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# THE STRATEGY TO SELECT AN E-COMMERCE PRODUCT – BASED ON THE FRAMEWORK OF PRODUCT E-COMMERCE VALUE

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Abstract. *According to the product E-commerce value theory, six main factors influence the selection strategy of E-commerce product, which are: supply and demand difference, perception difference of quality, willingness to pay for E-commerce, logistics satisfaction degree to goods, post-purchase evaluation, the opportunity cost of goods. Based on this theoretical framework, this article proposed a multi-agent simulation model. Based on the simulation results this article put forward the price strategy, supply strategy and quality strategy of the selection of E-commerce product.*
**Keywords:** E-commerce product, Strategy, Selection, Simulation

1. **Introduction.** According to the product E-commerce value theory [1], six main factors influence the selection strategy of E-commerce product, which are: supply and demand difference $\phi_1$, perception difference of quality $\phi_2$, willingness to pay for E-commerce $\phi_3$, logistics satisfaction degree to goods $\phi_4$, post-purchase evaluation $\phi_5$, and the opportunity cost of goods $C$. Any commodity can be identified by these six dimensions to reflect its suitability for E-commerce. Therefore, the product E-commerce value can be calculated through the function: $V = f(\phi_1, \phi_2, \phi_3, \phi_4, \phi_5)$. So the analysis framework can be shown below:

(1) For commodities $V > C$, the seller can implement E-commerce;

(2) For commodities $V < C$, the seller cannot implement E-commerce;

(3) $V = C$ is a critical value. According to it, the seller decides whether to implement E-commerce or not.

Here: $V$ – product E-commerce value; $C$ – the opportunity cost of goods.

In the following part of this article we will use this theory framework to analyze the selection strategy of E-commerce product through a multi-agent simulation.

2. **Creating a Simulation Environment.**

Assumption 1: The good in E-commerce environment is abstracted into the above six properties; in the initial state of the market there are $N$ consumers, and the consumers purchase the good repeatedly.

Assumption 2: At the time $t$, the product E-commerce value is $V = f(\phi_1, \phi_2, \phi_3, \phi_4, \phi_5)$, the price is $P$, and the opportunity cost is $C$. Then the rules of transactions can be concluded into Table 1.

3. **Creating the Simulation Model.**

(1) Calculate the product E-commerce value

TABLE 1. Rules of transactions

| Condition 1 | Condition 2 | Result | Post-buy behavior |
|---|---|---|---|
| $V - P \geq 0$ | $P - C \geq 0$ | Deal | Continue to buy, and attract new customers |
| $V - P \geq 0$ | $P - C < 0$ | No deal | Continue to buy |
| $V - P < 0$ | $P - C \geq 0$ | No deal | Stop buying |
| $V - P < 0$ | $P - C < 0$ | No deal | Stop buying |

The function of product E-commerce value is $V = f(\phi_1, \phi_2, \phi_3, \phi_4, \phi_5)$. If the form of function is unknown, we cannot process the analysis. Under normal circumstances it would not affect the analysis conclusion by linearization of the function.

So after linearization the function is given as (1):

$$V = \beta_1\phi_1 + \beta_2\phi_2 + \beta_3\phi_3 + \beta_4\phi_4 + \beta_5\phi_5 \tag{1}$$

Among them: $\beta_1 \geq 0$, $\beta_2 \geq 0$, $\beta_3 \geq 0$, $\beta_4 \geq 0$, $\beta_5 \geq 0$. $\beta_1$, $\beta_2$, $\beta_3$, $\beta_4$, $\beta_5$ are influence degrees to the product E-commerce value of every factor, that is the weights of every factor. When calculating the weights, we can obtain them through expert investigation. At the same time all the factors should be standardized using the following formula:

$$\phi_i' = \frac{\phi_i - \phi_{i-\min}}{\phi_{i-\max} - \phi_{i-\min}} \tag{2}$$

Prices and costs are also standardized, and the formulas are:

$$P_i' = \frac{P_i - P_{i-\min}}{P_{i-\max} - P_{i-\min}} \tag{3}$$

$$C_i' = \frac{C - C_{i-\min}}{C_{i-\max} - C_{i-\min}} \tag{4}$$

(2) Set the simulation parameters

Firstly, in this paper we give out a priori set parameters to construct the Meta model. Based on this Meta model we will research the price strategy, supply strategy and quality strategy to choose the E-commerce products. The parameters of Meta model are set below.

① The distribution of consumers' demand

In order to model the consumers' stochastic demand, so far the most used model is normally distributed model [3]. Generally the normal distribution will be adjusted somehow, for example, Tian et al. plus a normal random fluctuation on the basis of average demand, build a positive mean normally distribution [4]. Therefore, this article sets the demand distribution as $N(demand, \sigma^2_{demand})$.

② The distribution of supply

Taking the production capacity and easy management under consideration, the manufacturers would like to produce at the same speed, so manufacturers' supply is constant, and we mark it as $Supply$.

③ Consumers' preferences of quality and online payment

In research, the consumers' preferences are often set as uniform distribution in a specific interval, for example, Syam et al. carry out their research by setting the consumers' preference of the properties of product as uniform distribution [5]. So, in this article we set the consumers' preferences of quality and online payment as uniform distribution in $[\underline{\theta}, \overline{\theta}]$.

④ The actual distribution of quality

In quality management, normal distribution is often used to analyze the features of the quality data. For example, in $6\sigma$ management of quality, the quality data is assumed as

normal distribution [6]. Therefore, in this article we assume that the real distribution of product's quality is normal distribution $N(q, \sigma^2)$.

⑤ Logistics satisfaction degree to goods

Logistics satisfaction depends on the transport and storage characteristics of the goods. For specific goods the logistics satisfaction degree is a constant.

⑥ The distribution of post-purchase evaluation

Consumers' post-purchase evaluation depends on if the product quality can meet the consumers' quality preference. The real distribution of quality is normal distribution, and the consumers' preferences of quality are uniform distribution. So the real post-purchase evaluation should be normal distribution, but the consumers who had poor experience incline to express their dissatisfaction, while those who had good experience tend to be silence. So this article assumes that consumers' post-purchase evaluation is positively skewed distribution.

In addition, the opportunity cost is constant; the price is equal to the product E-commerce value. So the Meta model and strategy model are shown in Table 2.

Table 2. Parameters settings of Meta model and strategy model

| Parameters | Meta model | Price strategy | Supply strategy | Quality strategy |
|---|---|---|---|---|
| Demand distribution | $N(0.5, 0.25)$ | $N(0.5, 0.25)$ | $N(0.5, 0.25)$ | $N(0.5, 0.25)$ |
| Supply distribution | 0.5 | 0.5 | Add supply; stochastic supply | 0.5 |
| Consumers' preference to quality | Uniform distribution 0.6-1 | Uniform distribution 0.6-1 | Uniform distribution 0.6-1 | Uniform distribution 0.6-1 |
| The real distribution of quality | $N(0.5, 0.01)$ | $N(0.5, 0.01)$ | $N(0.5, 0.01)$ | Improve the quality of product |
| Consumers' preference to online payment | Uniform distribution 0.8-1 | Uniform distribution 0.8-1 | Uniform distribution 0.8-1 | Uniform distribution 0.8-1 |
| Logistics satisfaction degree to goods | 1 | 1 | 1 | 1 |
| The distribution of post-purchase evaluation | $\chi^2(4)$ | $\chi^2(4)$ | $\chi^2(4)$ | $\chi^2(4)$ |
| Cost | 0 | 0 | 0 | 0 |
| Price | $N(V, 0.01)$ | Change the price and variance | $N(V, 0.01)$ | $N(V, 0.01)$ |

(3) The simulation process

The Pseudo-code of simulation is as follows:

Start

$t = 0$

Step 1: select any consumer from the $N$ ($N = 10000$) consumers;

Step 2: generate the required data according to the parameters and calculate the product E-commerce value;

Step 3: take action according to Table 1;

Step 4: until all consumers have taken action;

Step 5: calculate the result;

Step 6: when it reaches the set time $t$, terminate the simulation.

Next $t$

End

In order to set up a standard for comparison, we do the simulation of the Meta model. Then for the price strategies: first, change the price from higher than the PECV 0.003 to lower than the PECV 0.003; second, increase the variance from 0.01 to 0.1. For the supply strategies: first, increase the supply from 0.5 to 5; second, increase the variance from 0.01 to 0.1. For quality strategies: increase the quality from 0.6 to 1.0.

## 4. **Analysis of the Results of Simulation.**

### 4.1. **The selection of E-commerce commodity: Simulation and strategy of price.**

(1) Price simulation results

The simulation results are shown in Figure 1 and Figure 2 below.

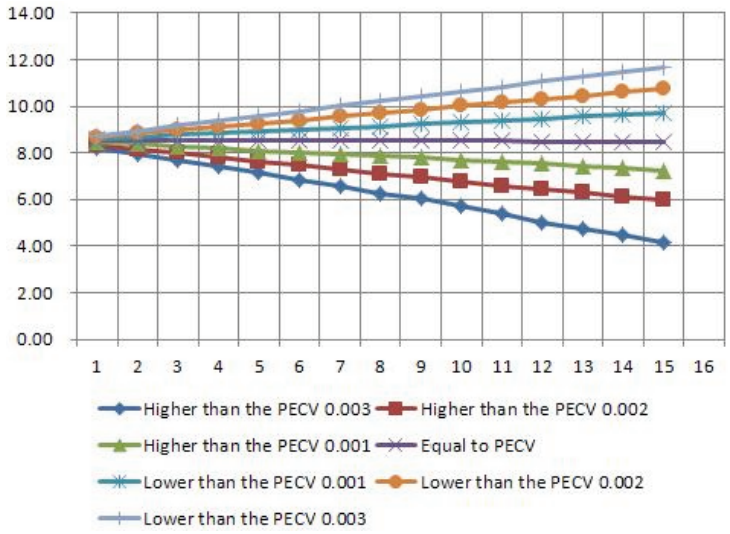
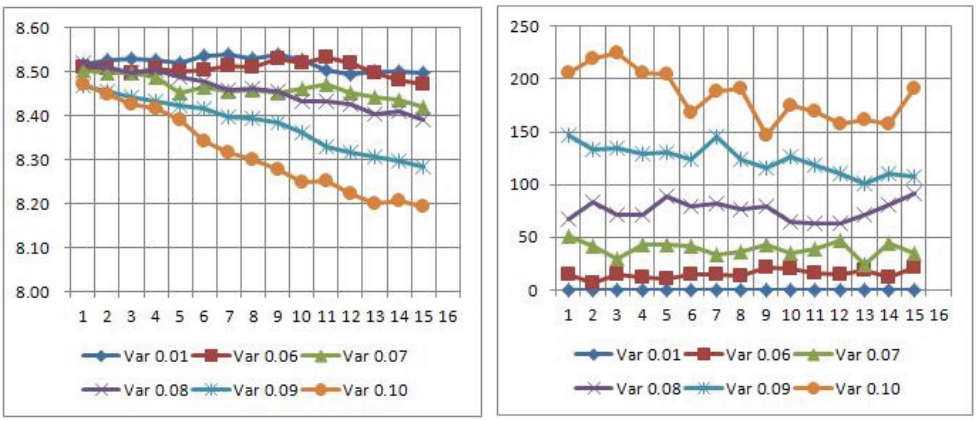



FIGURE 1. Simulation of different prices




(a) The buyers (b) Who wait to buy

FIGURE 2. Simulation of different price variances

Note: Figure 1 and Figure 2(a) are logarithmic scale; Figure 2(b) is real scale.

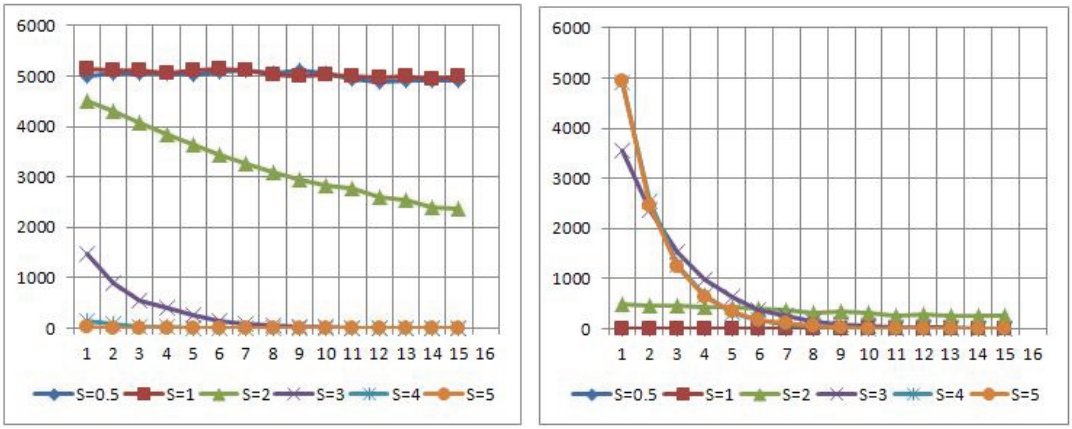
(2) Analysis of the price strategy

We can find that in Figure 1, when the price becomes higher and higher than the product E-commerce value, the market size becomes smaller and smaller. In Figure 2 we can find that, with the increasing of the variance of the price, the market size becomes smaller and smaller, and in the same time more and more consumers are waiting to buy. So our strategy is to choose the product whose price is lower than its E-commerce value, and try to keep prices stable.

### 4.2. **The selection of E-commerce commodity: Simulation and strategy of supply.**

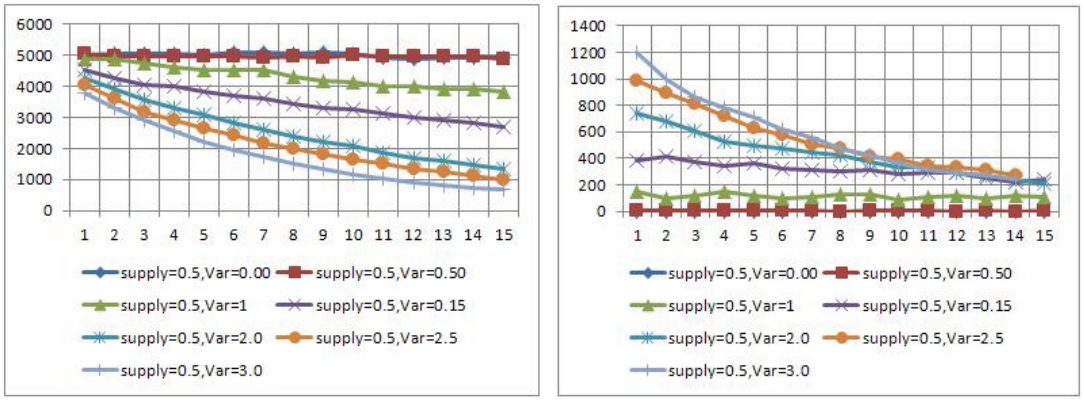
(1) Supply simulation results

The simulation results are shown in Figure 3 and Figure 4:




(a) The buyers (b) Who wait to buy

FIGURE 3. Simulation of the supply




(a) The buyers (b) Who wait to buy

FIGURE 4. Simulation of the variance of the supply

(2) Analysis of the supply strategy

In Figure 3 and Figure 4, we can find that with the increasing of the supply, the market size becomes smaller and smaller, while more and more consumers are waiting to buy. It is similar for stochastic supply. So our strategy is to choose the product with less supply or implement hunger marketing, and try to keep supply stable.

4.3. **The selection of E-commerce commodity: Simulation and strategy of quality.**

(1) Quality simulation results

The simulation result is shown in Figure 5.

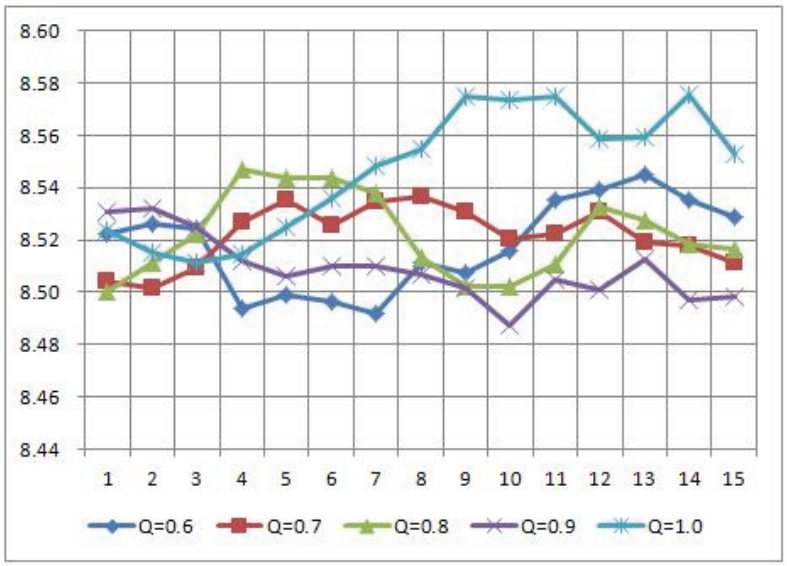



FIGURE 5. Simulation of the quality

Note: Figure 5 is logarithmic scale.

(2) Analysis of the quality strategy

In Figure 5, we can find that with the increasing of the quality the market size becomes bigger and bigger. So our strategy is to choose high-quality goods.

5. **Conclusions.** In order to solve the problem of how to choose an E-commerce product, this article established a multi-agent simulation model based on the product E-commerce value theory. The product E-commerce value consists of supply and demand difference, perception difference of quality, willingness to pay for E-commerce, logistics satisfaction degree to goods, post-purchase evaluation and the opportunity cost of goods. The results show as follows.

The price strategy is "choose the product whose price is lower than its E-commerce value, and try to keep prices stable".

The supply strategy is "choose the product with less supply or implement hunger marketing, and try to keep supply stable".

The quality strategy is "choose high-quality goods".

However, the results are based on a proper assumption of the parameters. Whether it could match the reality is unknown. So, we will carry out the practical research to confirm the effectiveness of this theory and the strategies.

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