

Game Analysis of Reverse Logistics in B2C Market

Qinglan Sun^{1, a}, Xiangli Jin^{1, b}, Yuquan Kang^{2, c} and Zhaoru Liu^{1, d}

¹School of management, Xi'an University of Science & Technology, Xian 715400, China

²School of Economic and Management, Xi'an University of Technology, Xian 710032, China

^alilysql@163.com, ^b646552074@qq.com, ^ckyquan@163.com, ^d190761463@qq.com

Abstract

B2C companies reverse logistics services have a certain influence on purchasing decisions for consumers, different attitudes and decision-making between businesses and consumers would eventually affect the subsequent sales and evaluation, how to analyze and balance the interests of both becomes one of the important issues. In this paper, B2C market existing reverse logistics model is analyzed at the first, established the game model, and analyzed the earnings of consumer and corporate in different policy choice, looking for Nash equilibrium point between B2C businesses and consumers. Finally, it put forwards the development countermeasures of reverse logistics of B2C businesses.

Keywords

B2C, reverse logistics, game.

1. Introduction

In recent years, B2C (Business to Consumer) e-commerce transaction model is developing rapidly, competition among merchants is fierce, sellers compete in product quality, while also supporting services launched a fierce competition. Studies have shown that convenient and efficient return policy for the smooth development of the retail network of some help. The survey of company Harris Interactive shown that 90 percent of consumers said that if the return and implementation process of electricity supplier website is convenience is a great reference value for consumers deciding whether to buy; 85% of consumers believe that if the return process is not easy, it is unlike to the shop to buy goods; while 81% of consumers will treat the convenience degree of return as reference factors during choosing shop. Therefore, B2C enterprises should provide good quality goods and also should enhance after-sale service, improve the management level of reverse logistics, so as to enhance customer satisfaction and increase revenue.

2. Research Status

Most existing research of electricity supplier reverse logistics start research from problems, countermeasures and so on, such as Cai Mei et al. (2008) for return reverse logistics in B2C e-commerce environment, propose differentiation return strategy, emphasis on information network construction, strengthening supply chain management and other recommendations. Du Hong (2010) analysis of the causes of reverse logistics in B2C environment and its role, he gave recommendations and strategies for reducing the probability of reverse logistics in the B2C electrical business mode. Wu Zhifeng (2011) started his research from the traditional reverse logistics and returns processing outsourcing and B2C reverse logistics way was interpreted. Another type of research use Game Analysis on reverse logistics process of e-commerce and the main relationship, such as Li Jinyong et al. (2007) constructed static and dynamic models of reverse logistics implementation, and do some analysis. Zhuang Xiaojing et al. (2009) conducted Game Analysis and Countermeasures for the B2C e-commerce environment under asymmetric information problem that should strengthen the role and the government. Yuan Xiaoming et al. (2009) using game theory to reverse logistics integration model were analyzed. Wang Shilei et al. (2011) use evolutionary game theory to build a government and enterprises evolutionary game model to analyze the role of government regulation in Enterprise

Reverse Logistics. In summary, reverse logistics issues for the electricity supplier macro level have been numerous studies, but specifically for the B2C market Reverse Logistics types, characteristics, and other aspects of the relationship between the various subject needs further deepen, this paper uses game theory relevant theory, B2C market reverse logistics issues for further study.

3. Reverse Logistics Model of B2C

Currently, B2C market reverse logistics modes are self reverse logistics business model, third-party reverse logistics model, strategic alliance-type reverse logistics mode and integrated solutions provider mode, as follows:

1) Enterprise self-management mode

Enterprise self-management mode refers B2C electricity supplier companies to build their own logistics company, solely responsible for their own business related logistics services. The advantage is that, B2C enterprises can fully grasp their own implementation process of reverse logistics, contact and communicate with customer directly, which is conducive to enterprise access to information, and establish a good relationship with customers. Compared to other reverse logistics models, it responses faster, deal with problems in a timely manner, the disadvantage is that large capital requirements, high investment costs.

2) Third party reverse logistics mode

Third party reverse logistics mode is to provide reverse logistics services from third-party logistics service providers. This model is low cost, is conducive to the development of commercial enterprises to focus on their core business. The cost of third-party reverse logistics mode is lower, but the disadvantage is that businesses and customers can not contact directly, could easily lead to information asymmetry between the two parties. And the third-party logistics business enterprises need demanding business ability, therefore, should be carefully chosen third-party logistics companies.

3) Strategic alliance-type reverse logistics mode

This mode refers to B2C companies and third-party reverse logistics company formed a strategic alliance partnership to jointly complete the implementation process of reverse logistics. This mode has the advantages, such as, low cost, in-depth cooperation, which is conducive to the smooth flow of information, and so on. The model will link up various enterprises, complementary advantages and disadvantages, resource sharing, but exist inter-enterprise credit risk and the difficulty of finding coalition partners between enterprises.

4) Integrated solution provider mode

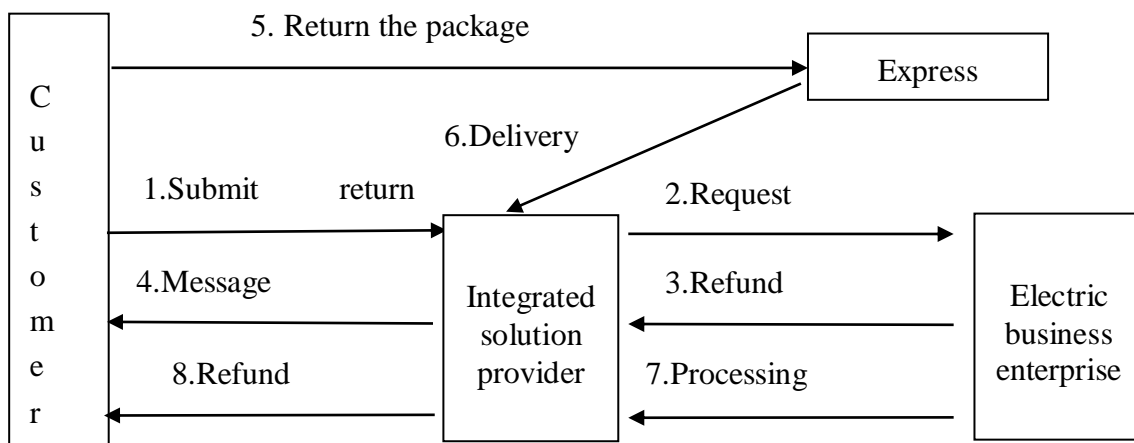


Fig. 1 Strategic alliance-type reverse logistics mode

Integrated solution provider mode is ISP mode (specifically shown in Figure 1), in this mode, the business of reverse logistics operations are outsourced .All operations are handled by the integrated

solution provider from the commodity delivered to the reverse logistics process , electric business enterprises just need select a suitable ISP, all of the business will be resolved by the contractor.

From the comparison of four reverse logistics model in B2C market, we can see that, the investment, operating costs and financial risks of enterprise self-mode is the largest, integrated solutions provider model required investment and operating costs were lower. In customer service, integrated solution provider model is best, poor self-employed business model. Enterprise self-mode has strong control over the business, and has strong ability on process control and information feedback, and the higher degree of Union, the process control capacity than weak, such as strategic alliances based reverse logistics mode, integrated service provider model. As shown in Table 1 below.

Table 1 Comparison of four kinds of reverse logistics modes

influential factors		enterprise self-management mode	third party reverse logistics mode	strategic alliance-type reverse logistics mode	integrated solution provider mode
finance	investment	high	a bit low	a bit low	lowest
	operating costs	high	a bit high	a bit high	a bit low
	financial risk	whole assumption	partial assumption	partial assumption	Little assumption
customer	convenience	a bit poor	good	good	moderate
	Service depth	a bit poor	general	good	best
	quality of service	general	general	good	good
learning and growing	competitive advantage	a strong control of business	convenient service	resources concentration	Highly integrated service project
	strategic alliance	none	simple alliance	complex alliance	high-degree alliance
internal operation	process control	strong	a bit strong	a bit weak	a bit weak
	information feedback	strong	a bit strong	weak	weak

The four kinds of reverse logistics mode in B2C market can be divided into two groups according to whether the third-party involved, namely, no third party involved in reverse logistics model (enterprise self-mode) and the participation of a third party reverse logistics model. There are third-party reverse logistics modes include the participation of third party reverse logistics model, strategic alliances based reverse logistics model and integrated solution provider mode. This article makes fully static information game analysis on have third party involvement and no third party involved in reverse logistics model respectively.

4. B2C market reverse logistics game agent analysis

B2C market reverse logistics behavioral agents generally includes three categories: consumer (including wholesalers and retailers), B2C companies and third-party logistics service providers. The three types of agent pursuit of different aimed profit, B2C electricity supplier companies provide products and services to consumers through the logistics activities to achieve the objective of maximizing corporate profits. The ultimate goal of consumer participation in the reverse logistics is to obtain satisfactory products and enjoy high-quality service. Third-party logistics service provider for commercial purposes, they provide logistics services to vendors and consumers.

The entire process of reverse logistics activities, consumer, B2C companies, third-party logistics service providers, game agents are of both competition and cooperation, the three parties in the transaction play different roles and have different behavior targets, in the process of seek their profit maximization, they need to cooperate with each other to complete the entire transaction process.

4.1 Enterprise self-management mode

If you follow the “checklist” your paper will conform to the requirements of the publisher and facilitate a problem-free publication process.

1) Model assumptions

① Suppose an independent game includes only two participants, B2C electricity supplier companies and consumers. Consumers have only two strategies either returned and replace substandard products or not returned. B2C business enterprises also have two strategies, or to provide a sound return reverse logistics channels, or do not accept returns.

② Assuming the entire process of e-commerce transactions, all of the participants are fully rational economic men, who at the same time participate in decision-making, and their income information are shared for each participant, and each game is independent.

③ Suppose enterprises need to pay the corresponding costs for implementing reverse logistics, companies do not implement reverse logistics will reduce customer satisfaction, it will cause some losses for the future development of the enterprise, and assuming the cost of implementation is less than the loss caused by reverse logistics is not implemented.

④ Assuming that when consumers receive unsatisfied goods, regardless of whether business has implemented the reverse logistics or not, the revenue of returned goods will be greater than the benefits obtained when not returned.

2) Establishment and analysis of game model

Under assumptions, this game can be seen as a complete information static game. Its payoff matrix shown in Table 2:

Table 2 B2C market for businesses and consumers pure strategy game payoff matrix

		B2C enterprise	
		Implement reverse logistics	Not implement reverse logistics
Consumer	Returned	$Ac_1, Ab_1 - C_1$	$Ac_2, Ab_2 - C_2$
	Not returned	$Ac', -C_1$	$Ac', -C_2$

$Ac_1, Ac_2, Ab_1, Ab_2, Ac_1', Ac_2', C$ are positive number greater than 0. C_1 represent the cost of enterprises provide a convenient channel for reverse logistics; C_2 represent the loss of B2C companies do not provide reverse logistics services. $Ac_1, Ab_1 - C_1$ respectively on behalf of the profit of consumers when they returned substandard products and the profit of enterprises when they implement perfect reverse logistics services, $Ac_2, Ab_2 - C_2$ respectively represent profits between consumers and enterprises when consumer choice to returned substandard goods while companies are not providing complete and convenient reverse logistics channel, Ac' represent the profit of consumers do not returned.

According to the assumption, when consumers returned goods, Enterprise Reverse Logistics will make consumers convenience, therefore there are $Ac_1 > Ac_2$, although as it is assumed that implement the reverse logistics enterprises will pay some costs, the losses caused by not implement reverse logistics for a long time will be greater, so implementing the reverse logistics will bring greater income, therefore $Ab_1 - C_1 > Ab_2 - C_2$. When consumers are not returned goods, regardless of whether the business enterprise implement reverse logistics or not, consumer benefits is Ac' , while B2C companies may to bear the possible greater risk of loss of C_2 , therefore, enterprises should choose to implement reverse logistics; Similarly, regardless of whether enterprises implement reverse

logistics or not, the best choice for consumers is to returned goods, so there is Nash equilibrium in this game(consumers returned goods, enterprise Reverse logistics), B2C companies can improve customer satisfaction and get good business reputation in the process of consumers returned goods.

4.2 Third-party participation in reverse logistics model

Actual operation, some B2C companies are constrained by size, strength and management capacity, and they select the reverse logistics model there is involvement of third-party logistics enterprise. As shown, the main actors of the reverse logistics mode are consumers, B2C companies, third-party logistics companies and financial clearing institutions, financial settlement institution only complete collection and refund mechanically according to the instructions of the B2C partner, it does not make decisions in the transaction and it is not included in game agents.

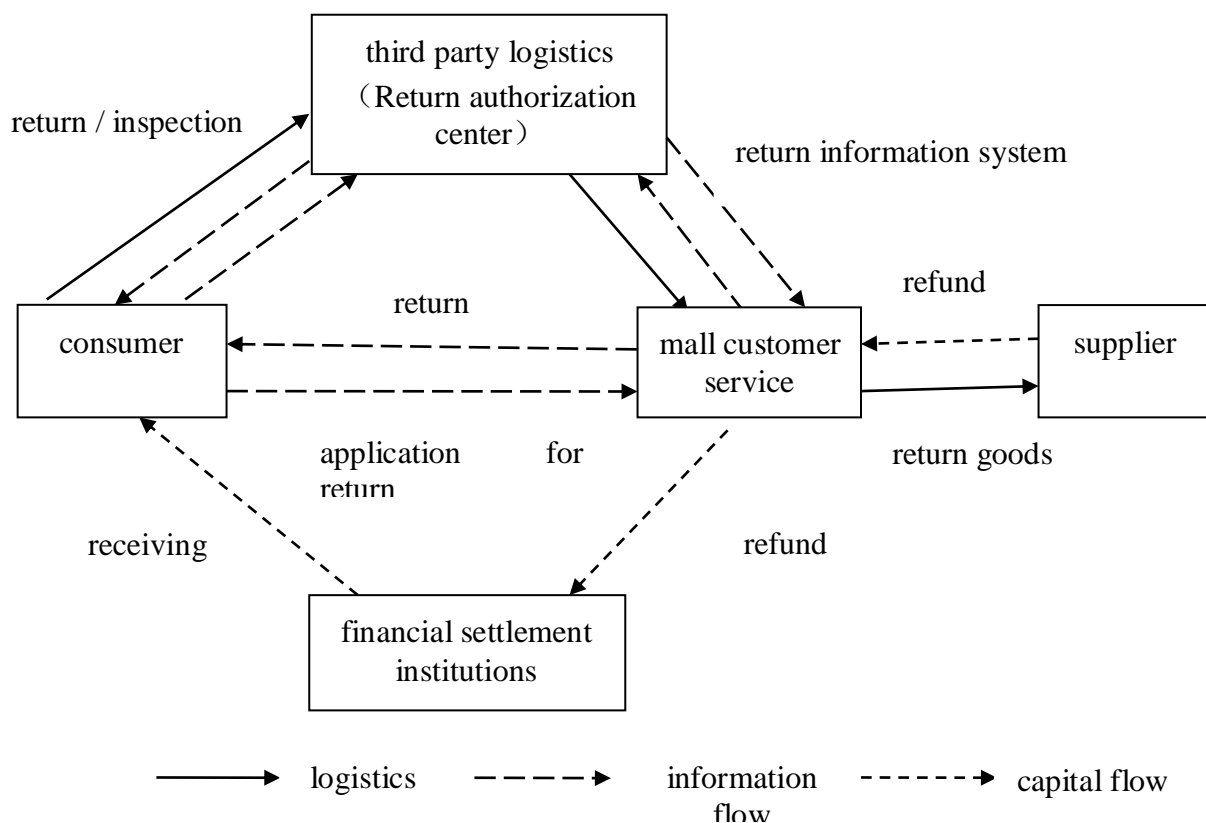


Fig. 2 Return modern e-commerce Reverse Logistics Model

1) Model hypothesis

- ① Suppose an independent game includes only two participants, B2C electricity supplier companies and consumers. Consumers only have two strategies, either returned substandard products or not returned. Two choices of B2C electricity supplier companies are there is third-party involvement in the reverse logistics model and there is not third-party involvement in the reverse logistics model.
- ② Assuming the entire process of e-commerce transactions, all of the participants are fully rational economic men, who at the same time participate in decision-making, and their income information are shared for each participant, and each game is independent.
- ③ Suppose enterprises need to pay the corresponding costs for implementing reverse logistics, third-party logistics companies have low-cost advantages because of specialization, it costs little than enterprises self-owned reverse logistics mode, and have large profits.
- ④ Suppose when consumers receive unsatisfactory or substandard goods, if they returned goods will make corresponding gains, if not, there is zero profit.

2) The establishment and analysis of the game model

ac1, ac2, ab1, ab2, ac', c are positive number greater than 0. ac1, ac2 respectively on behalf of the profit of consumers and enterprises when consumers choose to returned and B2C enterprises choose reverse logistics mode with third-party participation; b1, b2-c respectively on behalf of the profit of consumers and enterprises when consumers choose to returned and B2C enterprises choose reverse logistics mode without third-party participation, c on behalf of the risk cost of B2C companies when they choose reverse logistics mode without third-party participation. ac' represent the profit of consumers do not returned, based on the assumption, under complete information static game payoff matrix shown in Table 3.

Table 3 B2C market for businesses and consumers pure strategy game payoff matrix

		e-commerce enterprise	
		Third party participation	No third party participation
Consumer	Returned	ac ₁ , ab ₁	ac ₂ , ab ₂ -c
	Not returned	ac', 0	ac', -c

Ibid principle, it will be the Nash equilibrium, namely (ac1, ab1).

As consumers and commercial enterprises to make some kind of decision is not arbitrary, but reached under certain probability, so the game model is further extended to complete information mixed strategy game. Suppose consumers choose two pure strategies according to a certain ratio, B2C business enterprise also choose their own pure strategy according to a certain ratio. At the same time, in order to analyze simple, when consumers are not returned goods, suppose ac', the profit of B2C business enterprise, to be zero. Because when the goods are not satisfied or substandard quality and other reasons, the income is very low. Specific benefits matrix as shown in Table 4:

Table 4 B2C market, the two sides traded mixed strategy game payoff matrix

	e-commerce enterprise	
	Third party participation (q)	No third party participation (1-q)
Returned (p)	ac ₁ , ab ₁	Ac ₂ , ab ₂ -c
Not returned (1-p)	0, 0	0, -c

Here p, q are greater than or equal to 0 and less than or equal to 1, p on behalf of the probability of consumers choose to return goods, 1-p on behalf of the probability of consumers choose not to return goods; q on behalf of the probability of electric business enterprises choose reverse logistics mode with third-party participation, and the sum of probabilities should be 1; 1-q on behalf of the probability of electric business enterprises choose reverse logistics mode without third-party participation, and the sum of probabilities should be 1. The Nash equilibrium point can be calculated according to the reaction function.

Let U1 is the expected return of consumers; U2 is the expected return of B2C business enterprises. Here has:

$$U1 = pqac1 + p(1-q)ac2$$

$$= p[q(ac1-ac2) + ac2]$$

U1 is expectations of consumer, bigger are better. Because the B2C business enterprise of mixed strategy has been set to (q, 1-q), the best response function of consumers is as shown in Table 5:

Table 5 Best response function of consumers

Value of P1	Assumed condition
0	If $q(ac_1-ac_2)+ac_2 < 0$ equates $q < -ac_2/(ac_1-ac_2)$
[0, 1]	If $q = -ac_2/(ac_1-ac_2)$
1	If $q > -ac_2/(ac_1-ac_2)$

$$U_2 = pqab_1 + p(1-q)(ab_2 - c) - (1-p)(1-q)c$$

$$= q[pab_1 - pab_2 + c] + pab_2 - c$$

Similarly, considering the $[pc_2 - pb_2 + c]$, we can draw electricity supplier companies best response function as shown in Table 6:

Table 6 Best response function of e-commerce enterprise

Value of q	Assumed condition
0	If $pab_1 - pab_2 + c < 0$ equates $p > c / (ab_2 - ab_1)$
$[0, 1]$	If $p = c / (ab_2 - ab_1)$
1	If $p < c / (ab_2 - ab_1)$

In this case, M is the Nash equilibrium point of the mixed strategy in Cartesian coordinate system.

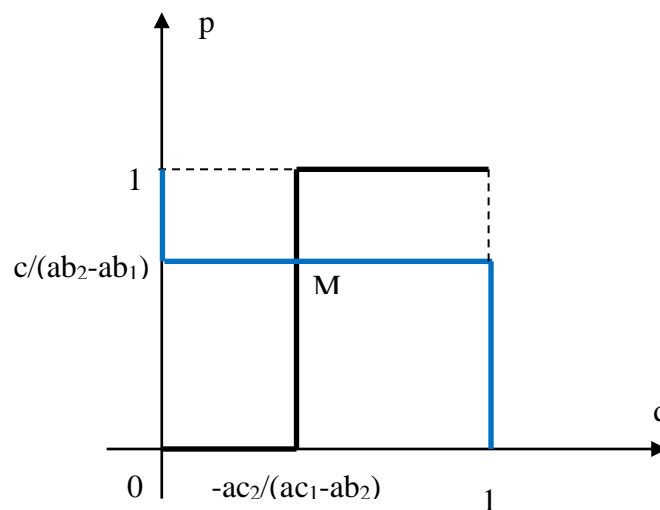


Figure 3 Consumer and B2C enterprise mixed strategy Nash equilibrium

Reaction function of mixed strategy of consumer and commercial enterprises in B2C market returns the mixed function Nash equilibrium is $(p, q) = [c / (ab_2 - ab_1), -ac_2 / (ac_1 - ac_2)]$. That Nash equilibrium is consumers returned goods which are not satisfied with by the probability of $p = c / (ab_2 - ab_1)$. The B2C choose reverse logistics which third party involved in by the probability of $q = -ac_2 / (ac_1 - ac_2)$ to deal with related business. As can be seen from Table 4 and Table 5, the other players' strategy is a function of income. When the c bigger, that is, when the electricity business enterprises adhere to choose reverse logistics without third-party participation, the risk cost it faces (investment too high, financial risk, inconvenience lead consumers do not buy it, etc.) is greater. However, in the network economy hits and keep those coming back are the roots of business enterprises' survival, so B2C companies can not only concerned with a transaction, but try to improve customer loyalty in this transaction, so that enterprises can achieve the goal of maximum long-term profit. As can be seen from the complete information static game analysis, under enterprise self-management reverse logistics mode, companies need to pay high cost and there is high risk, the consumer received the expected revenue associated with enterprise hardware level. Game analysis showed that when there is return business happen, the optimal strategy is to choose reverse logistics mode with third-party involvement.

5. B2C Enterprise Reverse Logistics Development Strategy

We can give following recommendations based on comprehensive results presented above:

First, B2C enterprises should pay attention to the construction of our return reverse logistics system. Through the game analysis of enterprise self-management reverse logistics mode can be seen, B2C business enterprise implement reverse logistics can get the maximum benefit.

Second, B2C companies should combine their own development situation to choose the reverse logistics mode. Self-built logistics companies, big one-time investment, require a strong logistics management capability, large financial risk and are not suitable for small and medium B2C businesses.

Third, B2C enterprises should actively pursue return policies if dissatisfied, improve customer satisfaction. Through the game analysis of enterprise self-management reverse logistics mode can be seen, if consumers are not satisfied with good and want to return but suffered cannot be returned, or it is inconvenient to returned, than the companies may bear the losses of $-C_2$. And if enterprises implement reverse logistics, and encourage consumers to return goods are not satisfied, the B2C business enterprise will be able to get the maximum benefit Ab_1-C_1 .

Fourth, B2C enterprises should cooperate with third party logistics. There are third-party involvement reverse logistics model had small investment costs, in the process of reverse logistics activities and complementary advantages and disadvantages of other parties; it is possible to reduce costs effectively. The results of Game Analysis of the Reverse Logistics Model with third-party involvement, for B2C businesses, consumers can get greater payment effectiveness under the reverse logistics mode with a third party involved in, and consumers will be more satisfied with the enterprise, thus bring potential payment benefits to the enterprise.

6. Conclusion

In reality, in B2C market transactions information is not symmetrical, likely to cause companies do not understand customers' needs and expectations, but also because customers cannot understand the business information and make inferior decisions. The results of this paper analyze show, for the smaller sized enterprises, reverse logistics mode with third-party involvement can save costs, increase efficiency and provide customers with convenient and efficient service.

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