ANALYTICS REPORT

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SUBJECT: CREDIT CARD DATA ANALYSIS

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Introduction

In this brief analysis, we analyzed data from approximately 25,000 Taiwanese credit card customers to uncover insights that could support both marketing and financial planning strategies. The primary objective of this analysis is to determine whether there are statistically significant differences in average bill amounts between male and female customers, and average payment amounts between the months of April and September.

To answer these questions, we conducted two hypothesis tests. First, we performed a two-sample t-test assuming unequal variances to compare average bill amounts between male and female customers. Second, we conducted a paired t-test to compare average April vs. September payment amounts for the same set of customers. Both tests were run using a significance level of 5%, and when results were found to be significant, we calculated a corresponding confidence interval at 95% to estimate the possible range of differences.

Our findings revealed a few key differences and insights.

- Male customers have significantly higher average bill amounts than females, with a difference of approximately $125.17 and a 95% confidence interval of [$69.74, 180.58].
- September payments are significantly higher than April payments, with a mean difference of -$15.15 (April – September), and a 95% confidence interval of [-$24.10, -$6.20].

Based on these findings, we recommend that the marketing department target male customers when promoting credit cards, as men carry a higher credit card balance, on average. We also recommend that the finance department focus on prioritizing September payments and upselling services during that time. Cards with annual fees could prove to be more successful when customers have more liquidity.

Data Analysis

The sections below include the results of the two hypothesis tests conducted for this analysis. Each test starts with the null and alternative hypotheses, followed by an interpretation of the test statistic and p-value to determine whether the result is statistically significant. When the result is significant, we find the possible range of differences by using a 95% confidence interval. Finally, the last section provides some practical recommendations based on the findings.

Section 1 – t-test Comparing Average Bill Amounts Between Males and Females
See the Technical Appendix for t-test output

H_0: There is no difference in average bill amounts between males and females.
H_A: There is a difference in average bill amounts between males and females.

We reject the null hypothesis because the p-value of 0.0000096 is less than our 0.05 significance level, and thus we can conclude that there is a statistically significant difference in average bill amounts between male and female customers. The test statistic is 4.427, with 19,129 degrees of freedom. These values show strong evidence that male customers have a higher average bill amount $1,570, compared to female customers $1,445, which represents a difference of approximately $125.

We now calculate a 95% confidence interval to estimate the range of possible differences in the population mean bill amounts.

$$(1570.46 - 1445.30) \pm 1.960 \sqrt{\frac{4919941.37}{9529} + \frac{4178620.34}{14760}}$$

$$[69.74, 180.58]$$

Since the interval does not include 0, a zero difference is not a possibility, and we can conclude that there is a difference in male and female average bill amounts. Since the interval was set up as Male Bills minus Female Bills and is entirely positive, we can say that male bills are higher than female bills, on average. On average, male bills are higher than female bills by between $69.74 and $180.58.

Section 2 – t-test Comparing Average Payment Amounts Between April and September
See the Technical Appendix for t-test output

H$_0$: There is no difference in the average payment amounts between April and September.
H$_A$: There is a difference in the average payment amounts between April and September.

We reject the null hypothesis because the p-value of 0.00091 is less than our 0.05 significance level, and thus we can conclude that there is a statistically significant difference in average payment amounts between April and September. The test statistic is 3.319, with 24,288 degrees of freedom. These values show strong evidence that customers make higher payments in September $185, compared to April $170, which represents a difference of approximately $15.

We now calculate a 95% confidence interval to estimate the range of possible differences in the population mean payment amounts between April and September.

$$(-15.15) \pm 1.960 * \frac{711.62}{\sqrt{24289}}$$

$$[-24.10, -6.20]$$

Since the interval does not include 0, a zero difference is not a possibility, and we can conclude that there is a significant difference in average payment amounts between April and September. Since the interval was set up as April – September and is entirely negative, we can say that

September payments are higher than April payments, on average. On average, customers paid between $6.20 and $24.10 more in September than in April.

Section 3 – Recommendations from Testing Results

Based on the results of our analysis, we have the following recommendations.

First, since male customers were found to have statistically significantly higher average bill amounts, with a 95% confidence interval ranging from $69.74 to $180.58, we recommend that the marketing department prioritize and create ad campaigns targeting male customers with incentives.

Second, we suggest that the finance department focus on prioritizing September payments and upselling services during that time. Cards with annual fees could prove to be more successful when customers have more liquidity.

Given that payment amounts in September are higher in September than in April by an average of $15.15, with a 95% confidence interval of $6.20 to $24.10. We recommend that the Finance department prioritize September payment efforts and adjust liquidity appropriately.

Additionally, we recommend the introduction of new products or upselling existing products in September, such as credit cards or payment plans, when customers are statistically more likely to have more available funds.

Conclusion

In this analysis, we examined credit card data from over 25,000 Taiwanese customers to determine whether meaningful differences exist between different customer demographics. Our results showed that male customers have significantly higher average bill amounts than female customers, and that customers make higher payments on average in September than in April.

Based on this analysis, we recommend that the company prioritize male customers and focus on collecting payments in September. These insights could lead the company to be able to make more targeted advertising campaigns and smarter budgeting decisions.

For future analysis, it could be helpful to investigate the data deeper and discover why payments are increasing in September. It could be beneficial to investigate other demographics, such as different months, income levels, or locations.

Please feel free to contact me at jakemoore@arizona.edu if you have any questions or would like to discuss these recommendations in more detail.

Technical Appendix
Figure 1 – t-test Comparing Average Bill Amounts Between Males and Females

t-Test: Two-Sample Assuming Unequal Variances		
	Male Bills	**Female Bills**
Mean	1570.462231	1445.296056
Variance	4919941.366	4178620.342
Observations	9529	14760
Hypothesized Mean Difference	0	
df	19129	
t Stat	4.42690642	
P(T<=t) one-tail	4.80616E-06	
t Critical one-tail	1.644933288	
P(T<=t) two-tail	9.61232E-06	
t Critical two-tail	1.960088007	
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Figure 2 – t-test Comparing Average Payment Amounts Between April and September

t-Test: Paired Two Sample for Means		
	September Payment	*April Payment*
Mean	185.82	170.67
Variance	272014.60	345387.43
Observations	24289	24289
Pearson Correlation	0.18	
Hypothesized Mean Difference	0	
df	24288	
t Stat	3.319	
P(T<=t) one-tail	0.000453	
t Critical one-tail	1.645	
P(T<=t) two-tail	0.000906	
t Critical two-tail	1.960	
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