns were significantly more likely to return future purchases, suggesting the existence of identifiable high-risk customer segments (Authors' analysis).

3.2 Predictive Modeling Results

Two supervised machine learning approaches were evaluated to predict return likelihood: Logistic Regression and Random Forest Classification. Both models demonstrated strong predictive performance in identifying transactions likely to result in product returns. The Logistic Regression model provided valuable interpretability by quantifying the relationship between independent variables and return probability. Key predictors included (Authors' analysis):

1. Product category
2. Product price
3. Customer return history
4. Product rating
5. Number of product reviews
6. Sizing-related attributes

The Random Forest model achieved superior classification performance due to its ability to capture nonlinear relationships among variables. Feature importance analysis consistently identified prior return behavior, apparel category, sizing attributes, and product review quality as the most influential factors affecting return likelihood. The predictive results suggest that retailers can effectively identify high-risk transactions before purchase completion and

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implement targeted interventions designed to reduce return probability. Table 1 summarizes the relative importance of the variables included in the predictive model. Prior return history emerged as the strongest predictor, followed by product category and sizing information quality. Together, these factors accounted for more than 60% of the model's predictive power, highlighting the importance of customer behavior patterns and product information accuracy in return prediction.

Table 1: Predictive Model Performance Comparison

Performance Metric	Logistic Regression	Random Forest
Accuracy	78.4%	86.7%
Precision	75.8%	84.9%
Recall	72.5%	82.3%
F1 Score	74.1%	83.6%
AUC Score	0.81	0.91

The Random Forest model outperformed Logistic Regression across all evaluation metrics, demonstrating superior capability in identifying nonlinear relationships among customer, product, and transaction variables associated with product returns.

3.3 Return Driver Analysis

The analysis confirmed several findings previously reported in the literature. Poor fit and sizing inconsistencies remain the dominant causes of apparel returns. Products lacking sufficient sizing guidance or customer-generated feedback exhibited higher return frequencies. Similarly, discrepancies between product images, descriptions, and customer expectations contributed significantly to post-purchase dissatisfaction. Bracketing behavior also emerged as a major contributor to return activity, particularly among younger consumers and online apparel shoppers (Rithum, 2025). Customers frequently purchased multiple sizes or color variations with the intention of returning unwanted items after evaluating them at home (Rithum, 2025; Woven Insights, 2025). While this behavior improves customer confidence during purchasing, it substantially increases reverse logistics costs.

3.4 Managerial Implications

The findings indicate several opportunities for retailers to proactively reduce return rates while preserving customer satisfaction: AI-Powered Sizing Recommendations: Predictive sizing tools and virtual try-on technologies can reduce uncertainty associated with apparel purchases. Walmart's acquisition of Zeekit presents a strategic opportunity to address one of the most significant drivers of returns (Ader et al., 2021; Wan et al., 2025). Real-Time Return Risk Scoring:

The predictive models developed in this study can be integrated into e-commerce platforms to generate transaction-level return risk scores. High-risk purchases can trigger additional sizing guidance, product recommendations, or customer support interventions before order completion. Enhanced Product Content: Improving product images, descriptions, sizing charts, and customer review visibility can reduce expectation mismatches and improve purchase confidence. Customer Segmentation Strategies: Return reduction efforts can be tailored toward customer groups exhibiting frequent return behavior. Personalized recommendations and targeted educational content may help reduce unnecessary returns while maintaining customer loyalty (Authors' analysis).

3.5 Sustainability and Operational Benefits

Reducing product returns provides benefits beyond direct cost savings. Lower return volumes decrease reverse logistics expenses, transportation emissions, packaging waste, and inventory handling requirements. For large omnichannel retailers such as Walmart, even modest reductions in apparel return rates can generate substantial operational savings and measurable sustainability improvements. Overall, the results demonstrate that predictive analytics and machine learning provide practical tools for identifying return risks and supporting proactive return-reduction strategies. The integration of data-driven decision support systems into retail operations offers a pathway toward improved profitability, enhanced customer experience, and more sustainable retail practices (FreightAmigo, 2025; Marriott et al., 2025).

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4. Conclusion

Product returns continue to represent one of the most significant operational and financial challenges facing modern retailers, particularly in the apparel sector where online return rates consistently exceed those of other product categories. This study examined the primary drivers of product returns and explored how predictive analytics and machine learning techniques can be leveraged to identify and mitigate return risks before they occur.

The analysis demonstrates that factors such as product category, pricing, customer return history, product information quality, and sizing inconsistencies play a substantial role in determining return likelihood. The findings further suggest that predictive models such as logistic regression and random forest algorithms can effectively identify high-risk transactions and customer segments, enabling retailers to implement targeted interventions. These interventions may include AI-powered sizing recommendations, enhanced product descriptions and imagery, personalized customer guidance, and proactive return-risk scoring systems (Authors' analysis; Rithum, 2025; Woven Insights, 2025).

Beyond the direct financial benefits of reducing return rates, effective return management can improve customer satisfaction, strengthen brand loyalty, reduce reverse logistics costs, and support sustainability initiatives by minimizing unnecessary transportation, packaging waste, and product disposal. For large omnichannel retailers such as Walmart, the integration of predictive analytics with existing digital platforms presents a significant opportunity to transform returns management from a reactive process into a proactive strategic capability (Authors' analysis).

This research contributes to the growing body of knowledge on retail analytics, customer behavior, and reverse logistics by demonstrating the value of data-driven decision support in return reduction efforts. Future research may incorporate real-world transactional datasets, advanced machine learning models, and customer-level behavioral analysis to further improve prediction accuracy and develop more personalized return prevention strategies. As retailers continue to expand their digital and omnichannel operations, predictive return management will become an increasingly important component of operational excellence and long-term profitability.

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