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Qualitative and Quantitative Analysis of the Puerile Strategy on Big Data

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Abstract: *With the advent of the era of big data, the economic market has been in a dynamic change. In order to adapt to this change, many companies have implemented a widely used strategy of expanding sales at low prices and low interests - "puerile". Thus, we analyze the "puerile" strategy from three aspects: turnover, profit margin, and discount strength of the mall. Through mathematical modeling, charts are created by collecting the sales data of a shopping mall in 2017 and 2018. By separating and filtering the collected data, the data with missing cost prices is separated and filtered out. The abnormal data is excluded, and the required data is finally obtained. By finding minimum and maximum profit margins, the average daily profit margin and turnover of the mall based on small profits and high sales are calculated. By setting the four indicators to measure the discount strength of the anti-discount sum, sales volume ratio, turnover ratio, and cost ratio, a linear weighting mathematics model of the discount force is established. Finally, the daily discount strength is classified, and the size of the discount force is analyzed.*

Keywords: *the puerile strategy, the big data, discount strength, linear weighting function*

1. Introduction

The puerile is a strategy to expand sales by reducing the profit per unit of goods to increase the number of sales so that merchants can obtain more profits [1]. For goods with elastic demand, when the price of that commodity falls, and the increase in demand (and thus sales) is greater than the price decrease, it leads to an increase in total earnings. In actual operation and management, the principle of puerile is widely used. Small profits and quick sales can make the product fast and easy to access to the buyer's market while promoting business life. Full production capacity increases production and accelerates capital increase. The speed of gold turnover and the revitalization of production funds are effective [2]. A promotional tool increases corporate profitability. However, thin sales are not simply a price war, so it has a certainty. The three aspects of the mall's turnover, profit margin, and discount strength can be qualitatively and quantitatively analyzed on the puerile strategy.

2. Basic Assumptions and Symbolic Descriptions of Model

We assume that the cost of an item does not change over time and the discounted products are the products in Annex 3 that have different selling prices and store prices.

M_i: Turnover on the i th day;

C_i: Cost on the i th day;

L_i: Profit on the i th day;

M_{ij}: The turnover of the j th t item on the i th day;

Q_{ij}: The Merchandise sales of the j th t item on the i th day;

P_{ij}: Store price of the j th t item on the i th day;

P'_{ij}: Cost price of the j th t item on the i th day;

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S_i: Discount strength on the i th day;

π_i: Average daily profit on the i th day;

3. Selection and Solution of Model

3.1. Collection and collation of sales data of a shopping mall

The data in this article can be downloaded from the National College Students Mathematical Modeling website [3]. The sales data are collected at a shopping mall and are separated and screened according to the number of orders and the number of goods sold based on the data of Annex 1 and Annex 2. The error data is eliminated, and then the product names in Annex 1 are matched and screened with the cost price in Annex 3, and the missing data of the cost price are separated.

Through the initialization of the data given by the question, the attachment given by the title is a collection of a large amount of data. For the improvement of the quality of the mining data, these erroneous data have little impact on the overall data statistics, so the wrong data is excluded. The collation filter data are found in several products in Annexes 1 and 2 with negative sales. We regard these negative sales quantities as incorrect data. Thus, there is no data on December 24, 2018, which is excluded.

We find that the barcodes of several data are duplicated, although the barcodes are unique. However, the same batch of products produced by the same manufacturer in the same period uses the same barcode, and it does not rule out that small workshops use the same barcode illegally. Because the number is not large enough, products with the same barcodes are not excluded.

Matching Annex 3 with the commodity IDs in Annexes 1 and 2 yields the cost of commodities. The obtained results include non-discounted commodities with missing cost prices. Thus, the non-discounted commodities with missing cost prices are filtered out, and the relationship between the profit margin of the commodities of between 20 and 40% is used to find the cost range of missing cost commodities.

3.2. Mathematics model of turnover and average profit margin per day

The data was organized and analyzed by using Excel's functions. The daily turnover was analyzed in the form of charts, and the net profit and profit margin of each month in 2017 and 2018 were compared and analyzed [4,5].

3.2.1. Turnover

Based on the processed data combined with the turnover of the i th day,

$$M_i = \sum Q_{ij} * P_{ij} \tag{1}$$

Due to the large number of days given in the annex and the use of MATLAB to fit the linear curve, its turnover is monotonically increasing. We obtain the daily turnover into two figures. Figure 1 shows the daily turnover from November 30 2016 to December 31, 2017, while Fig. 2 shows the daily turnover from January 1 2018 to January 2, 2019.

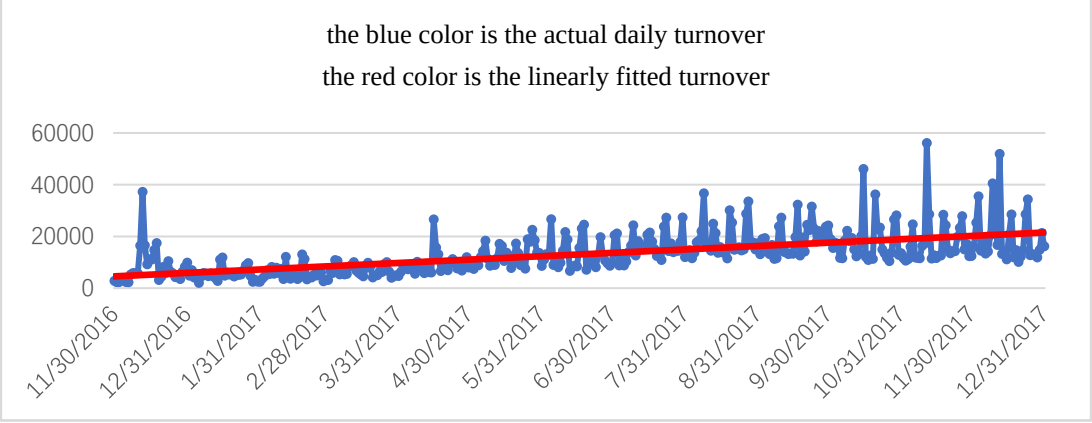

Figure 1: Daily turnover from November 30, 2016, to December 31, 2017.

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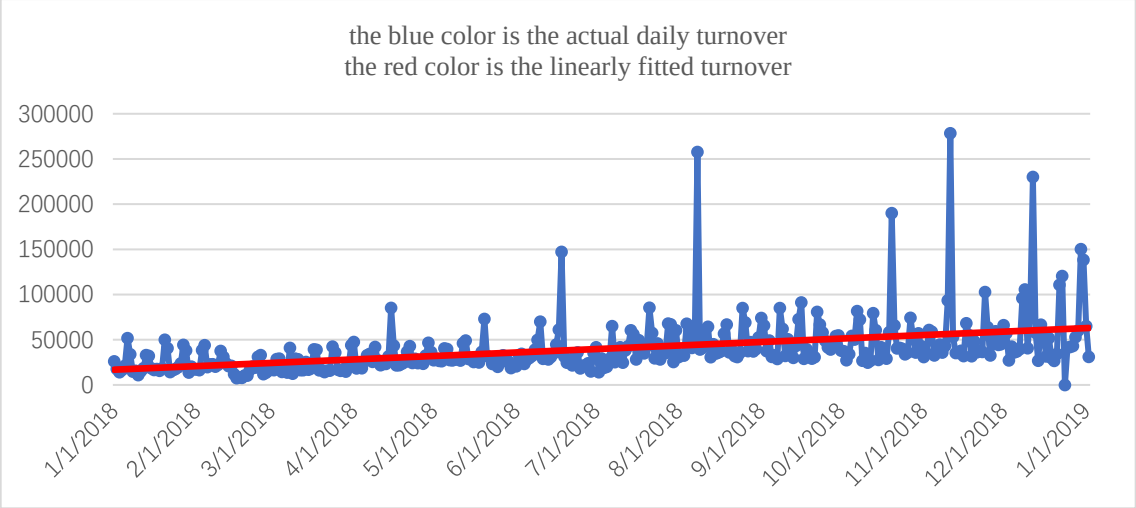

Figure 2: Daily turnover from January 1, 2018, to January 2, 2019.

Figures 1 and 2 present that the overall turnover is on the rise. The turnover of several days is significantly higher than that on other days. After comparison with the discount time in Annex 3 (e.g. June 18, August 8, November 11, and December 12), it is found that these days are the school season or other special festivals, and this shopping mall carries out discount promotion activities, thus promoting consumer consumption and increasing the turnover.

The overall turnover in 2018 is higher than that in 2017, which may be due to that the shopping mall adopted the sales mode of the Puerile, which makes customers keep coming back and gradually improve their reputation. With the rapid development of "we media", the exposure rate of shopping mall discounts gradually increases, which leads to an increase in customer flow and drives marketing. In the era of information technology, the continuous development of e-commerce industry has impacted traditional enterprises. In order to survive, traditional enterprises have to compete with double Eleven, Double Twelve, and other famous e-commerce festivals. Traditional enterprises are gradually benefiting from a win-win situation with e-commerce.

3.2.2. Cost

The total cost of the i th day is calculated as [6],

$$C_i = \sum Q_{ij} P'_{ij} \tag{2}$$

Goods are divided into two categories: non-discount goods and goods with known costs. Under normal circumstances, retailers' profit margin is between 20–40%. Thus, we calculate the cost of such goods as

$$P'_{ij} = (1-r)P''_{ij} \tag{3}$$

where P''_{ij} is the store price of the product $r \in [20\%, 40\%]$. We take $r = 20\%$ to figure out the maximum and minimum costs for the total cost of day i. The total cost of each day is the average of the maximum cost and minimum cost as Eq. (4).

$$C_i = \frac{C_{i\max} + C_{i\min}}{2} \tag{4}$$

3.2.3. Profits and profit margins

According to the turnover M_i and the cost C_i of the i th day is

$$L_i = M_i - C_i \tag{5}$$

Figures 3 and 4 show the daily profit.

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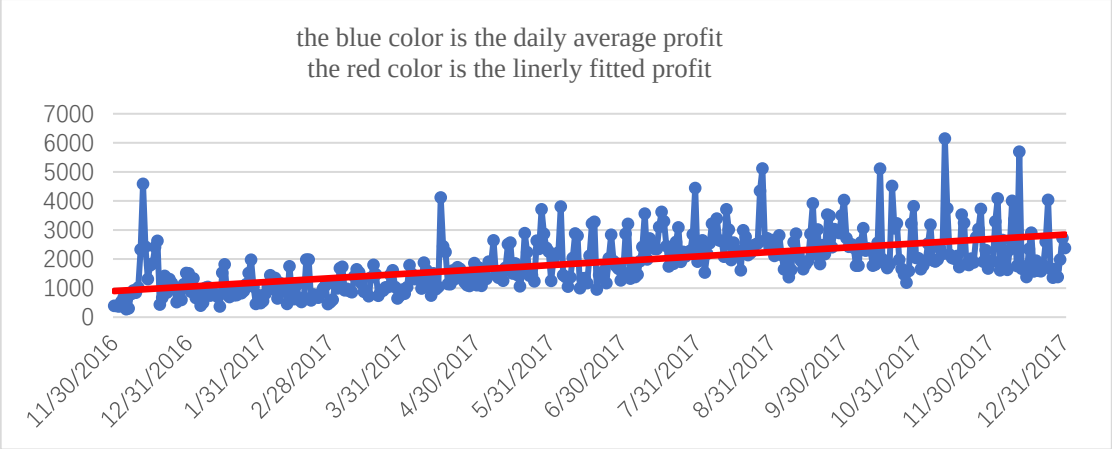

Figure 3: Daily profit.

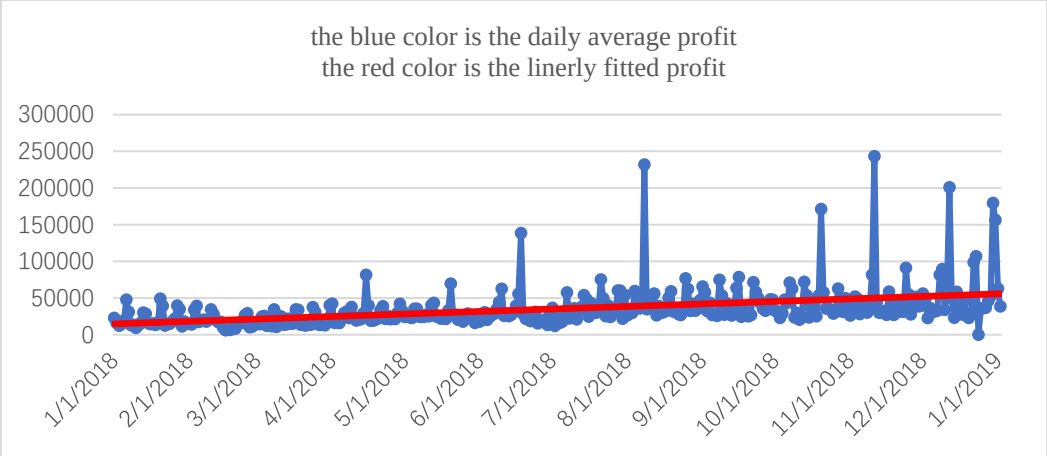

Figure 4: Daily profit.

The average daily profit shows an overall upward trend. When the turnover is high, the average daily profit is also high. The average daily profit in 2018 was higher than the average daily profit in 2017. The average profit was negative around January 1, 2019, and the corresponding profit margin was also negative, probably because there was not enough data to calculate a proper number, so it was considered as an error number.

Using the profit margin of the i th day,

$$\pi_i = \frac{L_i}{M_i} = \frac{M_i - C_i}{M_i} \tag{6}$$

We compare the profit with the profit margin data on monthly basis over two years from Figs. 5 and 6.

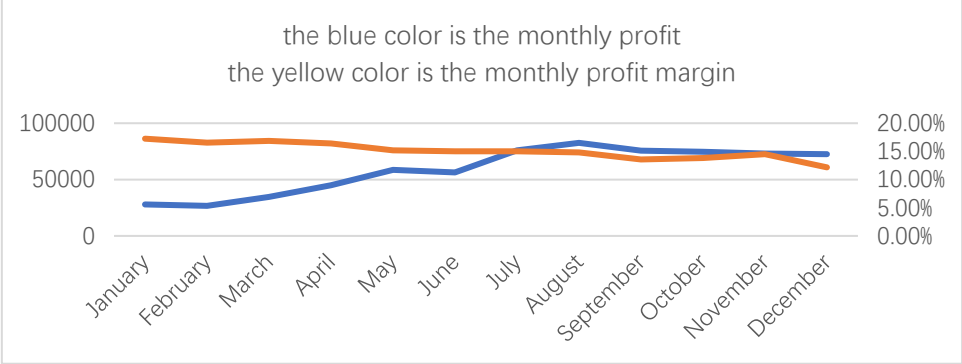

Figure 5: Monthly profit and profit margin in 2017.

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The profit margin declined slightly in 2017 but stabilized at 12–16%, with a sharp increase at first and then stabilized trend. The profit margin was the lowest in December 2017, but the profit was still high. There were more promotional goods in December, which increased the turnover. Thus, the profit was still high, which well reflected the shopping mall's sales strategy of "small profits but quick turnover".

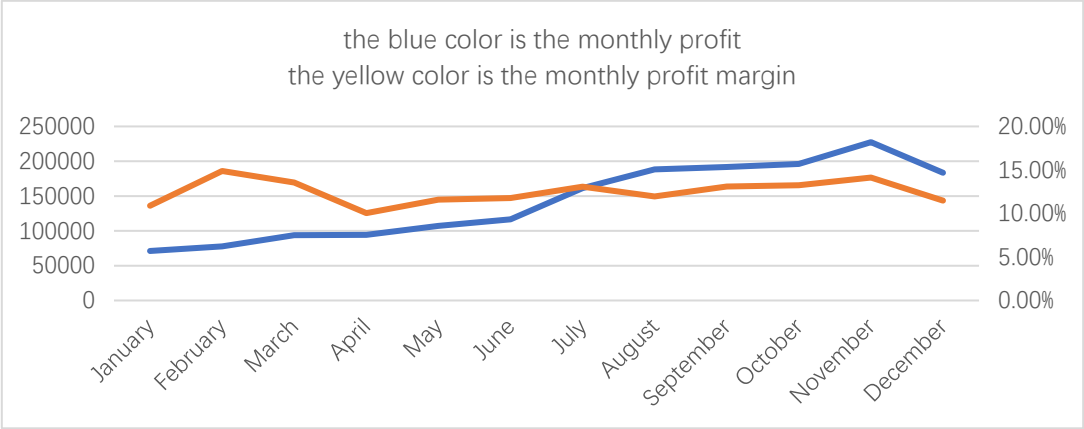

Figure 6: Monthly profit and profit margin in 2018.

The profit margin fluctuated greatly in the first quarter of 2018, but the profit showed an increasing trend. In the following three quarters, the profit margin remained stable at about 12%, while the profit showed an overall upward trend.

3.3. Mathematical modeling of discounted strength

Discounts are a common way to promote sales in department stores or street vendors. We need to have the index to measure the intensity of discount and build a model to calculate the intensity of discount by using economic weights. Then the calculated data is sorted out as a measure of the intensity of discount.

We calculated daily turnover, daily discount, daily sales volume, and daily cost and established the following four indexes to measure the intensity of daily discount.

3.3.1. The sum of counter discounts per item on the i th day

$$\alpha_i = \frac{\sum \alpha_{ij}}{n} \text{ (} n \text{ represents the type and discount)} \tag{7}$$

Regard the goods ($P_{ij} \neq P'_{ij}$) whose store price is not equal to the store price are the discounted goods. Since the discount ratio is negatively correlated with the sales of the goods, the inverse discount of each item is: $\alpha_{ij} = 1 - P_{ij} / P'_{ij}$;

3.3.2. Sales ratio of discounted goods β_i on the ith day

$$\beta_i = \frac{\sum_j Q'_{ij}}{\sum_j Q_{ij}} \tag{8}$$

where Q'_{ij} represents the quantity of discounted goods.

3.3.3. The turnover ratio of discounted items γ_i on the ith day

$$\gamma_i = \frac{\sum_j Q'_{ij} P_{ij}}{\sum_j Q_{ij} P_{ij}} \tag{9}$$

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3.3.4. The cost ratio of the discounted item θ_i on the ith day

$$\theta_i = \frac{\sum_j Q'_{ij} P'_{ij}}{\sum_j Q_{ij} P'_{ij}} \tag{10}$$

These indicators are used to establish the following mathematical model to calculate the discount intensity on the i th day.

$$S_i = \omega_1 \alpha_i + \omega_2 \beta_i + \omega_3 \gamma_i + \omega_4 \theta_i \tag{11}$$

In this model, S_i represents the discount intensity on day i, where ω_k (k =1,2,3,4) is the weight of these four indicators.

According to the economic curve, we know that the four factors have a great influence on the weight assigned, so the four weights assigned are equal [7], $\omega_k = 0.25$. According to this model, the value of daily discount intensity is calculated, and then the data obtained by classification is sorted into three categories of discount intensity: large, medium, and small. Because the data date is too large, we classify the discount intensity of each day of each year by year.

According to the sorted data, the discount intensity of each day was sorted out into line charts for analysis.

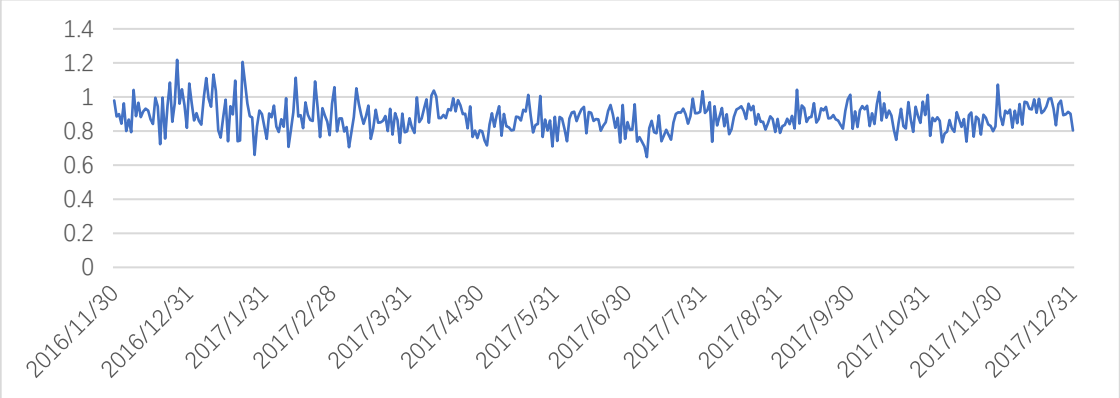

Figure 7: Daily discount from November 30, 2016, to December 31, 2017.

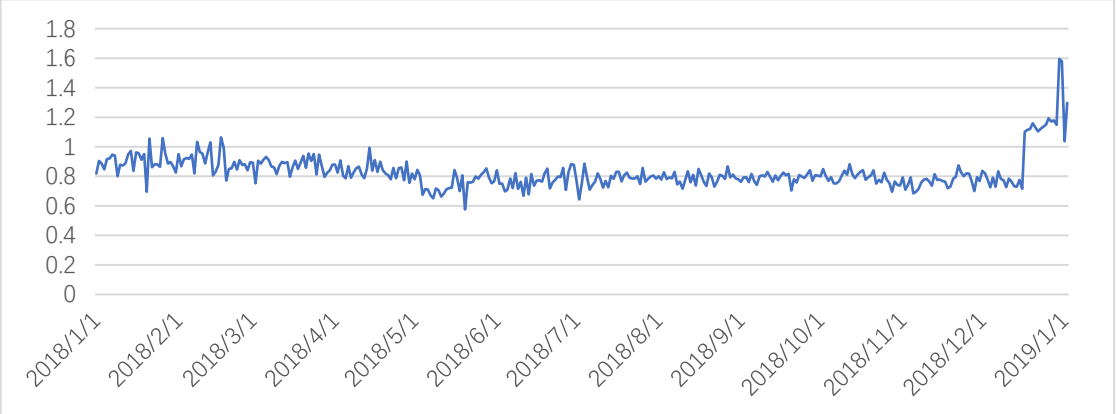

Figure 8: Daily discount from January 1, 2018, to January 2, 2109.

Figures 7 and 8 show that the daily discount intensity of the shopping mall fluctuated at 0.9 in 2017 and 2018, but the discount intensity increased significantly on the days around January 1, 2019, above 1.2. The highest point reached 1.6. The possible reason is that the mall has carried out clearance of goods and increased discounts

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4. Conclusion

From the overall sales situation of shopping malls, it is found that "thin profits" can bring "overselling". Moreover, the discount strength of the overall shopping mall and the trend of profit margins are consistent. However, it is necessary to accurately control the discount according to the business environment. On the 14th of mid-April 2018, the discount was higher than the evaluation discount, and the sales of the mall alone were only 31,643 yuan, which was low for the whole year. The profit margin and profit of the month were basically at the lowest level of the whole year. Therefore, it is not advisable to promote the sales status of shopping malls only by increasing the discount, and it is necessary to rely on the market trend of the entire market. In the peak season of consumption in the large market, the discount can be increased for the promotion of the mall. In the off-season of consumption, the discount is not beneficial to the sales of the mall.

The operation of shopping malls needs a big picture view to know how to take advantage of the situation and cater to the public's consumer psychology. Simply relying on discounts to achieve the strategy of "small profits and large sales" does not apply to promoting the sales of shopping malls [8–11].

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