Cooperative benefit allocation mechanism of logistics service integrated supply chain on electronic products

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Abstract

Considering the business partnership between logistics service integrator and functional logistics enterprise, we build a cooperative benefit allocation mechanism of logistics service supply chain about electronic products. Then operational effects and influence factors are analyzed. The result shows that logistics services integrator only need to consider output elasticity coefficients of both sides when setting optimal allocation coefficient. The optimal allocation coefficient is negatively correlated with output elasticity coefficient of logistics service quality invested by logistics integrator, positively correlated with output elasticity coefficient of logistics service quality invested by functional logistics enterprises. Optimum logistics service quality is positively correlated with output coefficient, negatively correlated with cost coefficient. The optimal fixed payment is negatively correlated with output coefficient, positively correlated with cost coefficient.

Keywords: Electronic Products, Logistics Service, Integrated Supply Chain, Benefit Allocation

1 Introduction

With the development of the product market and globalization, profits of enterprises are not only decided by quality and prices of the products. Logistics service plays an important role in the whole value chain, especially in electronic products. The features of high added value, timeliness, fast upgrading and product variety of electronic products result in a more serious requirement on rapid response to logistics distribution system. Therefore, electronic products manufacturing enterprises often subcontract logistics business to professional logistics service integrator, and then integrator subcontract concrete business such as transportation, distribution and inventtory to functional logistics enterprises. Therefore, a specialized logistics service supply chain of electronic products is formed. Logistics services integrator is the core of the electronic products logistics service supply chain. Logistics services integrator is not only the organizers of the business, but the organizers of the benefit allocation [1]. In the process of business organization, functional logistics enterprises provide logistics services according to the requirement of logistics services integrator. However, when comes to benefit allocation, logistics services integrator adopt a "non-cooperation" policy to functional logistics enterprises. Integrator pursues the maximum profit. "Non-cooperation" may easily lead to an unequal benefit allocation, which can affect the enthusiasm of function logistics enterprises. Thus low logistics service levels, high transaction costs and high moral hazard may occur. As to unequal benefit allocation caused by "non-cooperation", a cooperative benefit allocation mechanism is particularly important to be built.

Logistics service supply chain coordination mechanism has been studied by domestic and foreign scholars. Research achievements are mainly focused on benefit allocation, such as Frank [2] who built a service pricing model of logistics supply chain, and concludes that a reasonable benefit allocation mechanism can effectively promote enthusiasm of participators in the cooperation. A number of price strategies were given by Zhou [3] through game models, so as to solve coordination problems of logistics service supply chain between a single manufacturer and a retailer under stochastic demands. Under the uncertain demand conditions, Arcelus [4] built a game model between manufacturers and logistics service providers, and proposed a return policy that manufacturers should share risks for logistics service providers. Alfredsson [5] suggest that the revenue contract model can promote the enthusiasm of participators in the logistics service supply chain, but was fail to build a model of the benefit allocation contract between integrator and subcontractors. Several domestic scholars have also done some research on this field. Meng Lijun [6] studied the contract selection of functional logistics enterprise under the dominant condition of logistics services integrator. Chen [7] built a wholesale price contract and a revenue sharing contract of logistics service supply chain, and obtained the optimal order quantity and optimal quality cost of logistics service. Liu Weihua [8] used the principal-agent theory to build an optimization model between one logistics services integrator and several functional logistics enterprises, and finally obtained optimal allocation coefficient and the fixed payment that logistics service integrator should pay for functional logistics enterprises. Under the condition of demand uncertainty, He Meiling [9] studied issues about abilities of coordination and revenue-sharing contracts bet-

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ween logistics service integrators and functional logistics enterprises with the principal-agent theory. Gui Yunmiao [10] proposed that a competitive alliance coordination method can be built to solve the coordination problem between integrator and functional logistics enterprises. Under the condition of demand uncertainty, Li Jianfeng [11] studied the pricing and efficiency problem of the seconddary logistics service supply chain based on profit maximization principle.

Analysis of available literature shows that many achievements have been got on issues about benefit allocation of logistics service supply chain. However, they put too much emphasis on the view that logistics service integrator is the core position in the logistics service supply chain, and most of them use the Stackelberg model to describe the benefit allocation mechanism. In essence, integrator and functional logistics enterprises in the business execution are equal to partnership, and the relationship between them should also be existed in the benefit allocation. Considering the business partnership between logistics service integrator and functional logistics enterprises, as well as the features of logistics service supply chain about electronic products, this paper built a cooperative benefit allocation mechanism of logistics service supply chain, to promote the business cooperation between them and improve the efficiency of the whole logistics service supply chain.

2 Problem description and hypothesis

The conflicts of interest in logistics service supply chain of electronic products mainly exist between logistics service integrator and functional logistics enterprises. They pursue their largest self-interest [12]. During the benefit allocation, non-cooperative strategy affects the cooperative efficiency in the business. When integrator subcontracts business to functional logistics enterprises, both sides constitute a principle-agent relationship. In cooperation, integrator is not only responsible for organizing and coordinating logistics service supply chain of electronic products, but also for participating in concrete operation of logistics service in order to ensure service quality. Functional logistics enterprises mainly provide professional logistics service for the integrator, such as distribution service, transportation and storage. Service quality is decided by their degree of cooperation. The logistics service, which they provide, plays the role of functional supplement to the whole operation of logistics service supply chain of electronic products. The cooperation in both sides mainly includes the following three phases. See Figure 1.

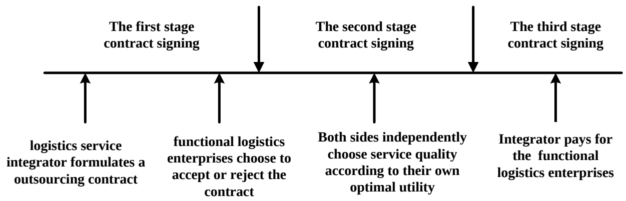

FIGURE 1 Game time-serial graph of electronic product between logistics service integrator and functional logistics enterprises

In the first phase, logistics service integrator of electronic products designs an outsourcing contract of logistics service. Then according to their self-interest, functional logistics enterprises choose to accept or reject. When the expected income is more than reservation utility, enterprises choose to accept the contract and both sides starting plan. When the expected income is less than reservation utility, enterprises choose to reject. In the second phase, logistics service integrator and functional logistics enterprises choose the optimal logistics service quality according to their own interests. In the third phase, when the service value is realized after logistics activity, logistics service integrator pay a service charge for functional logistics enterprises. Therefore, in order to analyze parameters and factors of outsourcing contract of logistics service, and provide the theoretical basis for logistics service integrator to formulate an outsourcing contract, this article makes the following assumptions.

Assumption 1: output function. Electronic products with high added value and timeliness require the greater business cooperation between logistics service integrator and functional logistics enterprises, so the total output of logistics service supply chain of electronic products can be expressed by Cobb-Douglas function.

We assume that output function of logistics service outsourcing is $\pi\ (e_1, e_2) = ke_1^a e_2^b + \varepsilon$, and e_1 is the service quality which is invested by logistics service integrator, namely organization efficiency. It mainly refers to the overall organizational capability of integrator to logistics service supply chain, such as technical training and guidance to functional logistics enterprises. e_2 is the service quality which is invested by functional logistics enterprises, namely operational efficiency in concrete business, such as the time control of delivery, transportation and the efficiency of distribution. To some extent, e_1 and e_2 play the role of functional supplement to the whole output of logistics service. If output efficiency wants to be improved, both sides should enhance cooperation in business. k is the output coefficient of logistics service quality, which is invested by both sides. The higher the value of k, the more the value of output. a is output elasticity coefficient of logistics service quality, which is invested by integrator and b is output elasticity coefficient of logistics service quality, which is invested by functional logistics enterprises. ε is random perturbed variable and influenced mainly by outside uncertain factors. Assuming that the mean value of ε is 0, variance is σ^2, output function of logistics service outsourcing is:

$$E\pi\ (e_1, e_2) = ke_1^a e_2^b.$$

Output function meets the conditions,

$\partial\pi(e_1,e_2)/\partial e_1 > 0$, $\partial\pi(e_1,e_2)/\partial e_2 > 0$,

$\partial^2\pi(e_1,e_2)/\partial e_1^2 < 0$, $\partial^2\pi(e_1,e_2)/\partial e_2^2 < 0$.

It represents that the output increases gradually with the improvement of logistics service quality invested by both sides. But it is affected by cost-control, the rate of output increase will decrease gradually with the increase of e_1, e_2. Therefore, assuming that 0< a,b <1.

Assumption 2: cost function. The cost is composed of fixed cost and variable cost. The fixed cost is the fixed capital for logistics service of electronic products, which is invested by logistics service integrator and functional logistics enterprises, such as software appliances and salary paid for employees. The variable cost is mainly decided by the quality of logistics service, which is provided by both sides. The higher the quality leads to the more the variable cost. Assuming that the fixed cost invested by logistics service integrator is m, m>0, and the variable cost is the function about the logistics service quality. It is assumed as $\alpha e_1^2/2$. In this assumption, α represents the cost coefficient of integrator, then the cost function of integrator is $C_1 = \alpha e_1^2/2 + m$. n represents the fixed cost of functional logistics enterprises and n >0. The variable cost is the function about the quality of logistics service e_2. It is assumed as $\beta e_2^2/2$. β represents the cost coefficient of functional logistics enterprises, and the cost function of functional logistics enterprises is:

$C_2 = \beta e_2^2/2 + n$.

Assumption 3: payment function. When the logistics service is completed and the service value is realized, integrator must pay a fee for functional logistics enterprises. In order to ensure that functional logistics enterprises can participate actively in cooperation, logistics service integrator not only needs to pay a fixed cost for functional logistics enterprises, but also allocate part of the profits to functional logistics enterprises. As a result, assuming the payment function is about the function of output, and distribution coefficient is θ, $0<\theta<1$. The fixed cost is F, so the payment function is:

$W(\pi) = F + \theta\pi = F + \theta k e_1^a e_2^b$.

Assumption 4: Assuming that logistics service integrator and functional logistics enterprises are all risk neutral, and they cannot supervise each service quality. The rest of the information is symmetric.

Assumption5: Assuming that R_O and R_S respectively represent the profits of logistics service integrator and the profits of functional logistics enterprises, they all pursue the maximal self-interests.

3 Logistic service outsourcing contract

According to the above assumptions, the whole logistics service outsourcing of electronic products is divided into three phrases. Firstly, integrator formulates an outsourcing contract. Then, logistics service integrator and functional logistics enterprises separately choose the optimal quality of logistics service. Finally, after realizing the service value, integrator pays a fee for functional logistics enterprises according to the contract. Based on the reverse solution of game theory, assuming that payment function $W(\pi)$ has been given and it is decided by the quality of their logistics service.

The expected profit function of functional logistics enterprises is

$$E(R_S) = E(W(\pi) - C_2) = F + \theta k e_1^a e_2^b - \beta e_2^2/2 - n \qquad (1)$$

The expected profit function of logistics service integrator is

$$E(R_o) = E(\pi - W(\pi) - C_1) = (1-\theta) k e_1^a e_2^b - \alpha e_1^2/2 - m - F \qquad (2)$$

According to the conditions of extreme value, calculate the derivative of e_2 and e_1 separately from formula (1) and formula (2), and make the first-order equality to be 0 so as to get their optimal quality of logistics service e_1 and e_2 under their objective of maximum self-interests. Then, design a logistics service outsourcing contract of integrator. Based on the principal-agent theory, the following principal-agent model between logistics service integrator and functional logistics enterprises is built.

$$U(O) = \max E(R_o) = \max_{e_1, e_2, \theta, F} (1-\theta) k e_1^a e_2^b - \alpha e_1^2/2 - m - F \qquad (3)$$

$$\text{St} \quad b\theta k e_1^a e_2^{b-1} - \beta e_2 = 0 \qquad (4)$$

$$a(1-\theta) k e_1^{a-1} e_2^b - \alpha e_1 = 0 \qquad (5)$$

$$F + \theta k e_1^a e_2^b - \beta e_2^2/2 - n \ge \bar{u} \qquad (6)$$

In this model, $U(O)$ represents the function based on the expected profit maximization of logistics service integrator. The formula (4) is incentive compatibility constraint of functional logistics enterprises, namely the optimal reaction function of logistics service quality, which is invested for logistics service integrator by functional logistics enterprises. The formula (5) is incen-tive compatibility constraint, namely the optimal reaction function of logistics service quality, which is invested for functional logistics enterprises by logistics service integrator. The formula (6) is participation constraint of functional logistics enterprises. u is reservation utility, it means that the profits of functional logistics enterprises obtained from the contract cannot be lower than reservation utility.

4 Solution and analysis

Under optimal circumstances, logistics integrators do not pay more to functional logistics enterprises. Therefore, the fixed costs that integrator paid for functional logistics enterprises is:

$$F = \bar{u} - \theta k e_1^a e_2^b + \beta e_2^2/2 + n \qquad (7)$$

Formula (7) is substituted into (3) and we can get:

$$U(O) = k e_1^a e_2^b - \alpha e_1^2/2 - \beta e_2^2/2 - n - m - \bar{u}.$$

Then simplify the qualification and get the principal-agent model:

$$U(O)=\underset{e_1,e_2,\theta}{\text{Max}}\ ke_1^a e_2^b-\alpha e_1^2/2-\beta e_2^2/2-n-m-\bar{u} \quad (8)$$

St. $$b\theta ke_1^a e_2^b-\beta e_2^2=0 \quad (9)$$

$$a(1-\theta)ke_1^a e_2^b-\alpha e_1^2=0 \quad (10)$$

The Lagrange multiplier λ and v is introduced and Lagrange function is constructed as follows:

$$\begin{aligned}U&=ke_1^a e_2^b-\alpha e_1^2/2-\beta e_2^2/2-n-m-\bar{u}\\&-\lambda\left(a(1-\theta)ke_1^a e_2^b-\alpha e_1^2\right)-v(b\theta ke_1^a e_2^b-\beta e_2^2)\end{aligned} \quad (11)$$

The function is solved with the Lagrangian method and get:

$$\theta^*=(1+\sqrt{a(2-b)/(b(2-a)})^{-1} \quad (12)$$

$$e_1^*=\exp\left[\frac{b\ln(\frac{ak(\theta^*-1)}{\alpha})-2\ln(\frac{ak(1-\theta^*)}{\alpha})-b\ln(\frac{bk\theta^*}{\beta})}{2(a+b-2)}\right] \quad (13)$$

$$e_2^*=\exp\left[\frac{(a-2)\ln(\frac{bk\theta^*}{\beta})-a\ln(\frac{k(1-\theta^*)}{\alpha})}{2(a+b-2)}\right] \quad (14)$$

$$F^*=\bar{u}-\frac{(2-b)\ k\theta^*}{2}\exp\left(\frac{\text{alnak}(1-\theta^*)-\text{ln}\alpha+\text{blnbk}\theta^*-\text{bln}\beta}{2-\text{a}-\text{b}}\right)+n \quad (15)$$

For 0< a,b <1, $\frac{\partial\theta^*}{\partial a}<0,\frac{\partial\theta^*}{\partial b}>0$ can be obtained from the formula (12). Therefore the conclusion 1 can be got as follows.

Conclusion 1: The optimal allocation coefficient θ^* is negatively correlated with logistics service quality output elasticity coefficient of integrator *a*, positively correlated with logistics service quality output elasticity coefficient of functional logistics enterprise *b*. The optimal allocation coefficient θ^* is independent of service levels e_1,e_2 invested by integrator and functional logistics enterprises, the variable cost coefficient α, β and the output coefficients of logistics service quality k.

Conclusion 1 illustrates that when determining benefit allocation coefficient of logistics service outsourcing contract, logistics service integrator need to consider output elasticity coefficients of logistics service, without considering the service quality and cost coefficient investted by both sides. According to $\frac{\partial\theta^*}{\partial a}<0$, optimal allocation coefficient is negatively correlated with output elasticity coefficient of logistics service quality invested by integrator. That shows when the elastic coefficient of service quality invested by integrator a increase, integrator should reduce the allocation ratio to functional logistics enterprises. This is because the service quality invested by integrator can affect the overall output of logistics service. Therefore, in order to enhance the overall benefit, integrator should invest more money in improving their logistics service quality. According to $\frac{\partial\theta^*}{\partial b}>0$, optimal allocation coefficient is positively correlated with output elasticity coefficient of logistics service quality invested by functional logistics enterprise. That shows when the elastic coefficient of service quality b invested by functional logistics enterprise increase, integrator should improve the allocation ratio of functional logistics enterprises. This is because that the improving of service quality provided by functional logistics enterprise can enhance the overall output. Integrator can stimulate functional logistics enterprise to improve their own service quality and cooperative closeness by means of increasing the allocation ratio of functional logistics enterprises. Then overall output benefits will be increased.

Plug formula(12) into formula(13) and formula (14), calculate the derivative of cost coefficient and output coefficient of logistics service, so as to get $\frac{\partial e_1^*}{\partial\alpha}<0$, $\frac{\partial e_1^*}{\partial\beta}<0,\frac{\partial e_1^*}{\partial k}>0;\frac{\partial e_2^*}{\partial\alpha}<0,\frac{\partial e_2^*}{\partial\beta}<0,\frac{\partial e_2^*}{\partial k}>0$. From this, conclusion 2 can be got.

Conclusion 2: Optimum logistics service quality invested by both sides is positively correlated with output coefficient k, negatively correlated with cost coefficient of both sides α, β.

Conclusion 2 shows that when the output coefficient k increase, logistics service integrator need to improve their ability of organization and functional logistics enterprises need to improve their cooperation with integrator on specific business. Both sides should improve their service quality to increase output benefits. However, when the cost coefficient of both sides α,β increase, both all should reduce their input in logistics service quality. When the effects of cost coefficient on logistics service supply chain increase, logistics services integrator and functional logistics enterprises should reduce their input into the logistics service quality, so as to reduce costs and ensure their own profits. According to formula (15), calculate the derivative of variable cost coefficient α, β and output coefficient of logistics service. Because of 0< a, b <1, we can get $\frac{\partial F^*}{\partial k} < 0$, $\frac{\partial F^*}{\partial \alpha} > 0$, $\frac{\partial F^*}{\partial \beta} > 0$. Then conclusion 3 can be got.

Conclusion 3: The optimal fixed payment is less than the sum of reservation utility and fixed costs of functional logistics enterprises. It is negatively correlated with output coefficient k, positively correlated with cost coefficient α, β.

Fixed payment is a fixed fee that logistics service integrator pay for functional logistics enterprises. It is unrelated to output value. If the fixed payment is more than the sum of reservation utility and fixed costs of functional logistics enterprises. It will be easy for functional logistics enterprises to get higher income without efforts and defraud the fixed cost. In order to attract functional logistics enterprises to actively participate in projects and promote the cooperation between them, logistics service integrator pay a fixed fee for functional logistics enterprises. When the output coefficient k increase, the output value of project increase. The project will be more attracttive. Logistics services integrator do not need to pay more fixed costs to attract functional logistics enterprise, therefore, integrator should reduce the fixed payment.

According to formula (3), when the cost coefficient of integrator increases, both sides will reduce their input into service quality, so as to cut down the output values. In order to attract functional logistics enterprises, integrator needs to increase the fixed payment. Similarly, when the cost coefficient of functional logistics enterprises increase, both sides will also reduce their investment on logistics quality, making the desired output value decreased. In order to attract functional logistics enterprises, integrator also needs to increase the fixed payment.

5 Example analysis

To verify conclusion 1, assuming that output coefficients of logistics service quality invested by both sides $k = 4$, the reservation utility of functional logistics enterprises $\bar{u} = 2$, the cost coefficient of logistics service integrator $\alpha = 3$ and the cost coefficient of functional logistics enterprises $\beta = 3$.

The elasticity coefficients of logistics service quality invested by both sides a and b are change value, which change from 0 to 1.

Calculate the value of θ^* and use maple 13 to draw a three-dimensional diagram of the relationship between elasticity coefficient and allocation coefficient of logistics service quality invested by integrator and functional logistics enterprises. Please see Figure 2.

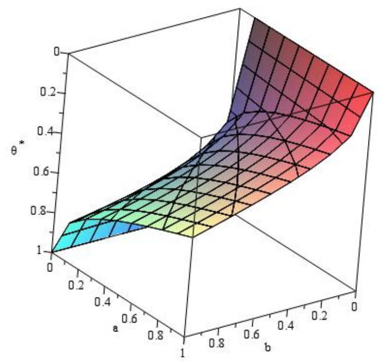

FIGURE 2 Three-dimensional diagram of the relationship between elasticity coefficient and allocation coefficient of logistics service quality invested by both sides.

As shown in Figure 2, when a increase from 0 to 1, θ^* decreases gradually. It means that the elastic coefficient of logistics service quality invested by integrator a is negatively correlated with allocation coefficient θ^*.

When b increase from 0 to 1, θ^* increases gradually. It means that the elastic coefficient of logistics service quality invested by functional logistics enterprises b is positively correlated with allocation coefficient θ^*. The verified result is the same as conclusion 1.

In order to verify conclusion 2 further, assuming that the output coefficient of logistics service quality invested by functional logistics enterprises $k = 4$, the reservation utility of functional logistics enterprises $\bar{u} = 2$, the elastic coefficients of logistics service quality invested by both sides $a = 0.6$ and $b = 0.6$, the cost coefficient of both sides α and β are change value.

Calculate the logistics service quality invested by integrator and functional logistics enterprises under different cost coefficients and draw a three-dimensional diagram of the relationship between cost coefficient and logistics service quality. Please see Figure 3 and Figure 4.

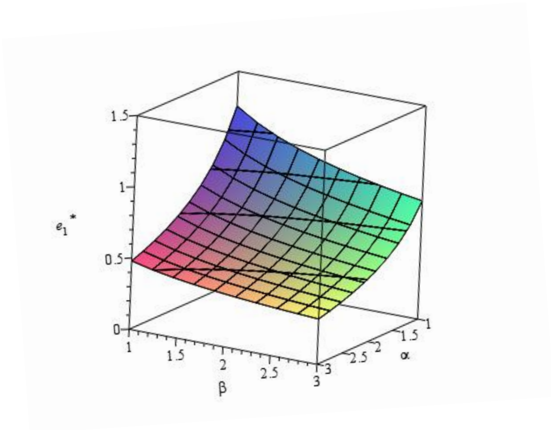

FIGURE 3 Graph of the relationship between cost coefficient and logistics service quality of integrator

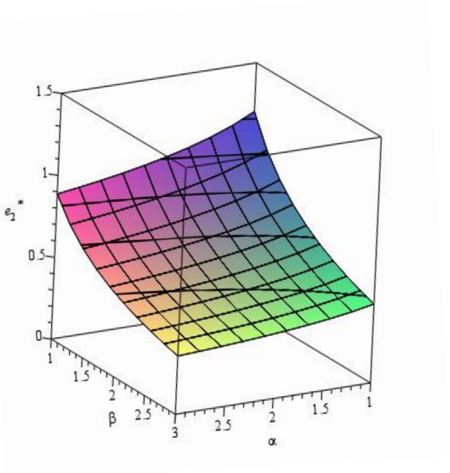

FIGURE 4 Graph of the relationship between cost coefficient and logistics service quality of functional logistics enterprises

The cost coefficient is greater than 0, so the values of α and β are change from 1 to 3. As shown in Figure 3 and Figure 4, when the cost coefficient of integrator α increases, the quality of logistics service invested by both sides e_1^* and e_2^* decrease. When the cost coefficient of functional logistics enterprises β increases, the quality of logistics service invested by both sides e_1^* and e_2^* decrease. Therefore, the optimal quality of logistics service, which is invested by integrator and functional logistics enterprises, is negatively correlated with cost coefficient.

In order to verify the relationship between output coefficient and logistics service quality invested by both sides, assuming that the reservation utility of functional logistics enterprises $\bar{u} = 2$, the elasticity coefficients of logistics service quality invested by both sides $a = 0.6$ and $b = 0.6$, the cost coefficients $\alpha = 3$ and $\beta = 3$, the output coefficient k is a change value and it change from 1 to 10. Calculate the value of logistics service quality invested by both sides under different output coefficient and draw a diagram of the relationship between output coefficient and logistics service quality. See Figure 5 and Figure 6.

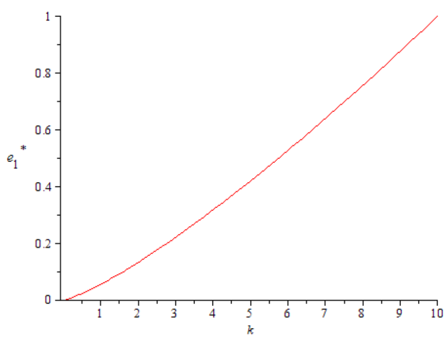

FIGURE 5 Graph of the relationship between output coefficient and logistics service quality of integrator

As shown in Figure 5, when the output coefficient k increases from 1 to 10, the logistics service quality invested by both sides e_1^* and e_2^* increase. As a result, the optimal quality of logistics service invested by integrator and functional logistics enterprises is positively correlated with output coefficient k. The verified result is the same as conclusion 2.

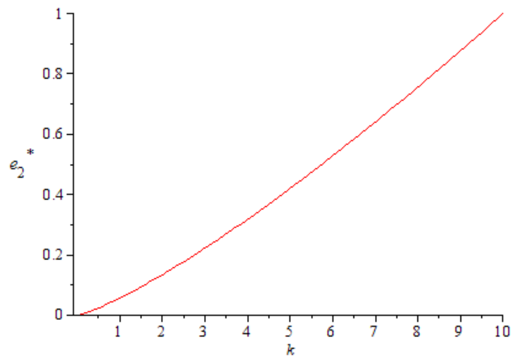

FIGURE 6 Graph of the relationship between output coefficient and logistics service quality of functional logistics enterprises

In order to verify conclusion 3, assuming that output coefficient of logistics service quality invested by two sides k =4, the reservation utility of functional logistics enterprises $\bar{u} = 2$, the elastic coefficients of logistics service quality invested by both sides $a = 0.6$ and $b = 0.6$, the fixed cost of functional logistics enterprises $n = 1$, and the cost coefficient of two sides α and β are change values. Calculate the optimal fixed payment of integrator under different cost coefficients from1 to 2.5. Then draw the diagram, which describes the relationship between the optimal fixed payment and cost coefficient. See Figure 7.

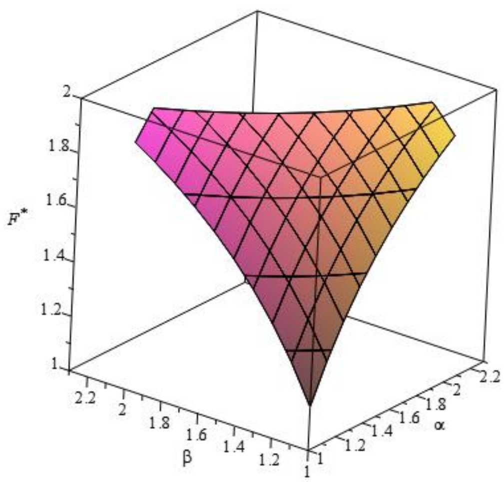

FIGURE 7 Graph of the relationship between the optimal fixed payment and cost coefficients of integrator and functional logistics enterprises

In order to verify the relationship between optimal fixed payment and output coefficient further, assuming that the reservation utility of functional logistics enterprises $\bar{u} = 2$, the elastic coefficients of logistic service quality invested by both sides $a = 0.6$ and $b = 0.6$, the cost coefficients of both sides $\alpha = 3$ and $\beta = 3$, the fixed cost of functional logistics enterprises $n = 1$. Set the output coefficient k is a change value and it change from 1 to 10. Draw a linear graph of the relationship between output coefficient of logistics service and the fixed cost paid by integrator. See Figure 8 .

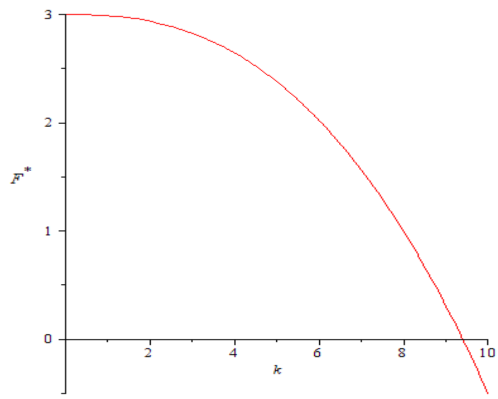

FIGURE 8 Linear graph of the relationship between output coefficient of logistics service and the fixed cost paid by integrator

As shown in Figure 8, with the increase of output coefficient k, the fixed cost paid by integrator decrease gradually. The optimal fixed payment is negatively correlated with output coefficient of logistics service quality invested by both sides k. The result is consistent with conclusion 3.

6 Conclusions

Integrated logistics service supply chain exists some problems such as low logistics service level and unequal benefit allocation caused by non-cooperative strategy. In order to solve these problems, based on the cooperation in logistics business between integrator and functional logistics enterprises of electronic products, this paper have built a principal-agent model of both sides and analyzed parameters of the contract. The results show that logistics services integrator only need to consider output elasticity coefficients of both sides when setting optimal allocation coefficient. The optimal allocation coefficient is negatively correlated with output elasticity coefficient of logistics service quality invested by integrator, positively correlated with output elasticity coefficient of logistics service quality invested by functional logistics enterprises. Optimal logistics service quality is positively correlated with output coefficient, negatively correlated with cost coefficient. The optimal fixed payment is negatively correlated with output coefficient, positively correlated with cost coefficient. It is not only conducive to promote the cooperation between both sides, but also provides a theoretical basis for logistics service outsourcing of electronic products. With the scope expansion of logistics services in electronic products, the number of logistics service integrator and functional logistics enterprises is gradually increasing. The coordination of benefit between multiple logistics services integrator and multiple functional logistics enterprises can be considered in further research.

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