

Research on vegetable pricing and replenishment based on value loss pricing and ARIMA model

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Abstract. Due to their short shelf life and difficulty in preservation, the sales strategy of vegetable products is closely related to the profits of merchants. This article studies the pricing and replenishment strategies of vegetable products in supermarkets. By analyzing the monthly changes and annual proportions of sales for each category, it was found that the sales of anthophyllum were the highest, while those of cauliflower were the lowest. The richness of products is positively correlated with total sales volume, and some categories have overlapping sales peaks. Introducing the Shannon Diversity Index to analyze the distribution pattern of sales volume. Establish an ARIMA time series model to predict sales for the next week and develop a daily replenishment strategy. Build a pricing model based on value loss and optimize the strategy using tail pricing method. At the same time, in order to maximize the benefits of supermarkets, a dual shelf model is established to implement promotional pricing for products with reduced freshness.

Keywords: Vegetable Pricing, Pearson Correlation Coefficient, ARIMA, Dual Shelf Model.

1. Introduction

Fresh agricultural products such as vegetables, fruits, and meat play an indispensable role in daily life and the development of the food industry [1]. However, due to the short shelf life and difficulty in preserving vegetables, businesses need to consider multiple factors when selling vegetables in order to meet market demand and achieve their own profits [2]. For example, during the transportation of goods, there will be varying degrees of loss, and over time, the freshness of the goods gradually decreases, thereby reducing their attractiveness to consumers. Therefore, developing scientifically sound replenishment and pricing strategies is of great significance for businesses and consumers [3].

In her doctoral thesis, Mao li sha [4] analyzed the pricing strategy and production and sales model of vegetable wholesale markets from the perspective of supply chain, explored multiple factors that affect price fluctuations, and used ARIMA model for intelligent prediction. Zheng Haohao et al. [5] constructed a stakeholder joint pricing model, revealing pricing issues and proposing improvement suggestions. Both provide strategic guidance for optimizing the vegetable market together. In summary, research on pricing strategies for vegetables involves multiple aspects, including supply chain management, price forecasting, and innovation in production and sales models. This article uses Shannon diversity index and statistical methods to explore strong correlations between categories, and establishes ARIMA model to predict sales and develop daily replenishment strategies. Based on value loss pricing, combined with tail pricing method optimization. Establish a dual shelf model to implement promotional pricing for products with decreased freshness.

2. Descriptive statistical analysis of data

2.1. Data Display

Data source: <http://www.mcm.edu.cn>. Table1(partially displayed due to space constraints) shows the finished product category data of vegetable single product classification, including sales date, single product code, sales volume, sales unit price, and category information.

Table 1. Single Product Classification Finished Product Category Data Preprocessing

Sales date	Code	Sales volume (kg)	Sales unit price (¥/kg)	Category
2020-07-01	102900005117056	0.396	7.60	Chilli
2020-07-01	102900005115960	0.849	3.20	Foliage
...	...	...	...	...
2023-06-30	102900005115250	0.125	24.00	Mushrooms

By calculating statistical indicators such as total sales frequency, total sales volume, average sales volume, and variance for each category, we can understand the overall distribution characteristics of sales volume. The statistical results are shown in Figure1(Only partially shown due to space). It is found that flower and leaf vegetables have the highest purchase frequency and sales volume, while eggplants have the least. It is speculated that flower and leaf vegetables have many varieties, high freshness, and reasonable prices. The average sales volume of flowers and leaves is the highest, while cauliflower is the lowest, but the total sales volume is greater than that of eggplants, which may be due to the large difference in sales of single products in cauliflower. Customers have a high preference for broccoli, while purple cabbage is less attractive. The sales volume variance of each category is small, and the degree of dispersion is low.

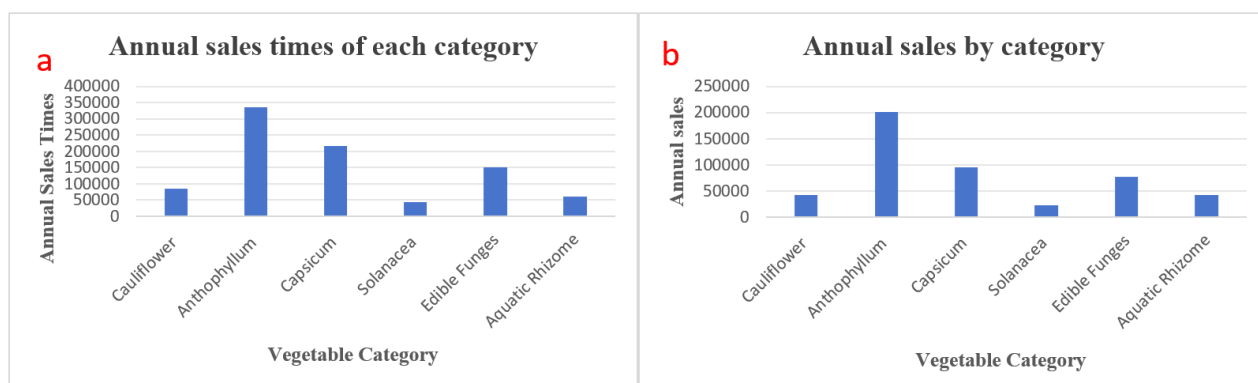


Figure 1. Statistical analysis results of various vegetable categories

2.2. Time distribution pattern of vegetable category sales

The line chart of the monthly sales volume of each vegetable category changing with the month is shown in Figure 2(Only partially shown due to space):

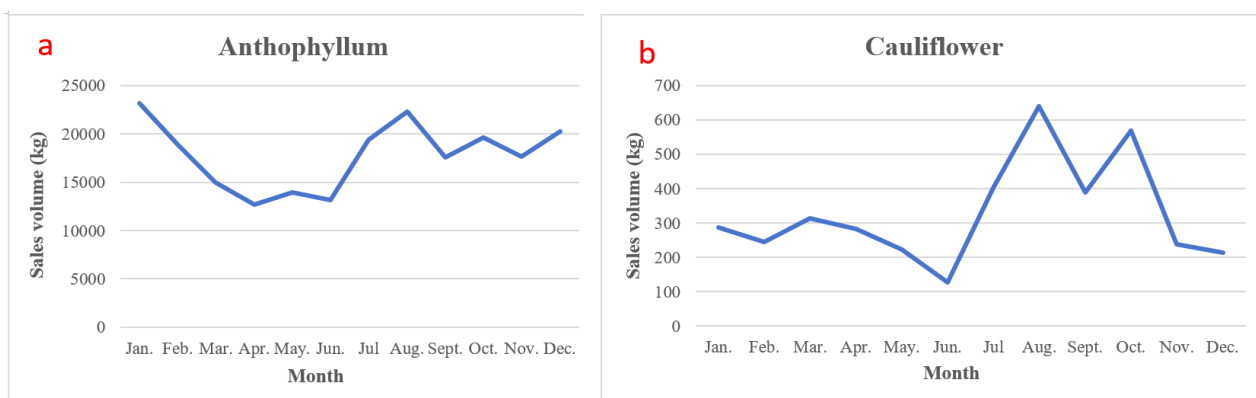


Figure 2. Line chart of monthly changes in leafy and cauliflower vegetables

According to Figure 2, it is found that the sales distribution pattern of each category is obvious in different months. Aquatic rhizomes have the highest sales in summer, while edible mushrooms have their peak sales in January, August, and October, which may be related to their lifestyle habits. Solanaceae have higher sales in August, September, October, and January, but lower sales in May and June. Chili peppers have high sales in January, February, and August. The annual sales of flowers and leaves are high, especially exceeding 20000kg in January, August, and October. Cauliflower has

high sales in August and October, with the lowest sales in June. In summary, the sales of edible mushrooms, eggplants, flowers and leaves, and cauliflower were the highest for the year in August and October.

From Figure 3, it can be seen that flower and leaf products have the highest annual sales, accounting for nearly half of the total sales (46%), while cauliflower products have the lowest annual sales, only 1%.

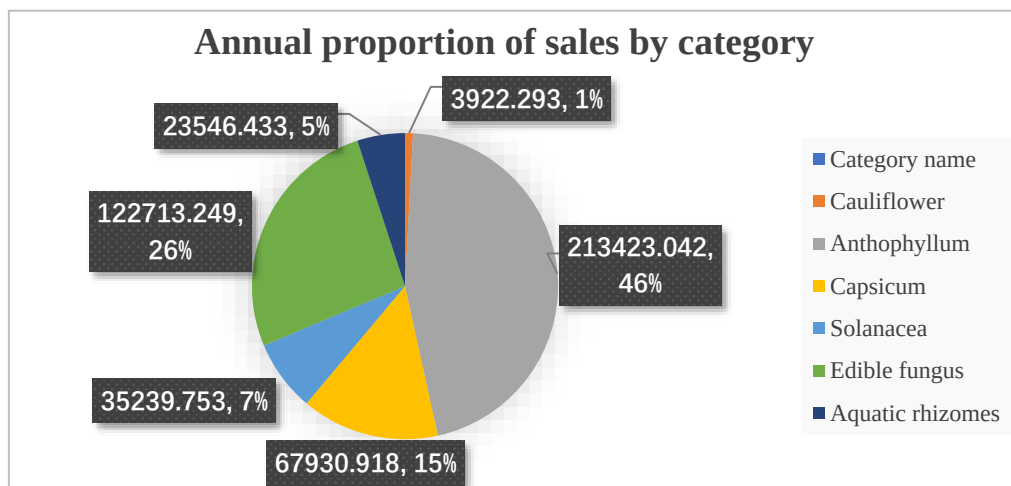


Figure 3. Annual sales ratio of various vegetable categories

In order to explore the relationship between the richness of fresh supermarket products and sales volume, the Shannon Diversity Index is introduced. This index quantifies diversity and tracks changes in vegetable richness[6-7]. A higher index value indicates a variety of vegetables in the market that are evenly distributed, while a lower index value may indicate a limited variety of vegetables or a dominant variety. Comparing the Shannon Diversity Index with monthly sales volume, as shown in Figure 4, it is found that there is a roughly positive correlation between the two, indicating that a variety of vegetables are beneficial for sales. According to the comprehensive research results, the annual sales of flowers and leaves are the highest, while cauliflower is the lowest, and the richness of vegetables is positively correlated with the total sales volume. In addition, the high sales time of edible mushrooms, eggplants, flowers and leaves, and cauliflower coincides, providing data support for subsequent pricing and replenishment strategies.

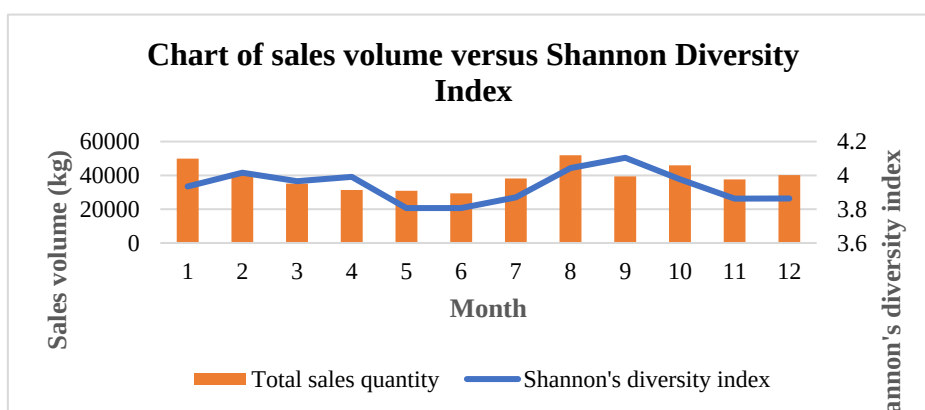


Figure 4. Comparison between monthly total sales and Shannon diversity index

3. Establishment of Pricing Model for Vegetable Products

3.1. Analysis of the Relationship between Vegetable Category Sales and Cost Plus Pricing

To explore the relationship between the total sales volume and cost markup pricing of various vegetable categories. Firstly, it is necessary to calculate the cost markup pricing for each vegetable category. The specific calculation steps are as follows:

(1) Calculate the unit product cost for each vegetable category:

$$\text{Unit product cost} = (\text{total cost of each category} + \text{loss cost of each category}) / \text{unit product quantity} \quad (1)$$

$$\text{Cost of loss for each category} = \text{average loss rate for each category} * \text{total cost for each category} \quad (2)$$

In the calculation of the total cost of each category, labor costs, transportation costs, etc. are ignored, and the total cost of each category is used as the wholesale price of the category.

(2) Looking for a target profit margin that maximizes supermarket revenue:

1) Define relevant variables: Assuming sales price is P , sales volume is Q , target profit margin is TP , unit product variable cost is (i.e. loss cost) VC , fixed cost is FC (i.e. wholesale cost), and target profit margin is TPM .

2) Establishing mathematical models:

$$TP = (P - VC) * Q - FC \quad (3)$$

3) Solve the target profit margin:

The target profit margin is the ratio between the target profit and sales revenue. It represents the proportion of profit per unit of sales revenue. The mathematical expression is:

$$\text{Target profit margin} = \text{Target profit} / \text{Sales revenue, i.e.: } TPM = TP / P * Q \quad (4)$$

In order to find the target profit margin that maximizes benefits, it is necessary to take the derivative of the above function, and then set the derivative to zero to obtain the maximum target profit margin for each category of vegetables.

(3) Calculate the unit product price for each vegetable category:

Calculate the unit product price for each vegetable category using the maximum target profit margin using the following formula:

$$\text{Unit product price} = \text{Unit product cost} * (1 + \text{target profit margin}) \quad (5)$$

In summary, the cost markup pricing for each vegetable category can be obtained. Using profit margin to represent cost plus pricing, in the calculation of profit margin, it is believed that the product will not be sold at a loss when initially priced, so the part with a profit margin less than 0 has been removed. Draw a combination chart of profit margins and sales volume for each category of vegetables, visualize the data, and the results are shown in Figure 5(Only partially shown due to space):

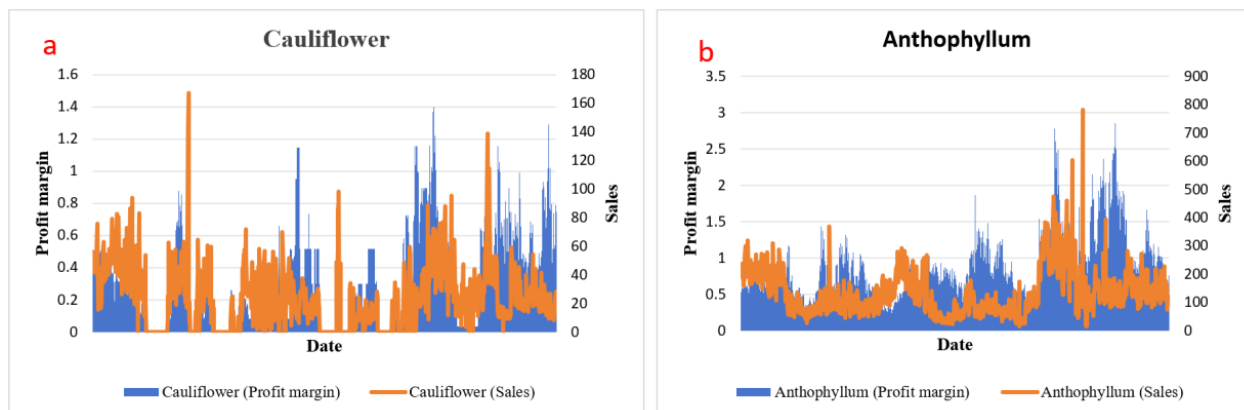


Figure 5. Comparison of profit margins and sales volume of various categories of vegetables

By observing Figure 5, it can be observed that in most categories, profit margins will increase sharply with increasing sales volume, but there will be a certain delay. Therefore, it can be concluded that cost plus pricing is roughly positively correlated with sales volume.

3.2. Daily replenishment total quantity strategy

The ARIMA model is adaptable, capable of handling non-stationary time series and making accurate predictions; the parameters and orders are flexible and adjustable, adapting to a variety of data characteristics; it is widely used in time series analysis[8-9]. However, it has high data requirements and is difficult to deal with nonlinear trends and multivariate factors[10]. This article chooses to establish a Time Series Model (ARIMA) to predict the future demand of supermarkets for various categories of vegetables by analyzing the historical sales data and market trends provided in the attachment, and then obtain the total daily replenishment of each vegetable category. The final predicted daily replenishment total for each category from July 1st to July 7th is shown in Table 2:

Table 2. Forecast Sales of Each Category from July 1st to July 7th (in kilograms) (i.e. Daily Replenishment Total Table)

	Anthophyllum	Solanaceae	Florescent vegetables	Aquatic rhizomes	Chili peppers	Edible fungi
July 1st	134.3724	23.4213	21.7425	18.4587	76.4801	41.2317
July 2nd	137.6811	23.0781	18.7966	18.3893	74.513	40.3481
July 3rd	138.6019	17.9462	18.0673	18.4599	72.9019	41.3788
July 4th	138.3753	16.8417	17.9887	18.5135	65.0426	45.0659
July 5th	138.1055	14.9065	18.0038	18.5493	71.2611	45.8332
July 6th	138.0897	17.5717	18.006	18.5796	78.815	44.5517
July 7th	138.2218	19.4545	17.9952	18.6091	78.7528	43.3552

In order to maximize the profits of supermarkets, that is, the daily replenishment volume is equal to the daily sales volume. Therefore, this article uses the predicted daily sales volume of each category as a decision on the total replenishment volume for that day.

3.3. Pricing Strategy

3.3.1. Fresh vegetable pricing model based on value loss

To achieve maximum profit for merchants, a dynamic pricing model was chosen. Based on this, two modeling perspectives based on vegetable freshness and value loss were compared and considered. Finally, a fresh vegetable pricing model based on value loss was chosen. The product sales process using this pricing model is shown in Figure 6:

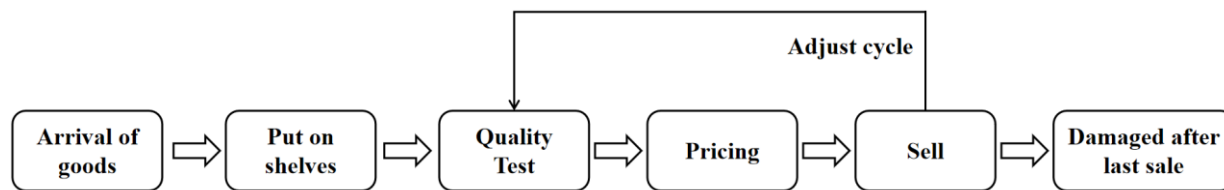


Figure 6. Product sales process diagram of fresh vegetable pricing model based on value loss

The specific modeling process is as follows: This section mainly establishes a pricing model for the value loss of fresh vegetables based on the relationship between the sales price of fresh vegetables in supermarkets and the value loss rate. The assumptions used in this article are commonly used in inventory research. According to classical inventory theory, it is assumed that demand is a linear function of retail prices:

$$D(x) = a - bx, p < x < \frac{a}{b}, a > b > 0 \quad (6)$$

Where x is the selling price, a is the demand scale of the retailer, and b is the price sensitivity coefficient of the product, then:

$$b = \frac{a - D(x)}{x} \quad (7)$$

Generally, when an item deteriorates at a constant rate per unit time θ When deterioration occurs, its inventory system can be described as a decrease in inventory $K(t)$ at time t during cycle T due to deterioration and sale. Therefore, the change in inventory can be represented by the following first-order ordinary differential equation. According to the inventory model with exponential decay rate proposed by Ghane and Schnaden:

$$\frac{dK(t)}{dt} = -\lambda(t)K(t) - D(x) \quad (8)$$

$$K(t) = \frac{D(x)}{\lambda(t)} (e^{\lambda(t)(\tau-t)} - 1), 0 \leq t \leq T \quad (9)$$

During an or $t = 0$ dering cycle T , the inventory level at which the supplier resells the goods to retailers can be calculated:

$$K_0 = \frac{D(x)}{\lambda(t)} (e^{\lambda(t)T} - 1) \quad (10)$$

The various cost components of retailers are as follows:

- 1) Order cost: S ;
- 2) Purchasing cost: pQ_0 ;
- 3) Stockholding cost: $H_p \int_0^r K(t)dt$;
- 4) Cost of value depletion: $\lambda(t)p \int_0^r K(t)dt$;

From the above subitems, it can be seen that the total cost of retail is TC , which is equal to the sum of the various types mentioned above:

$$\begin{aligned}
 TC &= S + pK_0 + Hp \int_0^T K(t)dt + \lambda(t)p \int_0^T K(t)dt \\
 &= S + p \frac{D(x)}{\lambda(t)} (e^{\lambda(t)r} - 1) + Hp \frac{D(x)}{[\lambda(t)]^2} (e^{\lambda(t)r} - 1 - \lambda(t)T) \\
 &\quad + \lambda(t)p \frac{D(x)}{[\lambda(t)]^2} (e^{\lambda(t)r} - 1 - \lambda(t)T)
 \end{aligned} \tag{11}$$

Due to the difficulty in obtaining the exact expression for the maximum value of the above equation, this article applies an approximate algorithm of exponential functions, based on the expansion of Taylor's formula:

$W\theta T < 1$ he $e^{\lambda(t)T}$ n, it can be used

$$1 + \lambda(t)T + \frac{1}{2}(\lambda(t)T)^2 \tag{12}$$

Approximate substitution;

By substituting equation (9) i $T C_1$ nto equation (13), the average total cost per unit time for retailers is equal to:

Total revenue per unit time:

$$TC_1 = \frac{TC}{T} = \frac{S}{T} + p(a - bx) + \frac{1}{2}[H + 2\lambda(t)]p(a - bx)T \tag{13}$$

$$x(a - bx) \tag{14}$$

Average total profit per unit time for retailers:

$$G = x(a - bx) - TC = x(a - bx) - \frac{S}{T} - p(a - bx) - \frac{1}{2}[H + 2\lambda(t)]p(a - bx)T \tag{15}$$

In the above equation λ Taking partial derivatives yields the following equation:

$$\frac{\partial G}{\partial T} = \frac{S}{T^2} - \frac{1}{2}[H + 2\lambda(t)]p(a - bx) \tag{16}$$

Calculate the second-order partial derivative of equation (18) again:

$$\frac{\partial^2 G}{\partial T^2} = -\frac{2S}{T^3} \leq 0 \tag{17}$$

The equation indicates that the average total profit function of retailers per unit time is a convex function of T. For a given retailer's sales price x and retailer's purchase price p, it can be solved

$$\frac{\partial G}{\partial T} = 0 \tag{18}$$

Substituting equation into equation yields the profit of the retailer when the selling price is x:

$$G = (a - bx)(x - p) - \sqrt{2S(H + 2\lambda t))p(a - bx)} \tag{19}$$

When the supplier and retailer independently determine their selling price, the supplier's unit selling price is p , and the retailer's selling price is:

$$x = \frac{1}{b} \left(a - \frac{2S}{pT^2[H+2\lambda(t)]*(1+d)} \right) \quad (20)$$

$$V = xq \quad (21)$$

Equations (19) and (20) are the pricing models for retailers. Equation (20) can indicate the relationship between the retail sales price and the value loss rate, when the value loss rate λ Reduce the hours, and the selling price x is getting smaller and smaller. As the value loss decreases over time, adjusting the selling price of fresh vegetables in a timely manner can promote an increase in retail sales by lowering the selling price, which is more helpful in controlling the loss of fresh vegetables in all aspects. The sales price of retailers is not only related to the value loss rate, but also to the demand scale of retailers, the price sensitivity coefficient of fresh vegetables, the purchase price of fresh vegetables, the cost of each order, the inventory cost rate, and the order cycle. The final sales revenue of the retailer is calculated by multiplying the selling price with the sales volume in equation (21).

Next, it is necessary (t) to first solve a series of unknown variables (b , S) in the formula.

(1) Price sensitivity coefficient b

According to classical inventory theory, assuming that customer demand is a linear function of sales price, the calculation formula is as follows:

$$D(x) = a - bx, p < x < \frac{a}{b}, a > b > 0 \quad (22)$$

Among them, x is the sales price; A is the demand scale of supermarkets (i.e. the daily purchase volume of such products); B is the price sensitivity coefficient of the product. By deducing the above equation, it can be concluded that:

$$b = \frac{a - D(x)}{x} \quad (23)$$

Using the predicted daily sales as the value of a , the price sensitivity coefficients b for each category calculated using the above formula are shown in Table 3:

Table 3. Price sensitivity coefficient b for each category from July 1st to July 7th

	Anthophyllum	Solanaceae	Florescent vegetables	Aquatic rhizomes	Chili peppers	Edible fungi
July 1st	3.908456127	1.769897026	1.969673366	1.18613998	3.3142308	1.843357638
July 2nd	3.900835537	1.743962144	1.702801536	1.181680396	3.259041624	1.820894244
July 3rd	3.914856519	1.924702907	1.633195188	1.186217091	3.166260475	1.84993408
July 4th	3.908456127	1.898883016	1.629613121	1.044696462	3.364332311	1.354344381
July 5th	3.900835537	1.059842576	1.6274551	1.046716617	2.389614009	1.377403688
July 6th	3.900389261	1.898883016	1.627653969	1.048426413	3.407600119	2.137912005
July 7th	3.904120469	2.061004105	1.759113005	1.192863334	3.404910875	1.512354799

(2) Value loss rate θ

In the process of vegetable sales, the loss of vegetables not only includes the natural loss caused by the decrease in freshness of the product over time, but also includes the discomfort of the spatial temperature of the sales location, as well as the loss caused by factors such as customers removing or breaking the product. Controlling the value loss of vegetables is beneficial for gradually realizing the value appreciation of the entire supply chain.

Due to the correlation between value loss function and freshness, it is a continuous decreasing function of time t . Therefore, a coefficient of $1n$ is chosen θ Can better describe the phenomenon of

high product freshness and relatively rough product selection by customers, resulting in less loss. In addition, by coefficient $\ln \theta$ Can achieve a conversion from high freshness to low loss rate, i.e. when freshness θ When it is 1, the value loss rate is 0.

Considering that $0 < \text{freshness } \theta < 1$ At 1 hour, $\ln \theta < 0$, and the loss rate is a positive number, so adding a negative sign before $\ln \theta$ can convert it to a positive number. Therefore, the value loss function is constructed as follows:

$$\gamma = -\ln \theta \quad (24)$$

The average loss rate of each category of vegetables calculated using the above formula is shown in Table 4:

Table 4. Average Loss Rate of Vegetables by Category (%)

Category name	Anthophyllum	Solanaceae	Florescent vegetables	Aquatic rhizomes	Chili peppers	Edible fungi
Loss rate	11.1577	6.751	9.168	9.440526316	8.004222222	8.2975

(3) Order cost

This article assumes that the daily demand for each type of vegetable is $a=500\text{kg}$, and the ordering cost (excluding cost) $S=200$ yuan/time. The following formula is derived to calculate the ordering cost of vegetables ordered once by the supermarket:

$$S=200 * \text{Predicted sales}/500 \quad (25)$$

In summary, the price sensitivity coefficient, value loss rate, and ordering cost of ordering vegetables obtained from the calculation are taken into formula 8. The calculated price sensitivity coefficient results are shown in Table 5; The final pricing strategy for each category from July 1st to July 7th is shown in Table 6.

Table 5. The ordering cost S of vegetables ordered by supermarkets (unit: yuan)

	Anthophyllum	Solanaceae	Florescent vegetables	Aquatic rhizomes	Chili peppers	Edible fungi
July 1st	53.74896	9.36852	8.697	7.38348	30.59204	16.49268
July 2nd	55.07244	9.23124	7.51864	7.35572	29.8052	16.13924
July 3rd	55.44076	7.17848	7.22692	7.38396	29.16076	16.55152
July 4th	55.35012	6.73668	7.19548	7.4054	26.01704	18.02636
July 5th	55.2422	5.9626	7.20152	7.41972	28.50444	18.33328
July 6th	55.23588	7.02868	7.2024	7.43184	31.526	17.82068
July 7th	55.28872	7.7818	7.19808	7.44364	31.50112	17.34208

Table 6. Final Pricing of Vegetables by Category from July 1st to July 7th

	Anthophyllum	Solanaceae	Florescent vegetables	Aquatic rhizomes	Chili peppers	Edible fungi
July 1st	27.8683	11.4162	9.8910	13.7848	19.9158	19.8000
July 2nd	27.9064	11.4162	9.8910	13.7848	19.9083	19.8000
July 3rd	27.8683	8.2468	9.8885	13.7848	19.9140	19.8000
July 4th	27.8683	7.8366	9.8910	15.7629	16.9860	29.8000
July 5th	27.8683	12.3849	9.8885	15.7629	25.9422	29.8000
July 6th	27.8683	7.8366	9.8885	15.7629	19.9177	18.0000
July 7th	27.8683	8.2683	9.0920	13.7796	19.9177	25.8000

3.4. Tail Pricing

By observing the pricing of various vegetables given in Table 9, it can be found that the pricing of edible mushrooms is slightly different from that of other categories, that is, the prices of the other 5

categories of vegetables can all maintain non-zero digits after the decimal point, while the pricing of edible mushrooms has already reached zero digits after the decimal point. Therefore, it can be adjusted to an appropriate tail price with two decimal places, as shown in the table below. The advantage of this operation is that it can unify the price form and make consumers believe that the price is discounted, thereby inducing or enhancing their purchasing desire and expanding sales volume to obtain more profits. The prices of various vegetables processed by tail end pricing are shown in Table 7:

Table 7. Price List of Various Vegetables after Tail Pricing (Unit: yuan/kg)

	Anthophyllum	Solanaceae	Florescent vegetables	Aquatic rhizomes	Chili peppers	Edible fungi
July 1st	27.87	11.42	9.89	13.78	19.92	19.80
July 2nd	27.91	11.42	9.89	13.78	19.91	19.80
July 3rd	27.87	8.25	9.89	13.78	19.91	19.80
July 4th	27.87	7.84	9.89	15.76	16.99	29.80
July 5th	27.87	12.38	9.89	15.76	25.94	29.80
July 6th	27.87	7.84	9.89	15.76	19.92	18.00
July 7th	27.87	8.27	9.09	13.78	19.92	25.80

3.5. Promotion Pricing

Due to the short shelf life of vegetables and the decreasing freshness, their attractiveness to consumers gradually decreases. Therefore, in order to maximize supermarket profits, promotional pricing has also been formulated for vegetables with lower freshness. After comparing various pricing methods, such as subsidiary product pricing, sales gift pricing, and dual shelf model, we ultimately chose to use the dual shelf model to promote pricing for various categories of vegetables in the supermarket.

3.6. Dual shelf model

Vegetables are fresh products with a shorter lifespan. Therefore, when selling, supermarkets can consider placing dual shelves, as shown in Figure 7. Fresh vegetables can be placed on regular shelves and sold at the above pricing, while on promotional shelves, vegetables with lower freshness but unchanged quality can be placed and sold at a certain discount price. Selling at a low price can not only attract some consumers, but also to some extent reduce the probability of vegetables being discarded due to decay and spoilage. Hermessy (1998) suggests that a retail store can increase profits by about 15% by reducing product decay and spoilage. Therefore, it can be considered that the strategy of selling vegetables with low freshness at a low price helps to maximize the profits of supermarkets.

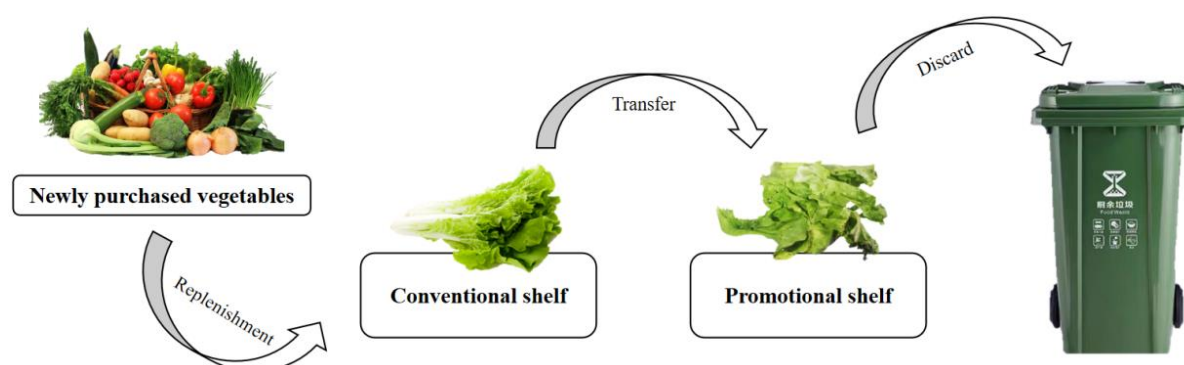


Figure 7. Legend of Dual Shelf Model

According to existing research, there is a Gaussian distribution between discount intensity and revenue, meaning that as the discount intensity continues to strengthen, the sales volume of the mall first increases and then decreases, and the profit margin of the mall is higher when the discount intensity is around 25%. According to the procurement cycle, establish a price adjustment cycle for

vegetables, that is, when supermarkets purchase, transfer the unsold vegetables from the previous day to the promotional shelves, and empty the regular shelves to place fresh newly purchased vegetables. And promote the vegetables on the promotional shelves at a 25% discount rate. The promotional prices for six categories of vegetables are shown in Table 8:

Table 8. Promotion Price List for Each Category from July 1st to July 7th (Unit: yuan/kg)

	Anthophyllum	Solanaceae	florescent vegetables	Aquatic rhizomes	Chili peppers	Edible fungi
July 1st	20.9012	8.5622	7.4183	10.3386	14.9369	14.8500
July 2nd	20.9298	8.5622	7.4183	10.3386	14.9312	14.8500
July 3rd	20.9012	6.1851	7.4164	10.3386	14.9355	14.8500
July 4th	20.9012	5.8774	7.4183	11.8222	12.7395	22.3500
July 5th	20.9012	9.2886	7.4164	11.8222	19.4566	22.3500
July 6th	20.9012	5.8774	7.4164	11.8222	14.9383	13.5000
July 7th	20.9012	6.2012	6.8190	10.3347	14.9383	19.3500

4. Conclusion

This paper begins with a data exploration of vegetable commodity sales data. It includes: analyzing the monthly change and annual proportion of sales volume of each category of vegetable commodities to find out the pattern of sales volume distribution of vegetable commodities over time; and introducing the Shannon diversity index to analyze the distribution pattern of sales volume of vegetable commodities. In order to formulate the pricing and replenishment strategy of vegetable products, this paper firstly establishes an ARIMA time series model to forecast the sales volume of vegetable commodities in a week and formulate the daily replenishment strategy. Meanwhile, a pricing model based on the loss of value is established to optimize the strategy using the tail pricing method. And in order to maximize the interests of supermarkets, a dual-shelf model is established to implement promotional pricing for products with reduced freshness.

The ARIMA model used in this paper may still have some limitations when dealing with nonlinear complex relationships. In the next step, it is considered that complex prediction models, such as deep learning models, can be used to improve the accuracy of prediction.

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