

Part 1: Analysis with a Fixed Discount (X=50%)

Background

Shopmart is considering a new pricing strategy for Tetto cookies, which includes a quantity discount model. Under this model, customers receive a 50% discount on additional packs of cookies. The goal is to evaluate whether this new pricing scheme will lead to increased profits compared to the old scheme, where cookies were sold at a fixed price of ₩3,000 per pack without any discount.

Data Overview

- Original Price per Pack: ₩3,000
- Cost per Pack: ₩1,000
- Total Number of Unique Weekly Customers: 10,000

Distribution of Customers Based on the Number of Packs Purchased (Under the old scheme):

- 80% buy 1 pack
- 15% buy 2 packs
- 5% buy 3 packs

New Scheme Impact

Under the "Buy one get one X% off" scheme with X=50%, the sales team expects a shift in customer purchasing behavior:

- $(0.75 * X)\%$ of customers who normally buy only 1 pack would now buy 2 packs.
- $(0.3 * X)\%$ of customers who normally buy 2 packs would now buy 3 packs.
- Customers who normally buy 3 packs would still buy 3 packs.

Customer Redistribution Calculation

Using the above expectations, the distribution of customers under the new scheme is recalculated:

Customers Buying 1 Pack:

- Originally, 80% (8,000 customers) bought 1 pack.
- Under the new scheme, this is reduced by $(0.75 * 50\%) = 37.5\%$, leaving 62.5% (**5,000** customers) still buying 1 pack.

Customers Buying 2 Packs:

- 37.5% of the original 1-pack buyers (3,000 customers) switch to buying 2 packs.
- 15% (1,500 customers) continue to buy 2 packs but are reduced by $(0.3 * 50\%) = 15\%$, leaving 1,275 customers.
- Total customers buying 2 packs = $3,000 + 1,275 = \mathbf{4,275}$ customers.

Customers Buying 3 Packs:

- 15% of the original 2-pack buyers (225 customers) switch to buying 3 packs.
- 5% (500 customers) continue to buy 3 packs.
- Total customers buying 3 packs = $225 + 500 = \mathbf{725}$ customers.

Revenue and Profit Calculation

For each category of customers (buying 1, 2, or 3 packs), the revenue is calculated based on the number of packs sold and the discounted price. The profit is then determined by subtracting the cost (~~₩~~₩1,000 per pack) from the revenue for each category.

Profit from Customers Buying 1 Pack:

- Revenue: 5,000 customers × ~~₩~~₩3,000
- Cost: 5,000 customers × ~~₩~~₩1,000

Profit from Customers Buying 2 Packs:

- Revenue: 4,275 customers × (~~₩~~₩3,000 + ~~₩~~₩1,500)
- Cost: 4,275 customers × 2 × ~~₩~~₩1,000

Profit from Customers Buying 3 Packs:

- Revenue: 725 customers × (~~₩~~₩3,000 + 2 × ~~₩~~₩1,500)
- Cost: 725 customers × 3 × ~~₩~~₩1,000

The total profit under the new scheme is the sum of the profits from each category.

Comparison with Old Scheme

The total profit under the old scheme (no discount) is also calculated for comparison:

- Revenue: 10,000 customers × ~~₩~~₩3,000
- Cost: 10,000 customers × ~~₩~~₩1,000

Conclusion

The analysis concludes that the new pricing scheme with a 50% discount on additional packs results in a higher total profit (~~₩~~₩22,862,500) compared to the old scheme without any discount (~~₩~~₩20,000,000). This suggests that the quantity discount model could be a profitable strategy for Shopmart, encouraging customers to purchase more packs of Tetto cookies, thereby increasing the overall profit.

Part 2: Variable Discount Analysis

Objective

The goal here is to determine how varying the discount rate (X) in the "Buy one get one X% off" scheme influences customer buying behavior and, consequently, Shopmart's profit. The analysis aims to find the optimal discount rate that maximizes Shopmart's profit.

Background

- Under the new pricing scheme, the discount rate (X) on additional packs of cookies can be varied.
- The task is to analyze how changes in X affect the number of packs bought by customers and the overall profit.

Methodology

Customer Behavior Adjustment:

- Based on the sales team's expectations, the customer purchasing pattern is assumed to shift with the change in the discount rate.

- $(0.75 * X)\%$ of customers who normally buy 1 pack will now buy 2 packs.
- $(0.3 * X)\%$ of customers who normally buy 2 packs will now buy 3 packs.
- Customers who normally buy 3 packs will continue to buy 3 packs.

Customer Redistribution:

- The distribution of customers buying 1, 2, and 3 packs is recalculated based on the variable discount rate X .
- These calculations are more complex as they now involve X as a variable affecting the percentage of customers switching between pack quantities.

Revenue and Profit Calculation:

- The revenue and profit are recalculated for each customer category (1, 2, or 3 packs) based on the variable X .
- The total profit is a function of X , considering both the revenue from sales and the cost of goods sold.

Optimization:

- The optimal value of X (the discount rate) that maximizes Shopmart's total profit is determined.
- This involves finding the maximum of the profit function with respect to X , typically through calculus (finding where the derivative of the profit function equals zero).

Considerations

- The analysis assumes that the total number of customers remains constant (10,000).
- The cost per pack (~~W~~1,000) and the original price per pack (~~W~~3,000) remain unchanged.
- The real-world applicability of the results would depend on factors like customer price sensitivity, competition, and overall market conditions.

Calculations

Step 1: Define the Variables and Constants

- **X:** The variable discount rate in the "Buy one get one $X\%$ off" scheme.
- **Price per Pack:** ~~W~~3,000.
- **Cost per Pack:** ~~W~~1,000.
- **Total Customers:** 10,000.
- **Initial Customer Distribution:**
 - 80% (8,000 customers) buy 1 pack.
 - 15% (1,500 customers) buy 2 packs.
 - 5% (500 customers) buy 3 packs.

Step 2: Adjust Customer Behavior Based on Discount Rate (X)

- **Customers Buying 1 Pack:**
 - Initially, 8,000 customers buy 1 pack.
 - Under the new scheme, $(0.75 * X)\%$ of these customers switch to buying 2 packs.

- New number of customers buying 1 pack = $8,000 * (1 - 0.75 * X)$.
- Customers Buying 2 Packs:
 - Initially, 1,500 customers buy 2 packs.
 - $(0.75 * X)\%$ of the original 1-pack buyers switch to buying 2 packs.
 - $(0.3 * X)\%$ of the original 2-pack buyers switch to buying 3 packs.
- New number of customers buying 2 packs = $8,000 * (0.75 * X) + 1,500 * (1 - 0.3 * X)$.
- Customers Buying 3 Packs:
 - Initially, 500 customers buy 3 packs.
 - $(0.3 * X)\%$ of the original 2-pack buyers switch to buying 3 packs.
- New number of customers buying 3 packs = $1,500 * (0.3 * X) + 500$.

Step 3: Calculate Revenue and Profit for Each Customer Category

- Revenue and Profit from Customers Buying 1 Pack:
 - Revenue: Number of customers * Price per pack.
 - Cost: Number of customers * Cost per pack.
 - Profit: Revenue - Cost.
- Revenue and Profit from Customers Buying 2 Packs:
 - Revenue: Number of customers * (Price per pack + Price per pack * $(1 - X)$).
 - Cost: Number of customers * 2 * Cost per pack.
 - Profit: Revenue - Cost.
- Revenue and Profit from Customers Buying 3 Packs:
 - Revenue: Number of customers * (Price per pack + 2 * Price per pack * $(1 - X)$).
 - Cost: Number of customers * 3 * Cost per pack.
 - Profit: Revenue - Cost.

Step 4: Combine Profits to Formulate the Total Profit Function

- Total Profit: Sum of profits from customers buying 1, 2, and 3 packs.
- This total profit is a function of the variable X.

Step 5: Optimize the Total Profit Function

- Differentiate the total profit function with respect to X to find the rate of change of profit with respect to the discount rate.
- Set the derivative equal to zero and solve for X to find the discount rate that maximizes the profit.
- Ensure that the solution is within a realistic range ($0\% \leq X \leq 100\%$).

Results

The analysis found an optimal discount rate of approximately 13.95%. At this rate, Shopmart is expected to achieve the maximum profit from the sales of Tetto cookies under the new pricing scheme. This result suggests a strategic balance between offering an attractive discount to customers and maintaining a profitable sales margin.

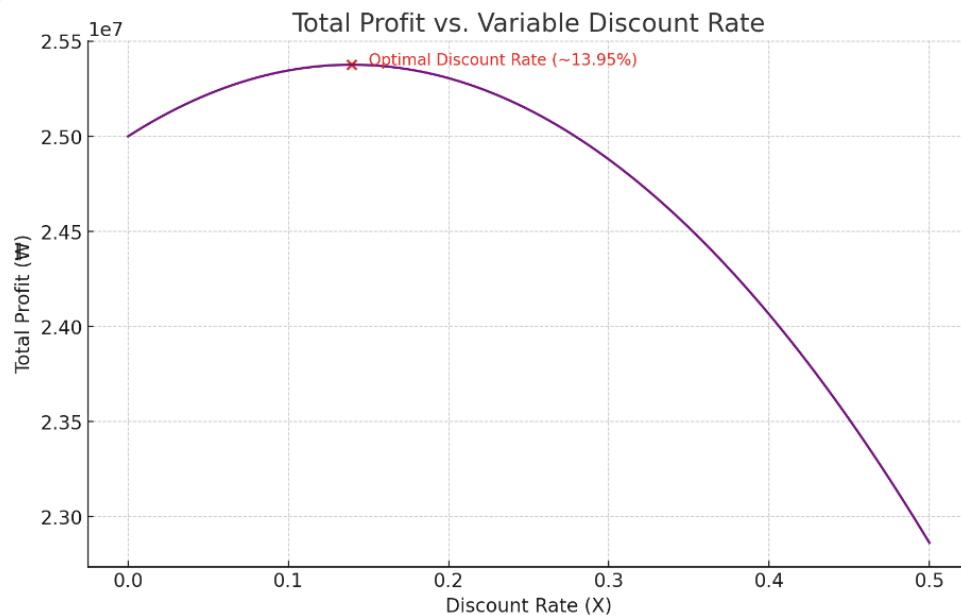


Figure 1 Cost function

Part 3: Price Discrimination Analysis

Objective

The objective of this part is to discuss whether the quantity discounts offered by Shopmart can be considered a form of price discrimination. If so, the task is to identify which type of price discrimination it represents.

Understanding Price Discrimination

Price discrimination occurs when a seller charges different prices to different customers for the same product or service, where these price differences are not justified by differences in cost. There are typically three degrees of price discrimination:

- **First-Degree (or Perfect) Price Discrimination:** The seller charges each customer the maximum price they are willing to pay. Essentially, each customer pays a different price.
- **Second-Degree Price Discrimination:** Prices vary according to the quantity purchased or the version of the product. Customers self-select into different pricing schemes based on their preferences or consumption habits.
- **Third-Degree Price Discrimination:** Different customer groups are charged different prices based on identifiable characteristics, such as age, location, or time of purchase.

Analysis of Shopmart's Pricing Strategy

In Shopmart's case, the "Buy one get one X% off" scheme for Tetto cookies is a form of **second-degree price discrimination**. Here's why:

- **Quantity-Based Pricing:** The discount applies based on the quantity of the product purchased. Customers who buy more packs of cookies receive a larger discount. This pricing strategy does not differentiate prices based on individual customer characteristics but rather on the amount of product they purchase.

- **Customer Self-Selection:** Customers decide how many packs to buy, effectively choosing their price point. Those who value the product more and are willing to buy more can avail of a lower price per unit. This self-selection is a hallmark of second-degree price discrimination.
- **No Individual Price Negotiation:** Unlike first-degree price discrimination, the prices under Shopmart's scheme are not individually negotiated. All customers have access to the same price tiers based on the quantity they choose to buy.

Conclusion

Shopmart's quantity discount scheme for Tetto cookies is an example of second-degree price discrimination. This approach allows Shopmart to segment its market based on purchase quantities, potentially increasing its sales volume and revenue without needing to collect specific data about individual customer characteristics. This strategy can be particularly effective in retail settings where customers' valuation of the product might vary significantly. By offering quantity discounts, Shopmart can appeal to both low and high-usage customers, maximizing its market reach and profitability.

Part 4: Comparison of Pricing Strategies

Objective

The objective of Part 4 is to compare two different pricing strategies: **regular price promotions** and **quantity discounts**. The task involves discussing the advantages and disadvantages of each strategy and suggesting which types of products might be better suited for each.

Regular Price Promotions

Regular price promotions involve temporarily reducing the price of a product to stimulate demand.

Advantages

Immediate Sales Boost: Temporary price reductions can quickly attract customers and increase sales volume.

Inventory Management: Helps in clearing out old or excess stock.

Market Penetration and Awareness: Can be used to introduce new products or attract new customers.

Disadvantages

Potential Brand Devaluation: Frequent price promotions might lead customers to perceive the brand as lower quality or always expect discounts.

Customer Timing: Customers may delay purchases until the next promotion, reducing regular sales.

Profit Margins: Short-term profit gains might be offset by reduced margins.

Quantity Discounts

Quantity discounts involve reducing the unit price of a product when purchased in larger quantities.

Advantages

Higher Volume Sales: Encourages customers to buy more, increasing the overall sales volume.

Stock Movement: Helps in moving larger quantities of products per transaction, which is beneficial for inventory management.

Customer Loyalty: Can enhance customer loyalty by offering better value on bulk purchases.

Disadvantages

Profit Margins: May lead to reduced profit margins per unit.

Not Suitable for All Products: Might not be effective for products with low consumption rates or perishability issues.

Product Suitability

Regular Price Promotions: Best suited for products with a short shelf life, seasonal demand, or for new product introductions. Examples include fashion items, seasonal goods, or new technology products.

Quantity Discounts: More effective for products with long shelf lives and consistent demand. Ideal for non-perishable groceries, household supplies, and items that are regularly consumed in large quantities.

Conclusion

Both pricing strategies have their merits and can be effective in different scenarios. The choice between regular price promotions and quantity discounts should be based on the nature of the product, the target market, and the overall business objectives. For Shopmart and its Tetto cookies, quantity discounts might be more suitable given the regular and consistent demand for such consumable goods. This strategy can encourage higher volume purchases and enhance customer loyalty, which is beneficial for a product with a stable and continuous market demand.