SOCIAL RESPONSIBILITY DECISION-MAKING OF AGRICULTURAL PRODUCT SUPPLY CHAIN UNDER RETAILERS MULTIPLE RATIONALITY

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Abstract: This paper studies the influence of retailers' multiple rationality on the optimal pricing strategy of agricultural product supply chain and corporate social responsibility investment and sharing decision. For the agricultural product supply chain composed of agricultural product suppliers and retailers, under the circumstances of multiple rationality of retailers, the optimal decision-making problems of agricultural product supply chain under the leadership of suppliers and retailers are discussed respectively. The research shows that: 1) In the context of retailers' economic rationality, agricultural product suppliers bear more social responsibility, which is conducive to improving the profits of the whole agricultural product supply chain and all members. When retailers are dominant, retailers share more costs but are fixed, and suppliers invest more in social responsibility. When suppliers play a leading role, retailers will increase the proportion of cost sharing, and the benefits of more suppliers bearing social responsibility will be more obvious. 2) In the context of the existence of retailers, the increase of agricultural product retailers' attention to consumer surplus will lead to an increase in the optimal cost sharing ratio of agricultural product retailers and encourage suppliers to take more social responsibility. It is always beneficial to suppliers. Retailers will improve consumer satisfaction by giving way to profits. 3) In the context of retailers' social rationality, although retailers have increased the proportion of cost sharing, they cannot encourage suppliers to take more social responsibility. The fairness concerns of agricultural product retailers are always unfavorable to suppliers, which is beneficial to agricultural product retailers when they are dominated by suppliers, beneficial to their own utility when they are dominated by retailers, and unfavorable to economic interests.

Keywords: Multiple rationality; Corporate social responsibility; Agricultural product supply chain; Cost sharing

1. INTRODUCTION

In the report of the 20th National Congress of the Communist Party of China, it is clearly stated that it is necessary to comprehensively strengthen the To build the foundation of food security and accelerate the construction of a strong agricultural country. Guarantee agricultural products Safety is the most basic task of building a strong agricultural country in our country. Agriculture The village department proposed "strengthening agricultural technology innovation, implementing agricultural product quality Safety and security project". The process of agricultural products from "farm to fork" "many points, long lines, wide areas, and intricate intersections" involved in the process. exist Under the background of rural revitalization, e-commerce of agricultural products develops rapidly, and agricultural Products flow relative to manufactured goods on the supply and demand sides more efficient[1], more agricultural products are used in the process from production to consumption Full of "opportunism" and "moral hazard" [2]. country vibration The key to prosperity lies in the revitalization of the agricultural industry and the security of the supply chain of agricultural products. It is a key link to ensure the resilience of the agricultural industry [3]. agricultural product supply The implementation process of the chain social responsibility involves multiple stakeholders, A single CSR input in the supply chain eases agricultural production Product quality and safety issues are more difficult. However, the social responsibility of the agricultural product supply chain needs to be realized by increasing the cost of the enterprise, which has a short-term effect. It is non-economic, therefore, to enhance the social responsibility of the agricultural product supply chain level, in addition to the establishment of social responsibility coordination between supply chain enterprises control mechanism, and more importantly, to solve the problem of supply of agricultural products under multiple rationality Supply chain decision-making and cost sharing. Only in this way can the guide Enterprises in the supply chain of agricultural products actively adjust to make the supply chain of agricultural products The social responsibility behavior of individuals develops from being organized to self-organizing, and finally Ultimately guarantee the quality and safety of agricultural products.

Existing studies have shown that within the supply chain, social responsibility contracts and cooperation between undertaking enterprises and cooperative enterprises can improve Social responsibility investment level[4-5] In terms of cost input, the cost -sharing contract can motivate enterprises to increase social responsibility input[6] in profit In terms of profit capture, revenue-sharing contracts can help incentivize firms to undertake Responsibility [7]. In the supply chain of agricultural products, supply chain social responsibility has become This sharing ratio is the result of the game between node companies in the supply chain. The social responsibility investment of product suppliers is influenced by suppliers and retailers.The impact of cooperation methods. At the same time, the agricultural products in the market environment are zero vendors have multiple factors such as economic rationality,survival rationality and social

rationality rational[8-11]. And economic is manifested in the profit-seeking nature of enterprises, survival Rationality embodies the enterprise's survival and development, while making profits and fully considering considering consumer surplus, social rationality is cooperation between retailers and suppliers Fairness concerns in the process .

decisions about optimal pricing and social responsibility in agricultural product supply chains most of the research on the problem regards the supply chain enterprise as a single rational individual the optimal cost sharing decision of social responsibility under the influence of multiple rationality policy analysis is not sufficient, and there is a big gap with social facts. base Herein, this research group studied the In the two-level supply chain of agricultural products, based on the supplier's commitment to social social responsibility, retailers share the cost of social responsibility, in the supply optimal social responsibility of agricultural product suppliers under different power structures in the supply chain any input, optimal cost sharing of multi-rational retailers and agricultural products The optimal pricing problem in the product supply chain .

2. MODEL CONSTRUCTION

The groups of agricultural product suppliers and retailers a two-level agricultural product supply chain has been formed. In the supply chain, agricultural Product suppliers are the main bearers of social responsibility, and the agricultural products, wholesale to produce retailers at wholesale prices. Produce Retailer Incentivize agricultural product suppliers to undertake social responsibility by sharing social responsibility input costs socially responsible and sell agricultural products to consumers at retail prices .

The specific meanings of the symbols used in the construction of the model in this study are as follows: Below (table1), where 1 means the supplier of agricultural products, 2 means Agricultural retailers. A Indicates economic rationality for produce retailers Vendor-led environment, B Indicates the economic rationality of agricultural product retailers In the retailer-dominated scenario, C Indicates the survival philosophy of agricultural product retailers Vendor-led in sexual contexts, D Indicates that produce retailers survive Under the rational situation, the retailer dominates, E Indicates agricultural retailer Supplier-led in a rational situation, F Indicates a produce retailer Retailers dominate under social rationality .

Hypothesis 1 : Referring to the research of Liu et al [12] ., it is assumed that agricultural products Cost function of supplier social responsibility $(1 - t) kr^2/2$, zero for agricultural products The social responsibility cost function shared by sellers is $tkr^2/2$, where k is the social responsibility cost input coefficient, and $k > 0$; t zero for produce Vendor's cost sharing ratio, and $0 \le t \le 1$.

Table 1 Description of Model Symbols

the symbol	description
π^i_j	i case j Profit earned by the enterprise, where i = A, B, C, D, E, F ; j = 1,2
CS^i	i Consumer surplus for the case where i = A, B, C, D, E, F
u^i_2	i The utility of agricultural product retailers in the case of i = A, B, C, D, E, F
c	Supplier unit cost of produce
p^i	i The retail price of a unit of agricultural product in case i = A, B, C, D, E, F
w^i	i The wholesale price of a unit of agricultural product in case i = A, B, C, D, E, F
m	market capacity
r^i	i In the case of agricultural product suppliers ' social responsibility inputs, of which i = A, B, C, D, E, F
alpha	Market Demand for Agricultural Products
k	Corporate Social Responsibility Cost Input Coefficient
θ	agricultural retailers pay attention to consumer surplus
lambda	Fairness Concern Coefficient for Produce Retailers

Hypothesis 2: In the supply chain of agricultural products, market demand is price A function of grid and CSR input. Suppliers and Retailers The returns are all related to the market demand for agricultural products, and the market demand Demand is a function of price and social responsibility inputs. Drawing on Wang et al. The research of[13], the impact of corporate social responsibility input on agricultural product market Demand has a positive effect, assuming that the market demand for agricultural products is $f(p, r, s) = M - p + ar$, where the market capacity is M, the market The elasticity coefficient of corporate social responsibility of market demand is α, and $\alpha > 0$, The price elasticity coefficient is 1 .

Hypothesis 3: Agricultural product suppliers are based on economic rationality, and agricultural products The commodity retailer is under the situation of multiple rationality and the situation of economic rationality Agricultural product suppliers and retailers pursue their own economic interests π_1^i and π_2^i of maximization. Agricultural Product Retailers in the Situation of Survival Rationality While focusing on its own profits, it also pays attention to the social responsibility of agricultural product suppliers. The improvement of consumer surplus brought about by social responsibility, refer to Sang Sheng Ju's [14]research, that is, the pursuit of self- utility $U_2^i = \pi_2 + 9\ CS_i$ The maximization of, where θ consumer surplus for agricultural retailers degree of attention, and $0 \le \theta \le 1$. According to the research of panda[15] In the study, suppose the consumer surplus function is $CS = \frac{(M-p+\alpha r)^2}{2}$. Agricultural product retailers have fairness-concerned behaviors under social rationality

As a result, it compares its own profits with those of agricultural suppliers, and expect a fair outcome. Referring to the research of Du Shaofu et al [16]. research, assuming that socially rational retailers of agricultural products pursue their own utility $u_2^i = (1 + \lambda)\pi_2 - \lambda\pi_1^i$ maximize, where λ is the fairness concern coefficient of the agricultural product retailer, and $\lambda \ge 0$.

In order to ensure that each decision value in the model is positive, it is assumed that The parameters should satisfy: $2(1-t)k - a^2 > 0$, $2k\_ - 3a^2 > 0$, $4k\ 9\_ < 8k\_ - 3a^2$, $4(1+2\lambda)(1-t)k - (1+\lambda)a^2 > 0$, $4k(1+\lambda) - a^2(3+4\lambda) > 0$.

According to the above assumptions, the profit function of the agricultural product supplier is:

$$\pi_1 = (w-c)(M-p+a r) - \frac{1-t}{2}kr^2. \tag{1}$$

The profit function of the agricultural product retailer is:

$$\pi_2 = (p-w)(M-p+a r) - \frac{t}{2}kr^2. \tag{2}$$

The total profit function of the agricultural product supply chain is:

$$\pi = (p-c)(M-p+a r) - \frac{1}{2}kr^2. \tag{3}$$

3. ANALYSIS OF AGRICULTURAL PRODUCT RETAILERS UNDER THE ECONOMICALLY RATIONAL SCENARIO

3.1 Supplier-Led Model (Model A)

Produce Suppliers Share Consciousness Based on Retailer Social Responsibility Willing to determine the wholesale price of agricultural products and the level of social responsibility input, The retailer follows the supplier's decisions and finally determines the retail price of agricultural products Grid . According to the reverse induction method, the optimal solution of the model can be obtained, Formula (4)~(10).

The retailer's optimal cost sharing ratio is:

$$t^A = \frac{\alpha^2}{8k}. \tag{4}$$

The optimal social responsibility input level of agricultural product suppliers is:

$$r^A = \frac{2a(M-c)}{8k\_ - 3a^2}. \tag{5}$$

of agricultural product suppliers is:

$$w^A = \frac{(8k - a^2)M + (8k - 5a^2)c}{2(8k - 3a^2)}. \tag{6}$$

of the agricultural product retailer is:

$$p^A = \frac{(24k - 3a^2)M + (8k - 9a^2)c}{4(8k - 3a^2)}. \tag{7}$$

The profit of the agricultural product supplier is:

$$\pi^A = \frac{(8k - a^2)(M-c)^2}{}$$

$$\pi_1 = \frac{}{8(8k - 3a^2)} \cdot \tag{8}$$

of the agricultural product retailer are:

$$U^A_{22} = \pi^A = \frac{(8k + a^2)(M - c)^2}{16(8k - 3a^2)} \cdot \tag{9}$$

the agricultural product supply chain is:

$$\pi^A = \pi_1^A + \pi_2^A = \frac{(c - M)^2(24k - a^2)}{16(8k - 3a)^2} \cdot \tag{10}$$

3.2 Retailer-Led Model (Model *B)*

Agricultural product retailers determine social responsibility cost-sharing ratio and retail prices of agricultural products, which are subsequently determined by following agricultural product suppliers Set the wholesale price of agricultural products and the input level of social responsibility. According to inverse Solving to the induction method, the optimal solution of the model can be obtained, formulas (11)~(16).
The optimal social responsibility input level of agricultural product suppliers is:

$$r^B = \frac{6a(M - c)}{16k - 9a^2} \cdot \tag{11}$$

of agricultural product suppliers is:

$$w^B = \frac{4km + (12k - 9a^2)c}{16k - 9a^2} \cdot \tag{12}$$

of the agricultural product retailer is:

$$p^B = \frac{(12k - 3a^2)M + (4k - 6a^2)c}{16k - 9a^2} \cdot \tag{13}$$

The profit of the agricultural product supplier is:

$$\pi_1^B = \frac{(16k - 12a^2)k(M - c)^2}{(16k - 9a^2)^2} \cdot \tag{14}$$

The utility and profit of the agricultural product retailer are:

$$U_2^B = \pi_2^B = \frac{2k(M - c)^2}{16k - 9a} \tag{15}$$

$$\pi^B = \pi_1^B + \pi_2^B = \frac{6k(c - M)^2(8k - 5\alpha^2)}{(16k - 9\alpha^2)^2} \cdot \tag{16}$$

Proposition 1: $\pi_1^A > \pi_2^A$, $\pi_2^B > \pi_1^B$. Agricultural supply chain Whether the supplier or the retailer dominates, whoever dominates will gain more profits.

Proposition 2: t A With α increases with the increase of not subject to alpha Change influence of culture. Social Responsibility Resilience When Agricultural Product Suppliers Dominate The increase of the coefficient will make the optimal cost sharing ratio of agricultural product retailers increase. Since the retailer's economic profit is low at this time, the retailer It is hoped that by increasing the cost-sharing ratio, suppliers will be motivated to improve social responsibility input, meet the needs of consumers, increase sales, improve Retailer economic profit. Social

Responsibility Resilience When retailers dominate The increase of the coefficient does not affect the optimal cost sharing of agricultural product retailers Proportion. At this time, the economic profit of the retailer is higher, occupying a dominant position An economically rational retailer sets a high cost-sharing ratio For example, do not think that increasing the ratio can bring economic profit Therefore, we choose not to adjust the cost sharing ratio .

Proposition 3 : r A, r B, w A, w B, p A, p B, π_1^A, π_1^B ,

π_2^A, π_2^B , π A, π B mean with α increases with the increase. regardless suppliers or retailers dominate, and the coefficient of social responsibility elasticity increases Both will bring about the social responsibility input level of agricultural product suppliers, agricultural product Wholesale prices of agricultural products, retail prices of agricultural products, and profits of supply chain enterprises and increase in total profit. The increase of the elastic coefficient of social responsibility means that consumers tend to buy products from more socially responsible businesses Safe agricultural products. In practice, social responsibility investment is The positive impact of consumer behavior is greater than that caused by price increases negative impact, consumers are willing to pay higher prices for such agricultural product . Boost sales by meeting consumer needs, agricultural products suppliers will increase their investment in social responsibility, and the increase in cost will lead to The increase in the wholesale and retail prices of agricultural products will affect the whole supply chain.

the body and each node in it bring more profits.

4. THE ANALYSIS OF AGRICULTURAL PRODUCT RETAILERS IN THE CONTEXT OF SURVIVAL RATIONALITY

The utility function of survival rational agricultural products retailer is:

$$U_2 = \pi_2 + 9\,CS = (p-w)(M-p\_ + problem\ r) - \frac{t}{2}\,kr^2 + \frac{9(M-p\_+problem\,r)^2}{2} \quad . (17)$$

4.1 Supplier-Led Model (Model *C)*

Produce Suppliers Share Consciousness Based on Retailer Social Responsibility Willing to determine the wholesale price of agricultural products and the level of social responsibility input, The retailer follows the supplier's decisions and finally determines the retail price of agricultural products Grid. According to the reverse induction method, the optimal solution of the model can be obtained, Formula (18)~(23).
The retailer's optimal cost sharing ratio is:
The optimal social responsibility input level of agricultural product suppliers is:

$$r^C = \frac{2\,proposals\,(M-c)}{4(2-9)\,k - 3\,meeting^2} \quad . \tag{18}$$

of agricultural product suppliers is:

$$w^C = \frac{[4(2-9)\,k - Proceeding^2]\,M\_ + [4(2-9)\,k - 5\,meeting^2]\,c}{2[4(2-9)\,k - 3\,proposals^2]} \quad . \tag{19}$$

of the agricultural product retailer is:

$$c- = M - \frac{2(c-M)(2k-3^2 9)}{9\,ix^2 + 12k(-2+\ )} + \frac{c-M}{12-6\theta}\_ \quad . \tag{20}$$

The profit of the agricultural product supplier is:

$$\pi_1^C = \frac{(c-M)^2\left[k^2 - 4k(2-9)\right]}{43\left[is^2 + 4k(-2+9)\right](2-9)} \quad \tag{21}$$

_ _ The profit of the agricultural product retailer is:

$$\pi_2^C = \frac{(c-M)^2\left[4(-3+9)-16k^2(-2+9)^2(-1+9)-8k2(2-3^9+9^2)\_\right]}{4\left[3\,is^2 + 4k(-2+9)\right]^2(-2+9)^2} \tag{22}$$

the agricultural product supply chain is:

$$C = \pi_1^c + \pi_2^c = \frac{(c-M)^2\left[y^4(3-2\theta)+16k^2(-2+\theta)^2(3-2\theta)-8k^2(10-11\theta+3\theta^2)\right]}{\left[3\theta^2+4k(-2+\theta)\right]^2(-2+\theta)^2} \cdot 4 \tag{23}$$

4.2 Retailer-Led Model (Model *D*)

Agricultural retailers determine social responsibility cost-sharing ratio and agricultural The retail price of the product, which is then determined by the following agricultural product suppliers Product wholesale price and social responsibility input level. According to reverse induction The optimal solution of the model can be obtained by solving with the method.The optimal social responsibility input level of agricultural product suppliers is:

$$r^D = \frac{6\ proposals\ (M-c)}{4(4-\theta)k-9\ proposals^2} = \frac{t}{3}^2 \cdot \tag{24}$$

Proposition 4 : t C with theta increases with the increase of t D not subject to θ Change influence of culture . When Produce Suppliers Dominate, Produce Retailers An increase in the degree of focus on consumer surplus will bring about the retailer's optimal Increased cost- sharing, survival-rational retailers looking to supply Businesses can increase their social responsibility investment level and increase consumer surplus. zero When the retailer dominates, its attention to consumer surplus does not increase It will affect the optimal cost sharing ratio of agricultural product retailers. Occupy at this time Survival-rational retailers, according to dominant positions, have set higher prices This sharing ratio, increasing social responsibility cost sharing cannot bring The improvement of personal utility, so I choose not to adjust the cost sharing ratio.

Proposition 5 : rC _, r D, w C, w D, π_1^c, π_1^D、 π^C all with theta increases with the increase. p C 、 p D, π_2^C, π_2^D, π C with

θ increase and decrease. π C   At $0 < \theta < \dfrac{16k-15\alpha^2}{20k}$ hour, with θ increases with the increase of ; when $\dfrac{16k-15\alpha^2}{20k} \le \theta < 1,$

with θ increase and decrease. Whether it is an agricultural product supplier or a zero Vendor -led, retailers pay more attention to consumer surplus Dajun will bring the level of social responsibility investment of agricultural product suppliers, Increased profits for suppliers and higher wholesale prices for agricultural products.

Retail prices and economic profits of agricultural product retailers increase as agricultural product zero The increase of the retailer's attention to the consumer's surplus decreases, because Survival- rational retailers pay attention to the increase of consumer surplus, because This option lowers the retail price and promotes consumers through profit sharing Remaining, while higher wholesale prices of agricultural products help supply Businesses assume social responsibilities and provide quality and safe agricultural products . Meet the needs of consumers. When the supplier dominates, the total supply chain

body Profit at $0 < \theta < \dfrac{16k-15\alpha^2}{20k}$, with agricultural products zero the seller 's attention to the consumer's surplus increases; when

$\dfrac{16k-15\alpha^2}{20k} \le \theta < 1,$ with the agricultural product retailer 's decreases with increasing residual concern . When retailers dominate, farmers Increased focus on consumer surplus by product retailers will increase supply The overall profit of the supply chain is reduced.

5. ANALYSIS OF AGRICULTURAL PRODUCT RETAILERS UNDER THE SOCIAL RATIONALITY SCENARIO

Socially Rational Produce Retailer Fair Concern Utility Letter The number is:

$$U_2 = (1+\lambda)\pi_2 - \lambda\pi_1 = (1+\lambda)[(p-w)(M-p+a\,r)-\tfrac{t}{}kr^2] - \lambda[(w-c)(M-p+a\,r)-\tfrac{1-t}{}kr^2]. \tag{25}$$

5.1 Agricultural Product Supplier-Led Model (Model *E*)

Produce Suppliers Share Consciousness Based on Retailer Social Responsibility Willing to determine the wholesale price of agricultural products and the level of social responsibility input, The retailer follows the supplier's decisions and finally determines the retail price of agricultural products Grid . According to the reverse induction method, the optimal solution of the model can be obtained,

$$E_w = \frac{M(8k - a^2)(1+\lambda) + 8\,ck(1+3\lambda) - c\,a^2(5+11\lambda)}{2(8k - 3a^2)(1+2\lambda)} \tag{26}$$

5.2 Agricultural Product Retailer-dominated Model (Model *F)*

Social Responsibility Cost-Sharing Ratio Determined by Produce Retailers and retail prices of agricultural products, followed by the supply of agricultural products that follow Suppliers determine the wholesale price of agricultural products and the level of social responsibility input. According to the reverse induction method, the optimal solution of the model can be obtained, the formula (27) ~ (34) .
of the agricultural product retailer is:

$$t^f = \frac{1 + 2\,lambda}{3 + 4\lambda} \tag{27}$$

The optimal social responsibility input level of agricultural product suppliers is:

$$r^f = \frac{2(M - c)\,a\,(1+\lambda)(3 + 4\,\lambda)}{8\,k\,(1+\lambda)(2 + 3\,\lambda) - a^2(3 + 4\,\lambda)^2} \tag{28}$$

of agricultural product suppliers is:

$$w^f = \frac{4\,km\,(1+\lambda)^2 - c\,a^2(3 + 4\,\lambda)^2 + 4\,ck(1+\lambda)(3 + 5\,\lambda)}{8\,k\,(1+\lambda)(2 + 3\,\lambda) - a^2(3 + 4\,\lambda)^2} \tag{29}$$

of the agricultural product retailer is:

$$p^f = \frac{2\,c\,(1+\lambda)2\,k\,(1+\lambda) - a^2(3 + 4\,\lambda) - M\,a^2(1 + 2\lambda)(3 + 4\lambda) - 4\,k\,(1+\lambda)(3 + 5\lambda)}{8\,k\,(1+\lambda)(2 + 3\,\lambda) - a^2(3 + 4\,\lambda)^2} \tag{30}$$

The profit of the agricultural product supplier is:

$$\pi_1^f = \frac{4k\,(c - M)^2(1+\lambda)^3\,4\,k\,(1+\lambda) - a^2(3 + 4\,\lambda)}{-8\,k\,(1+\lambda)(2 + 3\,\lambda) + a^2(3 + 4\,\lambda)^2} \tag{31}$$

The profit of the agricultural product retailer is:

$$\pi_2^F = \frac{2\,k\,(c - M)^2(1+\lambda)^2(1 + 2\lambda)\,16\,k\,(1+\lambda) - 3\,a^2(3 + 4\lambda) - 8\,k}{(1+\lambda)(2 + 3\,\lambda) + a^2(3 + 4\,\lambda)^2} \tag{32}$$

The agricultural product supply chain is:

$$\pi^F = \pi_1^F + \pi_2^F = \frac{2\,k\,(c - M)^2(1+\lambda)^2\,8\,k\,(3 + 8\,\lambda + 5\,\lambda^2) - a^2(15 + 44\,\lambda + 32\,\lambda^2)}{a^2(3 + 4\,\lambda)^2 - 8\,k\,(2 + 5\,\lambda + 3\,\lambda^2)^2} \tag{33}$$

The utility of the agricultural product retailer is:

$$u_2^F = \frac{2k(c - M)^2(1+\lambda)^3}{8k(1+\lambda)(2 + 3\lambda) - \alpha^2(3 + 4\lambda)^2} \tag{34}$$

Proposition 6: t E   and t F   mean with λ increases with the increase. Regardless of whether it is dominated by agricultural product suppliers or retailers, agricultural product retailing The increase of the quotient fairness concern coefficient will bring the optimal Increased cost- sharing, socially rational retailers want farm produce Product suppliers increase their investment in social responsibility to gain more profits.

Proposition 7: r F, p F, π_2^E with lambda increases with increasing ; w E, w F, π_1^E , π_1^F, π_2^F, π F   with lambda increase and decrease; r E, p E, πE _   not subject to lambda impact of change. agricultural product supplier When leading, the increase of the retailer's fairness concern coefficient will bring about increase the economic profit of food suppliers, and make the wholesale price of agricultural products Prices and supplier profits are reduced, but there will be no social responsibility for suppliers Input levels, retail prices of agricultural products, and overall supply chain

profit impact. At this time, the socially rational retailer raises the cost Share ratio, get feedback from suppliers lowering wholesale prices of agricultural products Feedback, resulting in an increase in the retailer's profit and an increase in the supplier's profit reduce . Fairness Concerns for Produce Retailers When Retailers Dominate The increase in the number will bring about the level of suppliers' social responsibility input and agricultural The increase in the wholesale price of products, and make the wholesale price of agricultural products, Declines in supplier profits, retailer profits and overall supply chain profits low . At this time, socially rational retailers can promote social responsibility by cost-sharing ratio and negotiate with suppliers to reduce agricultural production The wholesale price of products, and at the same time, due to the increase in investment in social responsibility, An increase in the retail price of agricultural products and a decrease in the quantity demanded, by sacrificing both The way of benefiting each other improves the fairness of cooperation.

6. COMPARISON BETWEEN MODELS

Comparing the optimal decisions of different models, it can be concluded that The following conclusions:

Conclusion 1: $r_B > r_A$, $r_D > r_C$, $r_F > r_E$. Description None Regardless of the rationality of agricultural product retailers, there will be retailers Under the leadership, suppliers invest more in social responsibility than agricultural product suppliers dominant situation. Because, with social responsibility investment will inevitably increase The quality of agricultural products increases consumers' willingness to purchase, so zero When the power of the seller is greater than that of the supplier, the retailer of agricultural products will cooperate of agricultural product suppliers have certain requirements for social responsibility inputs, while agricultural Product suppliers will also take the initiative to increase investment in order to obtain cooperation opportunities.

Conclusion 2: $t_B > t_A$, $t_D > t_C$, $t_F > t_E$. Description no matter what kind of rationality is the retailer of agricultural products in? The optimal cost sharing ratio of social responsibility is more than that under the leadership of suppliers share ratio. When the retailer dominates, more profits are obtained, so More sharing of social responsibility costs is conducive to motivating suppliers to undertake social responsibility. Will be responsible, meet consumer demand, and then increase sales to obtain more profit.

Conclusion3 : $\pi_1^A > \pi_1^B$, $\pi_2^B > \pi_2^A$, $\pi^B > \pi_A$. illustrate When Produce Retailers Are Economically Rational, When Suppliers Dominate own profit is greater than the supplier's profit when the retailer dominates, zero The seller is also the most profitable when he is in charge. agricultural product retailer The total profit of the supply chain led by the supply chain is higher than that of the supplier- led Run. This is due to the fact that suppliers' social The amount of input will be larger, and the sales volume of agricultural products will be larger .

Conclusion 4: $\pi_1^C > \pi_1^D$, $\pi_2^D > \pi_2^C$, $\pi_D > \pi_C$ $(\theta < \theta_a)$, $\pi_C > \pi_D$ $(\theta > \theta_a)$. Explain that when produce retailers are in production

rationality exists, the profit of the supplier when he owns the dominance The gain is greater than the profit led by the retailer, and the retailer is also its own Profit is greatest when dominant. consumer surplus at agricultural retailers Supply chains dominated by produce retailers when less attention is paid The total profit is higher than the case where the agricultural product supplier dominates. because, this When the agricultural product retailer only makes a small amount in order to increase consumer surplus Therefore, the result is closer to the retailer's economic rationality . When agricultural product retailers pay more attention to consumer surplus, The total profit of the agricultural product supply chain led by retailers is lower than that of agricultural products gross profit led by suppliers . Because, at this time, produce retailers In order to increase consumer surplus and make a large profit concession, by increasing Increase the wholesale price of agricultural products to encourage suppliers to increase social responsibility investment, And significantly reduce the retail price of agricultural products, leading to a decrease in their own profits, but increased consumer satisfaction.

Conclusion 5: $\pi_1^E > \pi_1^F$, $\pi_2^F > \pi_2^E$ $(\lambda < \lambda_a)$, $\pi_2^E > \pi_2^F$ $(\lambda > \lambda_a)$, $\pi_F > \pi_E$ $(\lambda < \lambda_b)$, $\pi_E > \pi_F$ $(\lambda > \lambda_b)$. It shows that when the agricultural product retailer is socially rational, the supplier is The profit obtained when the company owns the dominant power is greater than that obtained by the retailer's dominant power. earned profit. Produce retailers have the upper hand, and produce When the retailer's fairness concern coefficient is small, the retailer's profit and supply The total chain profit is greater than the supplier-led case. when produce retails When the coefficient of retailer fairness concerns is large, the retailer's profit and the total supply chain Margins are smaller than in a vendor-led situation. This is due to zero agricultural When the seller 's pursuit of fairness is relatively weak, the retailer's profit and The total profit of the supply chain is greater than that of the supplier-led situation. with retail Traders are increasingly pursuing fairness, and when retailers dominate, agricultural product retailers are In order to pursue fairness, they do not hesitate to reduce their own profits at the cost of in a supplier -led situation. Because no matter what power structure under these conditions, retailers' pursuit of fairness will bring about agricultural product supply decrease in business profits. According to the above analysis, retailers dominate the The overall profit of the supply chain will also be damaged, and when retailers dominate the supply chain The overall profit of the chain is lower than the overall profit of the supply chain when the supplier dominates.

Conclusion 6: $U2^{B} > U2^{A}, U2^{D} > U2^{C}, U2^{F} > U2^{E}$. explain ming as the dominant retailer, for whatever rational reason, obtains utility is always higher than when the supplier dominates. Therefore, for In pursuit of maximizing their own utility, agricultural product retailers should actively pursue dominance in the supply chain.

7.NUMERICAL ANALYSIS

In order to present the research results more intuitively, this study adopts specific An example is used to further verify the above conclusions. Suppose M =100, k =2, c =5 And it has been verified that the range of the above parameter settings satisfies The conditions under which the optimal solution exists for the model

take α is an independent variable, a ∈ (0,1), the retailer of agricultural products When the economy is rational, the wholesale price of agricultural products, retail price, supplier CSR investment, retailer's optimal cost sharing ratio,Each node in the supply chain and the overall profit vary with a see the changes.

It can be seen that consumers are willing to pay for the purchase Pay more for agricultural products provided by more social agricultural product suppliers high prices, and suppliers will also Assuming more social responsibilities, the corresponding increase in costs also brings an increase in wholesale prices . When suppliers dominate, economically rational farmers Product retailers in order to obtain more profits and maintain good relations with suppliers A good cooperative relationship, choose to share more costs of social responsibility. enterprise The amount of social responsibility investment has a positive effect on each node of the supply chain and the overall profit. This positive effect is more obvious when the retailer dominates Significantly . That is, when the retailer dominates, as the primary decision Retailers of agricultural products should choose agricultural product suppliers who are willing to undertake more corporate social responsibilities.

On the basis of the above parameter setting, let α =0.5, the agricultural product When commodity retailers survive rationally, the wholesale price and retail price of agricultural products price, suppliers' corporate social responsibility investment, retailers' optimal cost Cost sharing ratio, supply chain nodes and overall profit, and retail The quotient utility varies with θ see the changes.

It can be seen that, in cooperation with existentially rational retailers, Regardless of the prevailing situation, the interests of agricultural product suppliers will increase. plus . Survival rational produce retailers in order to make consumers feel Satisfaction, increase consumer surplus, selection incentives for agricultural product suppliers Assume social responsibility, reduce the retail price of agricultural products and make profit concessions Behavior. Especially when suppliers dominate, produce retailers gain The profit is low, and excessive profit sharing may seriously damage one's own interests . Therefore, agricultural product retailers should pay more attention to consumer surplus In order to maximize utility, it should not seriously damage its own economic profit .

agricultural product retailers are socially rational, the wholesale price of agricultural products, Retail price, supplier CSR investment, retailer The optimal cost sharing ratio, each node in the supply chain and the overall profit, and and retailer utility varies with λ see the changes.

It can be seen that working with socially rational retailers, Regardless of the prevailing situation, the interests of agricultural product suppliers will be affected loss . More sharing of social responsibility costs by agricultural product retailers does not stimulate Encourage suppliers to increase social responsibility investment. When retailers dominate, farmers Product retailers' focus on fairness has a more pronounced impact, With increasing focus on fairness, the amount of supplier social responsibility investment lower, the overall profits of agricultural product retailers, suppliers and supply chains Damaged . Therefore, when retailers dominate, produce retailers should Avoid excessive social rationality. When the supplier leads, with the public Increased level of attention, greater utility for produce retailers and more economic profit without compromising supplier social responsibility investment Intake and consumer demand [17] . Therefore, when the supplier dominates, ensure that Being socially rational can help retailers make more money.

8.CONCLUSION

The research group studied the socially responsible agricultural product supply Multi-rational agricultural products that provide suppliers and share social responsibility costs An agricultural product supply chain composed of commodity retailers has established an agricultural product supply chain Under the circumstances that suppliers and retailers are respectively dominant, retailers are pluralistically rational Supply chain social responsibility cost sharing and pricing decision-making model under the situation type, and comparatively analyzed the influence of retailers' multiple rationality on suppliers' optimal social Amount of social responsibility, retailer's optimal cost sharing ratio, supply Chain optimal pricing decisions and the impact of supply chain members' profits. with the first The previous research only analyzed the effect of cost sharing, this study will zero Vendor 's Optimal Cost-Sharing Ratio as a Decision in Agricultural Product Supply Chain Variables to examine how they change under different circumstances. different from Most studies on pricing decisions in agricultural product supply chains single Considering the situation of retailers' economic

rationality, this research starts from the perspective of multiple rationality Research on the decision-making of agricultural product retailers and the overall impact of cooperative suppliers and supply chains.

The main conclusions are as follows: 1) Whether the agricultural product suppliers or Under the situation dominated by retailers, suppliers' social responsibility will bring The increase in the wholesale and retail prices of agricultural products will help farmers Increase in the profits of the product supply chain as a whole and each member. 2) Agricultural products The dominance of product suppliers and retailers in the supply chain determines the From the profit situation, that is, whoever dominates gets more profit. and agricultural products When retailers dominate, suppliers will Take more social responsibility. 3) Led by agricultural product suppliers, Economically Rational Agricultural Product Retailers Will Share Social Responsibility Costs The willingness is relatively low, but the supplier's social responsibility investment is increased through the sharing ratio. enter. Under the leadership of retailers, an economically rational retailer of agricultural products The willingness to share responsibility and cost is high, and the social responsibility under its leadership The sharing ratio is the optimal solution of its own economic profit, therefore, zero Sellers will not use incentives to increase the share of social responsibility Suppliers increase social investment. 4) Retailers with Survival Rationality Cooperation will help increase the profits of agricultural product suppliers. supplier master Under the guidance, survival rational agricultural product retailers will increase cost sharing Ratio incentivizes suppliers to take on more social responsibilities and reduce agricultural output retail prices of goods to increase consumer surplus. led by retailers, Survival- rational produce retailers will not change the higher cost burden ratio, but it will increase consumer surplus by way of substantial profit reduction Yu . 5) Work with socially rational retailers that lead to produce Supplier profits suffer. Under the leadership of suppliers, socially rational farming Product retailers will increase their share of social responsibility costs to This has received feedback from suppliers for lowering wholesale prices of agricultural products. retail Under the leadership of merchants, socially rational agricultural product retailers improve their social Social responsibility will instead make suppliers reduce social responsibility investment and make farmers Wholesale prices of products are reduced and retail prices are increased. to reduce at the same time The way of profit for both parties is to pursue their own fairness.

The management enlightenment of this study lies in: 1) From the supply chain of agricultural products
From the point of view, the social responsibility of suppliers should be improved through system design investment, including the establishment of a supply chain corporate social responsibility disclosure mechanism, Strengthen the government's taxation and administrative measures, as well as media reports and market The use of means such as field education has promoted the development of agricultural products supply chain enterprises In the game between the pursuit of economic benefits and social responsibility, the Rationally and proactively assume responsibility for improving the supply chain as a whole and its members profits . 2) From the perspective of agricultural product suppliers, due to the supply When the business is in a dominant position, social responsibility investment will help its own profits Suppliers should take the initiative to pursue dominance in the supply chain. exist When choosing a retailer, priority should be given to choosing a retailer that survives rationally. Avoid working with socially rational retailers . 3) From the retail of agricultural products From the perspective of suppliers, the cost sharing of agricultural product suppliers' social responsibilities The ratio is not bigger is better. When self-dominated, economic rationality is zero Sellers cannot improve their own economic interests through social responsibility sharing. benefits ; when suppliers dominate, economically rational retailers can Increase the proportion of cost sharing to enhance their own economic interests. in its own Leading time, survival and rational retailers need to pay more attention to consumer surplus balance, to achieve a balance between consumer satisfaction and profit ; When leading, for the sake of its own economic profit and business safety, survival rationality of produce retailers need to be moderate in their focus on consumer surplus, Avoid loss of economic profit. When self-dominated, socially rational Produce retailers, should refrain from chasing after Behaviors seeking fairness ; socially rational farmers when suppliers dominate Product retailers should actively pursue fairness without prejudice to consumers While improving their own utility and economic interests. in this topic only a single agricultural product supplier and retailer were considered in the research of the group In the case of cost sharing between multiple retailers, future studies can or the situation of supplier competition and the relationship between suppliers and retailers The impact of establishing other cooperation contracts on supply chain coordination .

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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