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# The Inframarginal General Equilibrium Analysis of Production Structure in Instant Distribution Market

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## Abstract

**This article uses the new classical economic theory to analyze the different capacity organization modes in the instant delivery market, and summarizes the conditions for the existence of the four production structures (Platform self-operated, platform crowdsourcing, franchise, franchise crowdsourcing) in the instant delivery market. On this basis, based on the learning cost of the production process and the transaction efficiency factors of the objective market environment, an inframarginal general equilibrium model of the instant delivery market is constructed. Through the analysis of the model, the micro-mechanism and formation mechanism of the instant distribution companies adopting different capacity organization modes are obtained: Learning costs and market transaction efficiency determine the final production decisions of immediate delivery service producers and intermediate product producers, resulting in different capacity organization models. And the interaction of the decisions of these producers has formed a different production structure in the instant delivery market.**

## Keywords

**Instant Distribution; Inframarginal Analysis; Production Structure; Capacity Organization Model.**

## 1. Introduction

At present, consumers' demand for various fast-moving products is increasing, so the requirements for distribution efficiency and service quality are also increasing. The development of the new retail market and the pressure on the end of express delivery have also put forward new requirements for instant delivery in solving the problem of the "last mile" of logistics. With the increase in these demands and changes in requirements, the instant delivery market has developed more and more rapidly, which makes instant delivery become another fast-growing logistics market segment in addition to the express delivery market. The data shows that the scale of China's instant delivery industry alone has grown from 9.76 billion yuan in 2013 to 131.26 billion yuan in 2019, and the order volume has increased from 950 million orders in 2013 to 18.49 billion orders in 2019, and break through 24.3 billion orders in 2020[1]. After continuous development, the instant distribution industry has adopted different capacity organization modes in its production links: self-operated mode, franchise mode and crowdsourcing mode. The crowdsourcing model of the instant delivery market is to outsource the delivery tasks of orders to the mass idle capacity, which provides important help for instant delivery companies to replenish capacity and reduce costs to meet the delivery needs of instant delivery services. The self-operated model is to build the entire distribution link by itself and use the company's own capacity to provide services to the market, which guarantees the quality of the service, but the cost is relatively high. In addition to these two models, there are also instant delivery platforms that adopt the franchise model. This type of platform outsources the entire delivery link to a third-party

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capacity, which reduces certain operating costs while ensuring a certain level of delivery efficiency. These different organization modes of transportation capacity are bound to show different production structures in the production process of real-time logistics services.

The academic community's attention to instant delivery has also increased with the rapid development of the industry. From the perspective of network and distribution management, Hu Xiangpei and others analyzed a series of problems faced by logistics and distribution under the background of the current world economic environment, environmental protection needs and the rapid development of artificial intelligence[4]. Zhang Xiaoqin conducted a preliminary discussion on the connotation, model and development path of instant delivery, and pointed out that instant delivery related enterprises need to deepen the vertical market segmentation and standardize human resource management. Related departments also need to strengthen industry supervision and formulate industry standards. To ensure the good development of the instant delivery industry[5]. Xing Peng et al. used game theory to analyze the similarities and differences among the three modes of self-delivery, franchise platform delivery and merchant self-built platform delivery from the perspective of maximizing the profit of takeaway merchants[6]. Wang Lei conducted a simple comparative analysis of the operation mode and competitiveness of typical enterprises in the instant delivery industry, but did not further study the underlying reasons for these enterprises to adopt different modes[8]. However, most of the existing literature focuses on the research on the "route problem" or the "transport capacity scheduling problem" of instant delivery. This type of research solves specific problems in the distribution process by establishing models and improving algorithms.

Existing studies have positive significance for expanding academic research in the field of instant delivery, but this article believes that the rapid development of instant delivery and the emergence of different capacity organizations are essentially the result of the evolution of the division of labor. Therefore, if we can reveal the internal mechanism of the choice of the instant distribution capacity organization model from the perspective of specialization and division of labor, and clarify the interaction mechanism between the organizational model and the production structure, it will help the instant delivery market to build a reasonable production structure with a reasonable division of labor. And it will help promote the further development of the industry.

The new classical economics proposed by Yang Xiaokai uses the inframarginal analysis method from the perspective of division of labor, which has very good and effective characteristics for solving this complex division of labor[9]. Yao Shujie analyzed the relationship between technology, system and the change of logistics organization based on the new classical economics[10]. In the research of this article, the self-employment model is regarded as an integrated operation without division of labor, and the platform enterprises produce instant delivery services through internalized production. The franchise model and crowdsourcing model are two different forms of outsourcing after platform companies outsource part of the production of instant delivery services to others in the market for division of labor. Based on this, this paper establishes an inframarginal general equilibrium model of the instant delivery market. Through the analysis of this model, it analyzes the law of changes in the instant delivery market's production structure at a micro level. It also introduces changes in learning costs and transaction efficiency, and further analyzes the interaction mechanism between the immediate distribution market capacity organization mode, production structure and the objective environment.

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## 2. Individual Decision-making and Market Structure

To establish an inframarginal general equilibrium model of the production links in the instant distribution market, it is necessary to summarize and abstract various possible production, purchase and sales decisions from the different capacity organization modes of the production links in the current instant distribution market, and explore diversification market structure. In the production of an instant delivery market, there is an instant delivery service ($R$) that is a final consumer product necessary for everyone. In addition to the necessary labor $l_R$, its production also requires an indispensable product input--capacity allocation plan ($y$). The production of the capacity allocation plan requires further processing on the capacity ($x$) through labor $l_y$. Capacity can be obtained simply by labor $l_x$. Therefore, $y$ is the intermediate input used to produce $R$, and $x$ is the intermediate input used to produce $y$. Corresponding to reality, $l_x$ represents the logistics work performed by the delivery staff, $l_y$ is the organization and management of the delivery staff in accordance with the "instant" requirements, and $l_R$ is the operation of the instant delivery platform and the sale of services.

Obviously, $x$, $y$, and $R$ can be produced by themselves or purchased from others in the market. With the difference between "do" and "buy" decisions, everyone can have 6 decisions to satisfy consumer demand for R[10]: 1) Integrated platform Decision-making. This kind of decision is an instant delivery platform using a self-operated model. They carry out the production of capacity $x$ and capacity allocation plan $y$ by themselves, so as to produce $R$ to meet their own needs, which is a state of self-sufficiency; 2) Part of the professional platform Decision-making. This type of decision is an instant delivery platform that uses a crowdsourcing model. Different from the self-operated model, they crowdsource the capacity $x$, but they still need to organize and manage these crowdsourcing distributors themselves to meet the production of the capacity allocation plan $y$, and finally produce $R$ to meet their own and sales needs; 3) Delivery Decision-making. It is the crowdsourcing dispatcher who makes this decision. Because they do not have the conditions to carry out other links of production, they specialize in the production of capacity $x$ and sell them on the market, thus buying $R$ to meet their own needs; 4) Specialized platform Decision-making. The decision was adopted by the instant distribution platform that adopted the franchise model. This type of model outsources the production of the capacity allocation plan $y$ to franchisees, and only specializes in the operation of the self-platform and the sale of services, so as to meet the needs of oneself and the sale of $R$; 5) Integrated franchise Decision-making. It is the franchisees of the instant delivery platform that use this decision. They cooperate with large real-time distribution platforms in the form of franchise or agency, contract the production of capacity allocation plan y, and buy R from the market to meet their own needs; 6) Specialized franchise Decision-making. This decision is also adopted by franchisees, but when they produce capacity allocation plan $y$, they crowdsource capacity $x$, and finally conduct specialized production and sale $y$ and buy $R$ from the market to satisfy their own needs.

These six types of decisions interact with each other in the evolving timely delivery market, and can endogenously form 4 different production structures:

1. Platform self-operated structure, by adopting the integrated platform Decision-making, that is, the internal production of the instant distribution platform of the self-operated model can complete the production of $R$. Obviously, in this structure, no transactions occur in the production link.

2. The platform crowdsourcing structure, consists of a partially specialized instant delivery platform and crowdsourcing dispatchers. Here, crowdsourcing distributors professionally provide the production of capacity $x$, but they need to purchase $R$ to meet their own consumption. Correspondingly, the platform purchases $x$ from the crowdsourced delivery staff, produces $y$ through internalization, and then produces the instant delivery service $R$,

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both for its own consumption and for sale to the market. It can be seen that in this structure, there is a transaction between the capacity $x$ and the instant delivery service $R$, but the production of the capacity allocation plan $y$ is still the internal production of the instant delivery platform.

3. The joining structure is composed of an instant delivery platform that adopts professional Decision-making and franchisees that adopt integrated joining Decision-making. The difference from the second platform crowdsourcing structure is that the instant delivery platform purchases $y$ from franchisees, and then conducts specialized production of instant delivery service $R$ to meet the needs of itself and the market. At this time, the franchisee internalizes the production of capacity $x$, then produces capacity allocation plan $y$, and then sells $y$ to the market to buy $R$ to meet their own needs. In this structure, both the capacity allocation plan $y$ and the instant delivery service $R$ have transactions, but the production of capacity $x$ is the internal production of franchisees.

4. Join crowdsourcing structure is a structure produced by franchisees who adopt specialized franchise Decision-making after crowdsourcing the production of capacity $x$. At this time, there is a state of "complete division of labor", crowdsourcing distributors professionally provide $x$, franchisees professionally provide $y$, and the entire instant delivery market is professionally produced and supplied by the instant delivery platform that adopts the franchise model. Under this structure, the capacity $x$, the capacity allocation plan $y$ and the instant delivery service $R$ all have transactions.

## 3. Inframarginal General Equilibrium Model of Instant Delivery Market

Consider that there are $M$ producers/consumers in an instant delivery market, and they need an instant delivery service $R$. In addition to the labor input required to produce the final instant delivery service $R$, it also requires the input of a professional product capacity allocation plan $y$; and the production of the capacity allocation plan $y$ requires product capacity x and a certain amount of labor input. The production function of $x$ is:

$$x^P = x + x^s = Max\{0, l_x - a\}$$

$x^P, x, x^s \geq 0$ are the output, self-consumption and sales of capacity $x$, respectively; $l_x \in [0,1]$ is the share of labor input used by individuals to produce $x$. $a \in [0,1]$ is the learning cost parameter of $x$ production. Through further organization and management of the capacity $x$, the capacity allocation plan $y$ can be produced, and its production function is:

$$y^P = y + y^s = Max\{0, (x + kx^d)^\beta (l_y - b)^{1-\beta}\}$$

$y^P, y, y^s \geq 0$ are the output, self-consumption and sales of the capacity allocation plan $y$, respectively; $l_y \in [0,1]$ is the share of labor input used by individuals to produce technology $y$. $b \in [0,1]$ is the learning cost parameter of producing $y$. The parameter $\beta \in [0,1]$ represents the relative share of transport capacity and labor input in the production of $y$. In the production of capacity allocation scheme $y$, when crowdsourcing is used to purchase intermediate product capacity $x$ from the market, because a transaction occurs, there is a loss caused by transaction costs $(1 - k)$, so the final quantity purchased from the market is $kx^d$. Here $k$ is the transaction efficiency of the market. The size of the transaction efficiency reflects the impact of the institutional environment on the instant delivery market. The better the

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institutional environment, the higher the transaction efficiency. Therefore, the final production function of instant delivery service is:

$$R^P = R + R^s = Max\{0,\ (y + ky^d)^\alpha (l_R - c)^{1-\alpha}\}$$

$R^P, R, R^s \geq 0$ are the output, self-consumption and sales volume of the final product instant delivery service $R$ respectively; $y^d \geq 0$ is the quantity of the product capacity allocation plan $y$ purchased from the market. $l_R \in [0,1]$ is the share of labor input used by individuals in the production of the final product $R$. $c \in [0,1]$is the learning cost parameter of product $R$ production. The parameter $\alpha \in [0,1]$ reflects the relative share of intermediate products and labor input in $R$ production. Since three kinds of production activities are involved, the personal time endowment constraint is the time constraint of personal production:

$$l_R + l_x + l_y = 1$$

The budget constraints are:

$$P_R R^s + P_x x^s + P_y y^s = P_R R^d + P_x x^d + P_y y^d$$

$P_R,\ P_x,\ P_y,\ P_z \geq 0$ are the transaction prices of each product in the market. The final producer-consumer utility function is:

$$U = R + kR^d$$

s.t.

$$R^P = R + R^s = Max\{0,\ (y + ky^d)^\alpha (l_R - c)^{1-\alpha}\};$$

$$x^P = x + x^s = Max\{0, l_x - a\};$$

$$y^P = y + y^s = Max\{0, (x + kx^d)^\beta (l_y - b)^{1-\beta}\};$$

$$l_R + l_x + l_y = 1;$$

$$P_R R^s + P_x x^s + P_y y^s = P_R R^d + P_x x^d + P_y y^d.$$

## 4. Model Solving and Analysis

Based on the above model, we solve the six Decision-making maximization problems mentioned above.

1) Integrated platform Decision-making: using the self-operated instant delivery platform, there is no market exchange, that is, $R^P = R, x^P = x, y^P = y$, and the other parameters are all equal to 0. Its utility is:

$$U_{Rxy} = R^d = (1 - a - b - c)(\alpha\beta)^{\alpha\beta}(1 - \alpha)^{1-\alpha}(\alpha - \alpha\beta)^{\alpha-\alpha\beta}$$

2) Part of the Decision-making on specialized platforms: use a crowdsourcing model of instant delivery platform. They crowdsource the capacity $x$ ($x^d > 0$), but they still need to train and manage these crowdsourced dispatchers themselves to meet the production capacity

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allocation plan $y$ ($y^P = y > 0$), and finally produce $R$ to meet the needs of oneself and sales ($R^P > 0, R^S > 0$), the other variables are 0, and the utility is:

$$U_{Ry/x} = R = (1-b-c)\left[(\alpha-\alpha\beta)^{\alpha-\alpha\beta}(1-\alpha)^{1-\alpha}\left(\frac{P_R}{P_x}\alpha\beta k\right)^{\alpha\beta}\right]^{\frac{1}{1-\alpha\beta}}$$

3) Delivery and package decision: Independent crowdsourcing distributors who provide transportation capacity in the market only provide the production and sale of transportation capacity products, that is, $l_x = 1, x = 0, x^P = x^S$, and other variables are 0, its utility is:

$$U_{x/R} = \frac{P_x}{P_R}k(1-a)$$

4) Specialized platform decision: adopt the instant distribution platform of the franchise model. This type of decision outsources the production of capacity allocation plan $y$ to franchisees ($y^d > 0$), and only conducts self-platform operation ($R^P > 0, R^S > 0$), so as to satisfy the needs of oneself and selling *R*. Its utility is:

$$U_{R/y} = (1-\alpha)(1-c)\left(\frac{P_R}{P_y}\alpha k\right)^{\frac{\alpha}{1-\alpha}}$$

5) Integrated franchise decision: integrated franchisee. By joining the production of contracting capacity allocation plan $y$ ($y^P = y > 0$), they internalized the production of capacity *x* ($x^P = x > 0$), and bought R from the market to meet their own needs. Its utility is:

$$U_{xy/R} = k\beta^{\beta}(1-\beta)^{1-\beta}(1-a-b)\frac{P_y}{P_R}$$

6) Specialized franchise Decision-making: professional franchisees who adopt the crowdsourcing model, buy capacity ($x^d > 0$), production capacity allocation plan $y\, y^P = y > 0$), and buy *R* from the market, to meet their own needs. Its utility is:

$$U_{y/Rx} = k(1-\beta)(1-b)\frac{P_y}{P_R}\left(\frac{P_y}{P_x}k\beta\right)^{\frac{\beta}{1-\beta}}$$

Everyone chooses different decisions and interacts with each other in the market, then under certain conditions, the aforementioned "①Platform Self-support Structure (PS)" and "②Platform Crowdsourcing Structure (PC)", "③Joining structure (J)" and "④Joining crowdsourcing structure (JC)" These four organizational structures are balanced. This condition is the corner solution equilibrium condition, which are:

1. No intra-market interaction;

2. $U_{x/R} = U_{Ry/x}, M_{Ry/x}\, R^S = M_{x/R}\, R^d$(or $M_{x/R}\, x^s = M_{Ry/x}\, x^d$);

3. $U_{xy/R} = U_{R/y}, M_{R/y}\, R^S = M_{xy/R}\, R^d$(or $M_{xy/R}\, y^s = M_{R/y}\, y^d$);

4. $U_{x/R} = U_{y/Rx} = U_{R/y}, M_{R/y}\, R^S = M_{x/R}\, R^d + M_{y/Rx}\, R^d$,

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$M_{x/R}\, x^s = M_{y/Rx}\, x^d, M_{y/Rx}\, y^s = M_{R/y}\, y^d.$

Based on the above conditions, the equilibrium relative price, equilibrium relative number of people and per capita utility in these four structures are solved. The results are shown in Table 1. Furthermore, based on the sufficient conditions for the existence of inframarginal general equilibrium, the situation of platform self-support structure must meet $U_{PS} > U_{PC}, U_{PS} > U_J$ and $U_{PS} > U_{JC}$ respectively; platform crowdsourcing structure requires$U_{PC} > U_{PS}, U_{PC} > U_J$ and $U_{PC} > U_{JC}$; The joining structure requires $U_J > U_{PS}, U_J > U_{PC}$ and $U_J > U_{JC}$; the joining crowdsourcing structure requires $U_{JC} > U_{PS}, U_{JC} > U_{PC}$ and $U_{JC} > U_J$. According to these requirements, the static analysis results of general equilibrium and inframarginal are obtained, which are presented in Table 2.

**Table 1.** Equilibrium relative prices, relative numbers, and per capita utility

| Structure | Relative price | Relative number | Per capita utility |
|---|---|---|---|
| PI | N/A | N/A | $(1-a-b-c)\theta$ |
| PC | $\frac{P_x}{P_R} = k^{2\alpha\beta-1}\left(\frac{1-b-c}{1-a}\right)^{1-\alpha\beta}\theta$ | $\frac{M_{x/R}}{M_{Ry/x}} = \frac{\alpha\beta k}{1-\alpha\beta}$ | $k^{2\alpha\beta}(1-a)^{\alpha\beta}(1-b-c)^{1-\alpha\beta}\theta$ |
| J | $\frac{P_R}{P_y} = k^{1-2\alpha}\left[\frac{\beta^\beta(1-\beta)^{1-\beta}(1-a-b)}{\alpha^{\frac{\alpha}{1-\alpha}}(1-\alpha)(1-c)}\right]^{1-\alpha}$ | $\frac{M_{xy/R}}{M_{R/y}} = \frac{\alpha k}{1-\alpha}$ | $k^{2\alpha}(1-a-b)^{\alpha}(1-c)^{1-\alpha}\ \theta$ |
| JC | $\frac{P_y}{P_x} = \frac{1}{(\beta k)^\beta}\left[\frac{1-a}{(1-\beta)(1-b)}\right]^{1-\beta}$<br>$\frac{P_y}{P_R} = \frac{(k)^{\alpha-\beta(1-\alpha)-(1-\alpha)}}{\beta^\beta(1-\beta)^{1-\beta}}\frac{(1-c)^{(1-\alpha)}}{(1-a)^{\beta(1-\alpha)}(1-b)^{(1-\beta)(1-\alpha)}}\theta$<br>$\frac{P_x}{P_R} = k^{(\alpha+\alpha\beta)-(1-\alpha)}\frac{(1-c)^{1-\alpha}(1-b)^{\alpha(1-\beta)}}{(1-a)^{1-\alpha\beta}}\theta$ | $\frac{M_{x/R}}{M_{y/Rx}} = \frac{\beta}{1-\beta}$<br>$\frac{M_{y/Rx}}{M_{R/y}} = \frac{\alpha(1-\beta)k}{1-a}$<br>$\frac{M_{x/R}}{M_{R/y}} = \frac{\alpha\beta k}{1-a}$ | $k^{2\alpha+\alpha\beta}(1-a)^{\alpha\beta}(1-b)^{\alpha-\alpha\beta}(1-c)^{1-\alpha}\ \theta$ |

Ps: $\theta = (\alpha\beta)^{\alpha\beta}(1-\alpha)^{1-\alpha}(\alpha-\alpha\beta)^{\alpha-\alpha\beta}$

First, in Table 1, the utility of each person in the market is determined by the learning costs *a*, *b*, and *c* of each production link of the instant delivery service and the transaction efficiency *k* of the market. And as can be seen in Table 2, as the values of *a*, *b*, *c* and *k* are different, there will be different production structures in the market. This shows that the learning cost of each production link of the instant delivery service and the transaction efficiency of the market determine people's income, which in turn affects the Decision-making of all parties, and the mutual influence and effect of each individual's decision ultimately determines the production structure of the instant delivery market. This is the microscopic mechanism that determines the production structure of the instant distribution market. So, we can get the following proposition:

**Proposition 1**: The production structure of the instant delivery market is determined by the learning cost of each production link of the instant delivery service and the transaction efficiency of the market.

Second, it can be seen from Table 2 that when the transaction efficiency in the market is constant, only when the instant delivery platform enterprise bears lower learning costs in each link of production ($a + b + c < 1$), the platform structure will appear. The higher the learning cost, the more instant delivery platform companies will choose to find trading partners in the market through crowdsourcing or franchising, and save learning costs through division of labor. This can explain why the real-time distribution platform companies that generally adopt the self-operated model in the market are logistics companies with abundant

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logistics and distribution resources, represented by SF Express. On the contrary, when the learning cost in each production link of the instant delivery service is too high ($a+b\geq 1$ and $b+c\geq 1$), the instant delivery platform can only choose to join and franchisees adopt the crowdsourcing model, and the entire market is divided through labor division. Cooperation can avoid excessive learning costs.

**Table 2.** General equilibrium and relatively static

| Learning cost | Transaction efficiency | Structure |
|---|---|---|
| $a+b+c<1$ | $k<\left[\frac{1-a-b-c}{(1-a)^{\alpha\beta}(1-b-c)^{1-\alpha\beta}}\right]^{\frac{1}{2\alpha\beta}}$ | PS |
| | $\left[\frac{1-a-b-c}{(1-a)^{\alpha\beta}(1-b-c)^{1-\alpha\beta}}\right]^{\frac{1}{2\alpha\beta}}<k<\left[\frac{(1-a)^{\alpha\beta}(1-b-c)^{1-\alpha\beta}}{(1-c)^{1-\alpha}(1-a-b)^{\alpha}}\right]^{\frac{1}{2\alpha-2\alpha\beta}}$ | PC |
| | $\left[\frac{(1-a)^{\alpha\beta}(1-b-c)^{1-\alpha\beta}}{(1-c)^{1-\alpha}(1-a-b)^{\alpha}}\right]^{\frac{1}{2\alpha-2\alpha\beta}}<k<\left[\frac{(1-a-b)^{\alpha}}{(1-a)^{\alpha\beta}(1-a-b)^{\alpha-\alpha\beta}}\right]^{\frac{1}{\alpha\beta}}$ | J |
| | $k>\left[\frac{(1-a-b)^{\alpha}}{(1-a)^{\alpha\beta}(1-a-b)^{\alpha-\alpha\beta}}\right]^{\frac{1}{\alpha\beta}}$ | JC |
| $a+b<1$<br>$b+c<1$<br>$a+b+c\geq 1$ | $k<\left[\frac{(1-a)^{\alpha\beta}(1-b-c)^{1-\alpha\beta}}{(1-c)^{1-\alpha}(1-a-b)^{\alpha}}\right]^{\frac{1}{2\alpha-2\alpha\beta}}$ | PC |
| | $\left[\frac{(1-a)^{\alpha\beta}(1-b-c)^{1-\alpha\beta}}{(1-c)^{1-\alpha}(1-a-b)^{\alpha}}\right]^{\frac{1}{2\alpha-2\alpha\beta}}<k<\left[\frac{(1-a-b)^{\alpha}}{(1-a)^{\alpha\beta}(1-a-b)^{\alpha-\alpha\beta}}\right]^{\frac{1}{\alpha\beta}}$ | J |
| | $k>\left[\frac{(1-a-b)^{\alpha}}{(1-a)^{\alpha\beta}(1-a-b)^{\alpha-\alpha\beta}}\right]^{\frac{1}{\alpha\beta}}$ | JC |
| $a+b\geq 1$<br>$b+c<1$ | $k<\left[\frac{(1-b-c)^{1-\alpha\beta}}{(1-b)^{\alpha-\alpha\beta}(1-c)^{1-\alpha}}\right]^{\frac{1}{2\alpha-\alpha\beta}}$ | PC |
| | $k>\left[\frac{(1-b-c)^{1-\alpha\beta}}{(1-b)^{\alpha-\alpha\beta}(1-c)^{1-\alpha}}\right]^{\frac{1}{2\alpha-\alpha\beta}}$ | JC |
| $a+b<1$<br>$b+c\geq 1$ | $k<\left[\frac{(1-a-b)^{\alpha}}{(1-a)^{\alpha\beta}(1-a-b)^{\alpha-\alpha\beta}}\right]^{\frac{1}{\alpha\beta}}$ | J |
| | $k>\left[\frac{(1-a-b)^{\alpha}}{(1-a)^{\alpha\beta}(1-a-b)^{\alpha-\alpha\beta}}\right]^{\frac{1}{\alpha\beta}}$ | JC |
| $a+b\geq 1$<br>$b+c\geq 1$ | JC | |

Third, when the learning cost of an instant delivery platform company is constant, if the transaction cost $(1-k)$ is higher, that is, the lower the transaction efficiency $k$, then the instant delivery platform company will tend to reduce the division of labor to avoid higher transaction costs; At the same time, franchisees also tend to internalize production rather than crowdsourcing production. On the contrary, if the transaction costs are low, the instant

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delivery platform companies and franchisees can divide labor through the market to save learning and management costs. Figure 1 depicts the evolution path of the production structure of the instant delivery market (dashed arrow) and the path of the instant delivery platform and franchisee strategy changes (solid arrow) when the learning cost of each production link of the instant delivery service is constant. This figure shows that when the market's transaction efficiency changes from low to high across four intervals: the path of the evolution of the production structure is PS→PC→J→JC, this evolution can also be radical, for example, when the transaction efficiency $k > \left[\frac{(1-a-b)^{\alpha}}{(1-a)^{\alpha\beta}(1-a-b)^{\alpha-\alpha\beta}}\right]^{\frac{1}{\alpha\beta}}$, the production structure can be crowdsourced from structure PC directly evolved into the structure JC, and even directly evolved from the structure PS to the structure JC; whether it is a platform or a franchisee, its Decision-making changes are transformed into a professional with the improvement of market transaction efficiency Decision-making.

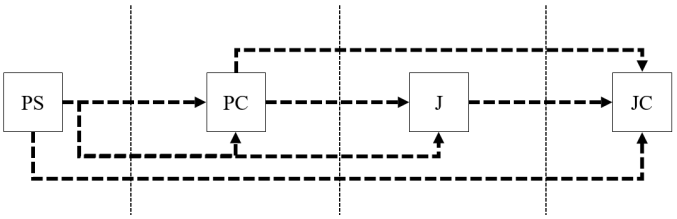


**Figure 1.** Production structure evolution path

Summarizing the above two points, the following propositions can be drawn:

**Proposition 2:** When the cost of learning in each production link of the instant delivery service is not high, the platform self-support structure will appear, and with the improvement of market transaction efficiency, it will move towards a platform crowdsourcing structure, franchise structure and franchise crowdsourcing with a division of labor structural changes; and when the cost of learning in each production link is high, the platform crowdsourcing structure, franchise structure and franchise crowdsourcing structure will replace the platform self-support structure.

**Proposition 3:** As the cost of learning in each production link of instant delivery services increases, the higher the transaction efficiency of the market, the more it can promote the evolution of the production structure to the franchise crowdsourcing structure, and the more specialized Decision-making platforms and franchisees will adopt.

Fourth, the capacity allocation plan and the sum of the learning cost ($a+b$ and $b+c$) of the capacity and immediate delivery service affect the choice of the strategies of the producers in each link in the market. When $a+b \geq 1$ and $b+c < 1$, the transaction efficiency is lower than $\left[\frac{(1-b-c)^{1-\alpha\beta}}{(1-b)^{\alpha-\alpha\beta}(1-c)^{1-\alpha}}\right]^{\frac{1}{2\alpha-\alpha\beta}}$, instant delivery platform companies will choose crowdsourcing mode for production; and will also choose to use the franchise model when the transaction efficiency is higher than $\left[\frac{(1-b-c)^{1-\alpha\beta}}{(1-b)^{\alpha-\alpha\beta}(1-c)^{1-\alpha}}\right]^{\frac{1}{2\alpha-\alpha\beta}}$ .When $a+b<1$ and $b+c \geq 1$, the distribution platform company will only choose the franchise model, and the franchisee will choose the franchise mode according to the level of market transaction efficiency (greater than or less than $\left[\frac{(1-a-b)^{\alpha}}{(1-a)^{\alpha\beta}(1-a-b)^{\alpha-\alpha\beta}}\right]^{\frac{1}{\alpha\beta}}$) to choose whether to use crowdsourcing mode or internal production. This can explain that the instant delivery platforms that adopt the crowdsourcing model in the market are professional capacity allocation plan delivery

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companies represented by flash delivery, and these companies will also play the role of franchisees to participate in other instant delivery services. Most of the instant delivery platforms that adopt the franchise model are "non-professional logistics companies" represented by Meituan. From this we can draw the following propositions:

**Proposition 4:** As a distribution platform company, it will choose the franchise model when the learning cost of its final instant delivery service is too high; and when the learning cost of its production capacity is too high, it will decide to choose crowdsourcing or franchise mode based on market transaction efficiency. The franchisees decide whether to choose the crowdsourcing model based on the efficiency of market transactions.

The above analysis shows that the capacity organization selection (self-operated, crowdsourcing, and franchise) of each producer in the instant delivery market is related to the transaction efficiency of the market and the learning cost of their respective production, that is, the allocation of resources. This reflects the conflict between the transaction costs of the immediate distribution market division of labor and the internal resource allocation of the producer organization.

## 5. Conclusion

This paper uses the new classical economic theory, uses inframarginal analysis method, focuses on the production structure produced by different capacity organization modes in the instant distribution market, and constructs an inframarginal general equilibrium model of the instant distribution market. Through the analysis of general equilibrium, this article explains the conditions for the occurrence of the four production structures of platform self-operating, platform crowdsourcing, franchising and franchising crowdsourcing from a micro level. No matter what kind of production structure, its appearance is related to the learning cost of the producer and the transaction efficiency determined by the institutional environment, that is, the conflict between the internal resource allocation of the producer's organization and the transaction cost. This shows that the transaction efficiency determined by the institutional environment and the learning cost of the production link determine the final immediate delivery service producer and the intermediate product producer's production decision, and the interaction of these producers' decisions forms a different production structure.

This article analyzes the various production structures of the instant delivery market, and discusses the micro-mechanism and formation mechanism of the instant delivery platform adopting different transportation capacity organization forms. It is believed that this can promote the deepening of related research in the instant delivery field to a certain extent. In this paper, the transaction efficiency of each production link in the instant delivery service market is simply regarded as equal, but if the transaction efficiency of each link exists separately, it should be possible to further explore the impact of the institutional environment on the instant delivery service market, which can continue in the future.

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