**TEACHING NOTE:**

**STRATEGIC CONSUMER CHOICE: A COLLEGE STUDENT’S DILEMMA**

**Critical Incident Overview**

This critical incident describes a perplexing dilemma challenging Peter, a newly arrived international student with financial problems. Without keeping an eye on his budget to manage it properly, Peter was running out of money shortly after arriving in the United States from China. Since his educational expenses were unavoidable, the best way for him to save money was to reduce money spent on groceries. As a new MBA student, Peter had insufficient time for activities in his life beyond studying on campus for more than 12 to 14 hours, day and night. Peter decided to solve his budget and time challenges by using the knowledge he acquired in a statistics class to shop more efficiently and effectively.

There were four popular grocery stores in his campus town: Woodman’s, Walmart, Target, and Piggly Wiggly. These stores were located within 1 to 11 miles from his residence. Each store had unique characteristics in terms of opening hours, products offered, and pricing policies. Peter collected price data for 55 grocery items at four grocery stores as a first step to perform price analysis. He wanted to apply the statistical techniques learned in class to his life experiences to save money. Although his shopping behavior is shaped by many factors, price comparison is an important criterion given his limited budget. This data-driven approach to problem solving was a more analytical way for him to reduce costs and save money.

**Research Methods**

The name of the individual and city described in this critical incident are disguised in order to protect the student’s identity. Price data given in this incident are publicly available.

**Learning Objectives**

After analyzing this critical incident, the student should be able to:

1. Perform data analysis techniques for price comparison
2. Conduct Analysis of Variances (ANOVA) analysis and interpret results
3. Demonstrate understanding of consumer behavior and strategic choices
4. Develop holistic approach for buying decision making

Note: The learning objectives may vary based on the course in which this Critical Incident is used. These are examples of some learning objectives with possible questions and answers listed below. For some of the questions multiple data approaches are suggested that range from simple analysis based on ranking to more complex analysis involving ANOVA. Textbooks are suggested at the end of this teaching note for more information on the ANOVA technique.

**Application**

This critical incident will be useful in undergraduate or graduate statistics, operations management, marketing research, strategic decision making, and buyer behavior courses. Students should be able to perform statistical analysis using software such as SPSS or Excel. In statistics courses, this case should be introduced after teaching ANOVA. In other courses, instructors should make sure students are familiar with this technique or other data comparison techniques. Note that in upper level courses such as marketing research or strategic decision making or buyer behavior, business students should already have completed at least one basic statistics course as a prerequisite. (In marketing or operations management classes, providing an introductory chapter on ANOVA analysis could serve as a quick refresher) In addition, students need to understand Peter and how his academic, budget, and cross-cultural situation help to shape his grocery shopping behavior. This can lead to more effective problem solving to resolve Peter’s dilemma, and develop a holistic shopping approach for him.

**Questions**

1. Based on the data provided, how would you compare the prices of products at different grocery stores? Is there a general guideline that can be formulated about where the prices are cheaper? (Learning objective a, b)
2. Should Peter shop for bulk produce at one location and branded products at another location? If so, will that help him to save money? (Learning objective a, b)
3. Based on price criteria, what advice would you give Peter to better manage his grocery shopping? (Learning objective c, d)
4. What other factors in addition to price could affect Peter’s grocery shopping decisions? How should he accommodate these factors in his shopping routine? (Learning objective c, d)

**Questions and Answers**

1. **Based on the data provided, how would you compare the prices of grocery products at different stores? Is there a general guideline that can be formulated about where prices are cheaper?**

There are multiple approaches to answer the above questions starting with a simple ranking of stores based on prices to more sophisticated statistical analysis using the ANOVA technique. Instructors should encourage students to come up with different ways to analyze the situation if ANOVA is not the primary emphasis of the course or if this critical incident is introduced in classes other than statistics. This may include a basic comparison of differences in the price of products across stores.

Below is a simple ranking analysis of data provided in the critical incident. Out of 55 total items, prices for 17 products were cheapest at Woodman’s; 25 products prices were cheapest at Walmart; 10 products prices were cheapest at Target; and prices for the remaining six products were cheapest at Piggly Wiggly. In Table 1 below, these statistics are listed across the 1st rank row. Similarly statistics for the 2nd, 3rd and 4th ranks are also provided in this table.

This type of preliminary analysis shows that Walmart is cheapest for most of the products. In fact, for 83% of the products Walmart has the lowest or second lowest prices making it the obvious choice from a low cost perspective. Woodman’s is not falling far behind in the competition and for 71% of products it is ranked lowest or second lowest in terms of prices. Statistics regarding mean price differences between these two stores provide insights about how significant the price differences are and their practical significance in the decision making process. It will be interesting to see additional answers that students develop in their analyses.

**Table 1. Retail Store Ranking Based on Grocery Prices**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Rank/Store | Woodman’s | Walmart | Target | Piggly Wiggly |
| 1st | 17 (31%) | 25 (45%) | 10 (18%) | 6 (11%) |
| 2nd | 22 (40%) | 21 (38%) | 16 (29%) | 5 (9%) |
| 3rd | 12 (22%) | 8 (15%) | 19 (35%) | 17 (31%) |
| 4th | 4 (7%) | 1 (2%) | 10 (18%) | 27 (49%) |
| Total Items | 55 | 55 | 55 | 55 |

A more sophisticated approach would be to analyze the data using the ANOVA technique. This method is used when you are comparing the difference in means of more than two populations. In this case we have four stores representing four populations, and we are analyzing the impact of types of store (independent variable) on product prices (dependent variable). There are many subtypes of ANOVA technique. Student may get tempted to use one-way ANOVA. However, performing one-way ANOVA will not capture price differences across stores since price differences between products are much larger than price differences across stores. For example, each lemon would cost between $0.48 and $0.59 across stores whereas the price difference between a lemon and a pound of asparagus would be around $3. Since we know that lemon and asparagus prices are going to be different, the product variable is introduced as block variable and a Randomized Block Design (RBD) ANOVA test is performed. Results of this test are summarized in Table 2. Results show that store is the significant predictor of prices (*p value < 0.0001*) and there are price differences across stores.

**Table 2: ANOVA-RBD Test Results (Independent variable Store)**

| Source | Type III Sum of Squares | df | Mean Square | F | *p value* |
| --- | --- | --- | --- | --- | --- |
| Corrected Model | 610.773a | 57 | 10.715 | 50.610 | .000 |
| Intercept | 1373.101 | 1 | 1373.101 | 6485.397 | .000 |
| Store | 7.764 | 3 | 2.588 | 12.224 | .000 |
| Product | 603.008 | 54 | 11.167 | 52.743 | .000 |
| Error | 34.299 | 162 | .212 |  |  |
| Total | 2018.172 | 220 |  |  |  |
| Corrected Total | 645.072 | 219 |  |  |  |

Significant ANOVA test indicates there are differences in the dependent variable based on the independent variable. In this case, we concluded that product prices vary across retail stores. The next logical question is which stores and how? To further analyze which store had different prices, the Bonferroni Post Hoc Multiple Comparison test is performed. Results are summarized in Table 3. Results show that there were no significant price differences among grocery products at Woodman’s, Walmart, and Target (*p value = 1.0*). However, prices at Piggly Wiggly were significantly higher than at all of the other stores (*p value < 0.001*).

**Table 3: Bonferroni Multiple Comparison Test Results for Store**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| (I) Store | (J) Store | Mean Difference (I-J) | Std. Error | *p value* | 95% Confidence Interval | |
| Lower Bound | Upper Bound |
| Woodman’s | Walmart | 0.0051 | 0.08774 | 1.000 | -0.2293 | 0.2395 |
| Target | -0.0485 | 0.08774 | 1.000 | -0.2829 | 0.1858 |
| Piggly Wiggly | -0.4456\* | 0.08774 | 0.000 | -0.68 | -0.2113 |
| Walmart | Target | -0.0536 | 0.08774 | 1.000 | -0.288 | 1807 |
| Piggly Wiggly | -0.4507\* | 0.08774 | 0.000 | -0.6851 | -0.2164 |
| Target | Piggly Wiggly | -0.3971\* | 0.08774 | 0.000 | -0.6315 | -0.1627 |
|  | | | | | | |

1. **Should Peter shop for bulk produce at one location, and branded products at other location? Will that help him to save money?**

The best statistical approach to test this question is through a two-way ANOVA analysis. This test is performed when there are two categorical independent variables impacting the dependent variable. In this case the Store is the first independent variable, and the second independent variable can be defined as Product type with two categories—bulk produce and branded products. Price is the dependent variable in this analysis. When a full factorial ANOVA model is run, it automatically generates a third independent variable which is the interaction between Store and Product type with eight categories (4\*2 = 8). Significant interaction is indicative of fact that the main independent variables do not affect the dependent variable in a unidirectional manner but the combination of two variables in each category does affect price differently. It means, for example, that bulk produce at Woodman’s is cheaper whereas branded products are cheaper at Walmart.

The result of two-way ANOVA is given in Table 4. The results show that interaction between Store and Product type is not significant (*p value = 0.831*). Hence, we cannot conclude bulk produce is cheaper at one location, and branded products at another location.

**Table 4: Two-way ANOVA Test Results (Independent variable Store and Product type)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | Type III Sum of Squares | df | Mean Square | F | *p value* |
| Corrected Model | 211.587a | 7 | 30.227 | 14.783 | .000 |
| Intercept | 1353.564 | 1 | 1353.564 | 661.974 | .000 |
| Store | 7.728 | 3 | 2.576 | 1.260 | .289 |
| Product type | 202.026 | 1 | 202.026 | 98.803 | .000 |
| Store \* Product type | 1.796 | 3 | .599 | .293 | .831 |
| Error | 433.485 | 212 | 2.045 |  |  |
| Total | 2018.172 | 220 |  |  |  |
| Corrected Total | 645.072 | 219 |  |  |  |

Another simpler approach to perform this analysis is by calculating mean prices of all bulk produce and branded products for each store. The mean prices are listed in Table 5. In less quantitative courses or in classes that do not focus on statistical techniques, students can merely calculate the mean prices and compare. In this critical incident, bulk produce was cheaper at Woodman’s and Walmart and there was an insignificant difference in their mean prices. Branded products are cheaper at Target, but Woodman’s and Walmart were not far behind. The difference of 14 cents in mean prices between Target and Walmart may neither be statistically different nor significantly different to alter buyer behavior. Thus, the possibility of saving money by shopping at two different places for branded and bulk produce was practically non-existent.

**Table 5: Mean prices by Product type and Store**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Product type/Store | Woodman’s | Walmart | Target | Piggly Wiggly |
| Bulk Produce | $1.34 | $1.35 | $1.61 | $1.79 |
| Branded Products | $3.37 | $3.35 | $3.21 | $3.82 |

1. **Based on price criteria, what advice would you give to Peter to manage his grocery shopping?**

Results of the analysis show that Piggly Wiggly had higher prices than the other three stores. Mean prices in the selected sample for branded products and bulk produce were highest at Piggly Wiggly. There was no difference among prices at the other three stores. Purely from a price perspective, Peter may choose to shop at Woodman’s, Walmart or Target to reduce his grocery bills. There was no evidence to support that savings could be gained by shopping at two different places for branded and bulk produce. Peter should not split his grocery list. Shopping once a week at one of the three stores is fine.

1. **What other factors in addition to price will affect Peter’s grocery shopping decisions? How should he accommodate these factors in his shopping routine?**

Peter should take into consideration the following factors before shopping for groceries. He spends almost 12 to 14 hours a day working on assignments and attending five graduate classes. This left very little time to manage his grocery shopping. ANOVA test results showed that Peter should not split his grocery list and make all weekly grocery shopping at Woodman’s, Walmart or Target. If he could not go grocery shopping during the daytime, then Woodman’s and Walmart were the only two choices to select from since they are open 24 hours a day. If there is only limited time available between classes or commitments, then distance (travelling time) to the store would be the crucial factor. Walmart clearly provided an advantage over Woodman’s and Target after taking price into consideration. Peter should also look out for coupons deals and special discounts as well and take that into consideration before doing his weekly shopping. Woodman’s was the grocery store with the largest selection of international food. If Peter has a strong desire for Chinese food or Asian food, he should pick Woodman’s without a doubt. Preference is an important cross-cultural consideration that can significantly impact buyer behavior. He could also alternate visiting Woodman’s to stock up on ethnic foods every other week.

Finally, if Peter ran out of an important item or two and could not wait until his next weekly shopping trip, then he could choose a store nearby, Piggly Wiggly, to save precious time. Driving far to save a few cents on one item would not justify the additional gas expense he would incur by traveling farther. Gas prices can become significant factor in this case.

Thus, the final decision about which grocery store Peter should select depends on his situation at that time. Factors such as time available, time of day, ethnic preferences, advertisements, discounts, and whether it was the weekly grocery shopping or just a single item purchase would affect his decision.

**References**

1. Anderson, David R., Sweeney, Dennis J., & Williams, Thomas A. (2012) Experimental Design and Analysis of Variance. *In Statistics for Business and Economics, 11th edition revised* (pp. 560-641). Mason, OH: South-Western Cengage Learning
2. Dielman, Terry E. (2005) An Introduction to Analysis of Variances (ANOVA). *In Applied Regression Analysis, fourth edition* (pp. 335-372). Mason, OH: South-Western Cengage Learning