The Impact of Discount Presentation Formats on Consumer Purchasing Behavior: An Empirical Investigation

Group23

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Introduction

In the ever-evolving landscape of retail and e-commerce, understanding the psychology behind consumer purchasing decisions is pivotal for businesses aiming to optimize sales. Among the myriad strategies employed to entice buyers, the presentation of discounts stands out as a crucial element that can significantly influence shopping behavior. This study investigates the nuanced effects of discount presentation on consumer decision-making, specifically comparing the impact of showing discounts as a total dollar amount saved versus a percentage of the price saved.

While discounts are universally recognized as a powerful tool to attract customers, the manner in which they are communicated can subtly sway decision-making processes, nudging customers towards a purchase by appealing to their perception of value. By conducting a meticulously designed experiment involving participants from diverse demographics, this research seeks to unravel the nuances of discount presentation and its psychological implications on consumer behavior. Through a blend of statistical analysis and consumer feedback, we aim to provide insightful revelations on how small changes in marketing strategies can lead to significant shifts in customer engagement and sales outcomes, thereby aiding businesses in crafting more effective promotional tactics. This research endeavors to uncover whether the format of discount presentation significantly alters consumer behavior, offering empirical evidence to a marketing strategy that has largely been guided by intuition and anecdotal evidence

Research question

At the heart of this exploration lies the critical question: How does the method of discount presentation—total dollar amount saved versus percentage saved—affect consumer purchasing behavior? This question seeks to dissect the psychological underpinnings of consumer choices and to ascertain which strategy might be more effective in driving sales.

Null Hypothesis

There is no difference in the effect on purchasing behavior between the control group, which is shown the original price, and each of the treatment groups, which display the discount as either a total dollar amount saved or a percentage saved.

For Treatment Group 1 (dollar amount saved) vs. Control:

Displaying the discount as a total dollar amount saved does not significantly affect purchasing behavior compared to displaying the original price.

For Treatment Group 2 (percentage saved) vs. Control:

Displaying the discount as a percentage saved does not significantly affect purchasing behavior compared to displaying the original price.

Methodology

Goal of the Experiment

The experiment aimed to observe how different ways of displaying discounts affect customer purchasing behavior. We divided the survey participants into three groups: one control group and two treatment groups. The control group was shown the original price of an item, while Treatment Group 1 was shown the discount in total dollar amount saved, and Treatment Group 2 was shown the discount as a percentage saved. We compared each treatment group separately with the control group to assess which treatment had a larger effect on purchasing behavior.

Survey Design

We designed the survey using the Qualtrics platform. The survey began with an introduction, followed by questions on basic information including the country of residence, gender, age, career, and monthly expenses ranging from $300 to $3000. Each participant received a survey containing nine questions, randomly comprising both control and treatment question sets. Each question set contained three questions, totaling three question sets. At the end of the survey, a section was provided for participants to leave any additional information or feedback. The survey concluded with a thank you message. It was promoted on social media platforms such as Instagram, WeChat, WhatsApp, Line, and Facebook. To ensure diverse demographic responses, we offered incentives in our classroom, promising a free Starbucks to the 5th and 70th survey respondents. This strategy aimed to attract both early participants and those who might respond later, assuming they could still win the prize.

Control and Treatment Assignment

Qualtrics options allowed us to randomly assign participants to one of the three groups—control or one of two treatments—with each group comprising approximately 33% of participants. The participants answered the nine question sets, which included both control and treatment questions, randomly assigned.

Survey Questions Design

The survey contained a total of nine questions across three sets, each addressing different price levels: low, medium, and high. The low level included images of daily foods like three types of pizza flavors, desserts, and pasta, with prices ranging from $4.75 to $17. The medium level featured items such as black backpacks, scarves, and grey sneakers of different designs, with prices ranging from $36 to $109. The high level contained expensive items like monitors, washing machines, and mattresses, priced from $90 to $550.

Randomization at the Question Level

Qualtrics enabled us to randomize all nine questions, so each participant randomly received a question displaying the original price (control) or one of the treatment displays (discount in total dollar amount saved or discount in percentage saved). This approach allowed for randomization at the question level.

Procedure
Before the main research study, we conducted a pilot experiment to test and refine the research methodology, procedures, and instruments, ensuring their appropriateness and effectiveness. Afterward, we distributed the survey link across various social media platforms. The survey was open for a full week, yielding 231 responses, with 165 completed and 66 incomplete, from participants across Taiwan, the United States of America, China, the Philippines, Canada, Indonesia, India, Germany, Japan, Hong Kong, and France. The demographic results showed 64.2% females, 35.2% males, and 0.6% others.

Data Analysis

Data Cleaning
Remove the first two rows, the redundant columns, from the dataframe, relabel the incorrectly named column 'Q17' as 'Q2', replace all missing values with 0, filter respondents who have completed the survey, and discard any unused columns.
Exploratory Data Analysis
Our survey respondents currently reside in Taiwan, the United States, and China. Additionally, respondents from other countries are included in our dataset, with each of these countries having fewer than four respondents. In terms of gender distribution, approximately 64.2% identify as female, while 35.2% identify as male. Age-wise, 44% fall into the 18-24 age group, 43% in the 25-34 age group, and the remaining 12% are distributed across other age categories. Notably, students constitute the majority of respondents at 40%, followed by IT professionals at 15% and individuals in the education sector at 12%. Regarding monthly expenses, 55% of respondents report a monthly expense of less than 1,200, 25% fall within the 1,200 ~ 2,400 range, and 20% report monthly expenses above 2,400.

T-test

	T1 vs Control	T2 vs Control	T1 vs T2
t-test	6.757***	6.389***	0.352

The result of the t-test suggests a statistically significant difference between T1 and the control group, with T1 having a higher mean than the control group. The disparity between the two groups is considerable relative to the variability within them. Similar results can be observed for T2 compared to the control group. However, for the comparison between T1 and T2 groups, no statistical significance is observed.

Statistical Power

	Cohen's d	Cohen's d Effect	Power	Power Effect
T1 vs control	0.582	Large	0.853	High
T2 vs control	0.687	Large	0.943	High
T1 vs T2	-0.168	Small	0.143	Low

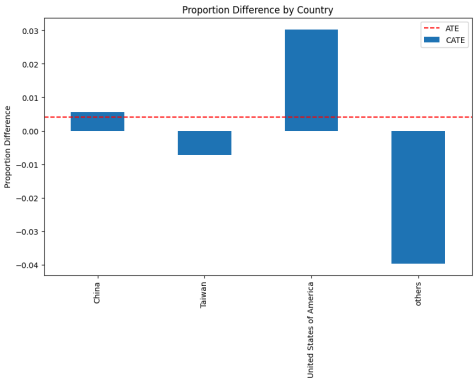
For the comparison between T1 and the control group, the Cohen's d value of 0.582 indicates a large effect size, suggesting that the observed difference is unlikely to be due to random chance alone. Additionally, the power value of 0.853 indicates the probability that a statistical test will correctly reject the null hypothesis. Similar results are observed in the comparison between T2 and the control group. As for the comparison between T1 and T2, the Cohen's d value is -0.168, indicating a small difference between the two groups. However, the power test shows a low probability, suggesting a limited ability to detect any true differences between the groups.

Average Treatment Effect

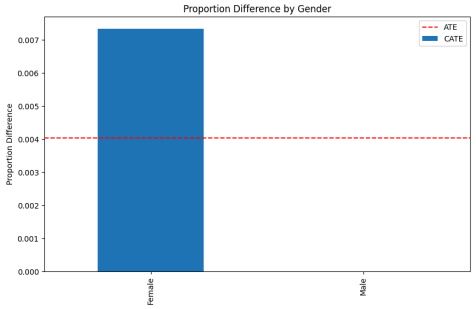
In estimating the average treatment effect, we initially compute the disparity between the outcomes of Treatment Group 1 and the Control Group, followed by the contrast between Treatment Group 2 and the Control Group. The subsequent comparison of these disparities denoted as T1 - T2, reveals that Treatment Group 1 exhibits a more pronounced positive impact, reflected by a positive value. This outcome suggests that Treatment Group 1 has a more significant effect. The positive value indicates that the strategy of presenting discounts as total dollars has a more substantial influence on purchasing behavior compared to the method of portraying discounts as a percentage saved, as observed in the control group, where the original price is displayed.

Conditional Average Treatment Effect

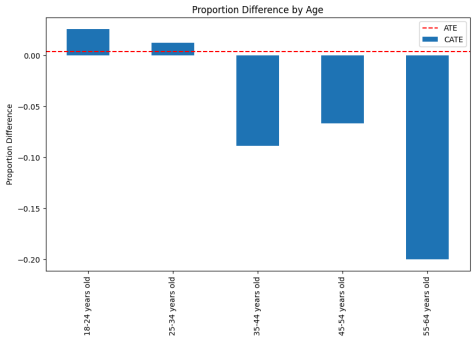
In examining the overall Average Treatment Effect (ATE) as a benchmark, our research aims to systematically evaluate individual subgroups by comparing their respective outcomes against the established ATE threshold. This analytical approach aims to discern distinctive patterns and variations in the observed effects under diverse conditions.



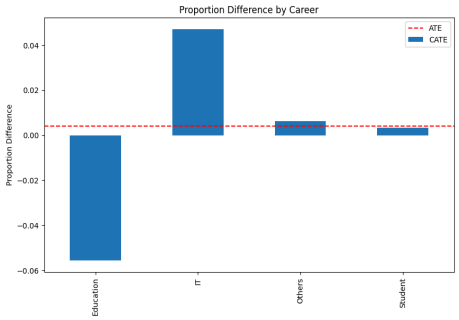
The bar chart analysis highlights positive proportion differences (T1 - T2) for China and the United States, indicating a stronger influence of percentage-based discounts within their subgroups. Conversely, Taiwan's negative proportion difference suggests greater susceptibility to percentage-based discount displays. Comparing with the ATE reveals nuanced impacts, with China primarily affected by T2, the United States influenced by T1, and Taiwan exhibiting heightened susceptibility to T2 effects.



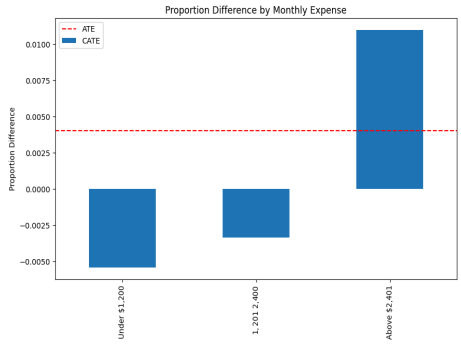
Females show a 0.7338% CATE, while males exhibit 0%, with an ATE of 0.4%. In this context, females demonstrate a more pronounced T1 value compared to T2 when contrasted with males, suggesting a preference for items with total dollar discounts. On the other hand, males remain unaffected by both T1 and T2. In essence, male decision-making remains uninfluenced by the discount presentation.



As age increases, the Conditional Average Treatment Effect (CATE) experiences a significant decline, suggesting that the impact on the elderly is more pronounced when discounts are presented as a percentage rather than directly in monetary terms.



In this context, the two main career categories are IT and education. The chart shows contrasting results, with education's CATE displaying an extremely negative value and IT's CATE showing a significant positive value. This suggests a preference in the education sector for percentage-based discounts, while those in IT prefer discounts in monetary terms. Surprisingly, students are unaffected by either T1 or T2.



The study reveals individuals with lower monthly expenses favor percentage-based discounts, while those with higher expenses emphasize monetary differences. This trend persists even after comparing with the Average Treatment Effect (ATE). In summary, the lower expense group prioritizes percentage displays.

Regression - Adding Covariates

In examining the results of the multinomial logistic regression the focus lies on the influence of treatment groups (group_T1 and group_T2) as well as demographic and professional covariates (country_grouped, gender_grouped, and Career) on the recorded responses denoted as "y=filter_recoded." The regression model, with a sample size of 165 observations, suggests a lack of convergence, indicating potential issues with the estimation. The model's overall significance is supported by the LLR p-value of 0.02014, demonstrating a statistical difference from a null model. However, careful interpretation is required due to non-significant coefficients associated with group_T1, group_T2, country_China, country_Taiwan, country_United States of America, country_others, gender_Female, gender_Genderqueer, gender_Male, career_Education, career_Information Technology (IT) and Telecommunications, career_Others, and career_Student across the response categories 2.0 and 3.0. The pseudo R-squared value of 0.09810 suggests a moderate explanatory power of the model.

MNLogit Regression Results

Dep. Variable:	y	No. Observations:	165
Model:	MNLogit	Df Residuals:	143
Method:	MLE	Df Model:	20
Date:	Fri, 08 Mar 2024	Pseudo R-squ.:	0.09810
Time:	03:46:58	Log-Likelihood:	-160.87
converged:	False	LL-Null:	-178.36
Covariance Type:	nonrobust	LLR p-value:	0.02014

y=filter_recoded_2.0	coef	std err	z	P>|z|	[0.025	0.975]
group_T1	-1.0314	0.533	-1.934	0.053	-2.077	0.014
group_T2	-0.5141	0.540	-0.951	0.341	-1.573	0.545
country_China	-0.4249	1.4e+07	-3.04e-08	1.000	-2.74e+07	2.74e+07
country_Taiwan	0.9818	1.32e+07	7.44e-08	1.000	-2.59e+07	2.59e+07
country_United States of America	-0.3665	1.38e+07	-2.66e-08	1.000	-2.7e+07	2.7e+07
country_others	-0.4569	1.31e+07	-3.5e-08	1.000	-2.56e+07	2.56e+07
gender_Female	0.7501	9.17e+06	8.18e-08	1.000	-1.8e+07	1.8e+07
gender_Genderqueer	-2.0696	9.16e+06	-2.26e-07	1.000	-1.79e+07	1.79e+07
gender_Male	1.0531	9.16e+06	1.15e-07	1.000	-1.8e+07	1.8e+07
career_Education	-1.2567	1.36e+07	-9.21e-08	1.000	-2.67e+07	2.67e+07
career_Information Technology (IT) and Telecommunications	1.1327	1.32e+07	8.58e-08	1.000	-2.59e+07	2.59e+07
career_Others	-0.2959	1.3e+07	-2.28e-08	1.000	-2.55e+07	2.55e+07
career_Student	0.1535	1.4e+07	1.1e-08	1.000	-2.74e+07	2.74e+07

y=filter_recoded_3.0	coef	std err	z	P>|z|	[0.025	0.975]
group_T1	-0.2109	0.557	-0.379	0.705	-1.303	0.881
group_T2	-0.1353	0.584	-0.232	0.817	-1.280	1.009
country_China	2.5548	8.13e+06	3.14e-07	1.000	-1.59e+07	1.59e+07
country_Taiwan	3.2336	8.21e+06	3.94e-07	1.000	-1.61e+07	1.61e+07
country_United States of America	1.8721	8.54e+06	2.19e-07	1.000	-1.67e+07	1.67e+07
country_others	1.3623	8.36e+06	1.63e-07	1.000	-1.64e+07	1.64e+07
gender_Female	-5.0590	1.08e+07	-4.69e-07	1.000	-2.12e+07	2.12e+07
gender_Genderqueer	17.9186	1.09e+07	1.64e-06	1.000	-2.14e+07	2.14e+07
gender_Male	-3.8369	1.09e+07	-3.51e-07	1.000	-2.14e+07	2.14e+07
career_Education	0.5189	9.35e+06	5.55e-08	1.000	-1.83e+07	1.83e+07
career_Information Technology (IT) and Telecommunications	3.0952	9.35e+06	3.31e-07	1.000	-1.83e+07	1.83e+07
career_Others	2.2727	9.35e+06	2.43e-07	1.000	-1.83e+07	1.83e+07
career_Student	3.1360	9.35e+06	3.36e-07	1.000	-1.83e+07	1.83e+07

Randomization Check - Balance Check using Proportions Ztest

In this empirical investigation, proportions z-tests were employed to assess the efficacy of randomization across control, treatment group 1 (T1), and treatment group 2 (T2) for nine distinct survey questions denoted as Q1 to Q9. The analysis involved calculating the count and proportion of respondents within each group and subsequently executing z-tests for pairwise group comparisons. The null hypothesis posited that there were no significant differences in response distributions between the groups. Remarkably, for all questions examined, the obtained p-values surpassed the conventional significance threshold of 0.05, leading to the inference that the randomization procedure was successful. These findings underscore the adequacy of the random assignment process, indicating a balanced and unbiased distribution of responses across the control, T1, and T2 groups for each investigated question. This robust methodology ensures the reliability and validity of subsequent analyses conducted on the collected survey data.

Limitations

While our study provides valuable insights into the effects of discount presentation formats on consumer purchasing behavior, it is imperative to acknowledge its limitations for a comprehensive understanding. Firstly, the sample size of 165 valid responses, though insightful, limits the generalizability of our findings. A more extensive sample size across varied demographics and geographies would enhance the robustness of our conclusions and allow for more nuanced analyses of subgroup behaviors.

Furthermore, the sample characteristics exhibit a significant bias towards certain demographics, notably with a higher representation of females and students. This skewness potentially affects the extrapolation of our findings to the broader population, as different demographic groups may respond uniquely to discount presentations. The overrepresentation of certain careers and age groups further compounds this limitation, suggesting that future research should strive for a more balanced demographic distribution to ensure findings are reflective of a diverse consumer base.

In conclusion, while our study sheds light on the significant influence of discount presentation on purchasing behavior, these limitations highlight the need for further investigation and the importance of a diversified approach in future research endeavors.

Conclusion

The analysis of our collected data reveals a compelling insight: discounts presented in absolute dollar amounts tend to have a more pronounced effect on customer purchasing behavior compared to percentage-based discounts. This finding suggests that consumers may find dollar-based discounts more tangible and straightforward, possibly due to the ease of understanding the direct value offered. Such clarity in savings can be particularly persuasive in driving purchase decisions, underscoring the importance of how discounts are communicated in retail and e-commerce environments.

Despite this observation, our regression analysis indicates that none of the variables examined exhibited significant effects, highlighting the complexity of consumer behavior and the multifaceted nature of purchasing decisions. This outcome suggests that while discount format is a critical factor, it operates within a broader spectrum of influences, including product type, price level, and individual consumer characteristics such as demographics and personal preferences.

These findings underscore the necessity for marketers to adopt a nuanced approach to promotional strategies, tailoring discount presentations not only to the nature of the product but also to the targeted consumer segment. The variation in responses across different demographics and price levels further emphasizes the need for a segmented marketing strategy, allowing for more personalized and effective promotional efforts.

In sum, while the preference for dollar-based discounts offers a valuable insight for designing marketing campaigns, the lack of significant effects from other variables calls for a more holistic understanding of consumer behavior. Future research should delve deeper into the interplay between discount format and other factors, facilitating the development of more sophisticated and consumer-centric marketing strategies.

Reference

Usage of ChatGPT: We used ChatGPT for code debugging and text refinement.

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Appendix