Study on the E-commerce Trust Based on Evolutionary Game Mechanism

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Abstract

The evolutionary game model of E-commerce trust is established according to the behavior choice character of the online trader and supervisor. The replicator dynamic principle t is put forward and corresponding evolutionary differential equation is established; we put forward the conception of the evolution balance, requiring the evolutionary balance of the differential equation and condition and make an annotation of the evolutionary game mechanism of E-commerce trust.

Key words: E-commerce; Trust; Evolutionary Game.

1 Introduction

With the development and mature of the 3W technology, the Internet brings an information age. Especially in recent years, the E-commerce which based on the internet appears the exponential increasing. For example, E-commerce (made up of U.S. companies generating related revenues worldwide) is account for about 1/3 of the GNP in 1998 (Barua et al, 1999). Under the guidance of E-commerce, the internet has become a new economy, the enterprises and consumers will obtain tremendous benefits from it through the value-added chain, the digital and informational of all the equipment (Barua et al, 2001). This innovative economic environment brings the challenge to us in different forms, such as through the society, technology, psychology, politics and geography, etc. Research, awareness and use this new environment will help us to develop new value and performance (Keeney, 1999).

Actually, as a new business model, the potential value of E-commerce that the giant internet user dimensions, the rapidly and convenience information transmit (Litan and Alice, 2001). However, the characters of the impersonalization trader and the asymmetric information have become the major obstacle of its healthy development and are also the major difficult problem of the establishment of directly trust between the buyer and sellers. In fact, online

dishonesty worries the trader all the time since the emergence of the E-commerce. So, how to establish the E-commerce trust has become a key factor of its continuing development. Different scholars respectively from the technology (Wang gaoping, 1999) and trust agency (Wei mingxia, 2005) to study. But the behaviour choice of related subject is determinant and direct factor of the E-commerce trust's establishment. Therefore, this paper through the visual angle of the online trader and supervisor behaviour selection and evolution, study the evolutionary game mechanism formed by E-commerce trust.

2 The Establishment of the Evolutionary Game Model Formed by the E-Commerce Trust

2.1 The base of the model establishment

2.1.1 The online trader and supervisor's behavior choice and evolution characteristics

The behaviour model of the online trader (trustworthy or dishonesty) is variable and so does the supervision strategy of the online supervisor; the level of the E-commerce trust on certain time is the result of the online trader and supervisor's behaviour selection. In reality, the character of the online trader and supervisor's behaviour selection are as follows:

First, bounded rationality. Many models require the participants are rational, but they are not entirely rational in reality; owing to the virtual of the E-commerce exacerbate the information asymmetry and the speculative factor of the online trader. Therefore, most of the online traders and supervisors' behaviour selection are bounded rationality in E-commerce.

Second, repeatability. The E-commerce action of the online trader and supervisor can't finish in one time. The former usually do many business with many partner in the virtual market, the latter need to manage the online trader many times and long-term. Therefore, the two sides will continue to learn and adjust strategy so that make his total, long-term or expected revenue maximization.

Third, speculative that is the opportunism. It exists the opportunism behaviour besides the above two characters between the online trader and supervisor in the process of the E--commerce. The online trader can't directly divide into trustworthy and dishonesty trader, they may take dishonesty or trustworthy strategy in different time. So does the online supervisor, they may choose supervision and no supervision behaviour. Therefore, the trustworthy and dishonesty strategy, supervision and no supervision strategy will exist for a long time.

Fourth, group. Although the level of E-commerce trust is the result of individual behaviour choice in microcosmic, but it displays the group behaviour in macrocosm. No matter the online trader or supervisor all can divide into different group by some strategies, such as the trustworthy group and dishonesty group, supervision group and no supervision group, the character of opportunism decide the scale of the different group change all the time. The level of E-commerce trust depends on the group structure of different active subject.

Combine with the above characters; the game between online trader and supervisor has the character of the evolutionary game form the perspective of the game theory. So, we can apply with the related theory of evolutionary game to explain the behaviour choice and evolutionary problems of the online trader and supervisor group.

2.1.2 The explanation of the online trader and supervisor group evolution on the evolutionary game

As the evolutionary game theory requires the participants are bounded rationality, start from the bounded rational individual and take the group as research object, we can learn that the behaviour of the individual is not optimization, the decision-making of them is achieved by the individual imitate, learn and mutation etc dynamic process(Joe Root, 2006).This theory basically from the point of "the survival of the fittest" to look on the regulation process of the group behaviour, and adopt the group to individual local dynamic method to analyse the participant's decision-making behaviour, the result from these will more exactly to describe the individual or group's behaviour in the reality. Therefore, the evolutionary game has stronger explanation on the behaviour selection and evolution of the online trader and supervisor seen from the character of them.

According to the evolutionary game theory (Joe Root, 2006), the evolutionary process of the online trader and supervisor's evolutionary game include two possible behaviour evolution mechanisms which are the selection mechanism and variation mechanism. The selection mecha-nism is the strategy that the online trader and supervisor obtain higher income in the current period of the game, there will be more selectors in the next period. The variation mechanism is the online trader and supervisor (the participant of the game) use the random type (aimlessly) to choose the strategy. So the variation mechanism may obtain higher or lower income. But the variation occurs rarely and the new variation can be survived only through selection, test error and strategy which obtained higher income. Finally, the strategy which mostly relatively survived group adopts is the so-called evolutionarily stable strategy (evolutionarily stable strategy, ESS) in one certain period or evolutionary phase , (Joe Root, 2006). If most individuals which accounts for big proportion choose the evolutionarily stable strategy, then the small variation group are impossible invade into the group. In other words, the variation either change the strategy enter into the ESS or withdraw from the system and disappear in the process of the evolution under the pressure of natural selection. From the angle of online trader, if the trustworthy strategy is the ESS that the most traders choose in E-commerce, then the online trader as the dishonesty variation will change the strategy and choose the ESS (trustworthy) in the trading or withdraw from the system and disappear in the process of the evolution, consequently form the E-commerce trust.

We can use the replicator dynamic model (replicator dynamic is the increase ratio of the person number who use one strategy equal to the difference that the income and average pay when use this strategy) to in-depth explanation (Taylor and Jonker,1978).This model can reveal the group behaviour selection mechanism and evolution trend of the limited rational individual. According to the basic of the model and consult the research thinking of the related scholar on the supervision (Liu Weiqi, superb, 2006; Wu Liansheng, Wang Yaping, 2003), establish the evolutionary game model formed by the E-commerce trust.

2.2 The evolutionary game model formed by the E-commerce trust
2.2.1 The basic assumption of the model

The game circumstance is the parameter gather which is the opponents, information and market, etc, may affect the result of the game when the participators do the game. The realistic economy environment is complex, in order to convenient for analysis, now we combine with the basic of the foundation model to make the following assumption on the evolutionary game circumstance formed by the E-commerce.

(1) The participants of the evolutionary game are online trader and online supervisor (government); the game between them is a repeat dynamic game.

(2) The discovery probability of the government (that is supervision intensity, also the capture probability) is $p(0 \leq p \leq 1)$. The trustworthy income of the online trader is Φ , the level of the online trader's dishonesty is f ($f \geq 1$) and dishonesty income is $f\Phi$(it implies a assumption that the more level of the dishonesty, the higher dishonesty income), meantime, it brings a loss that is $\alpha f\Phi$($0 < \alpha \leq 1$) on the society.

(3) If the dishonesty behaviour of the online trader is discovered, the Government punishment and the level of the dishonesty appears direct ratio. That is $\beta f^2\Phi$(β>0), the β is the punishment factor and denotes the punishment intensity of the dishonesty trader. The $\mu\beta f^2\Phi$(0<μ≤1) is the net income of the supervisor, $^\mu$ is the transfer gene and denotes the proportion of the net income that transfer to the government in the punishment. The supervision cost of the government is c(c>0).

(4) Suppose the online trader's discount gene is δ(0≤δ≤1) , the discount gene is the function of the time preference of the trade and the time length, the more attention the online trader pay on the current profit, the smaller theδ , the longer the time, the smaller the$^\delta$; the discount gene of the government is 1.

(5) Suppose the above information is the common knowledge besides the dishonesty level of the online trader and the supervision intensity of the government.

(6) As long as the government supervises the online traders, the dishonesty behaviours of them can be discovered. But it is impossible to achieve it for the cost of the supervision and the restriction of other uncertain factors; But it can be realized through add the supervision cost c infinitely.

(7) The avail of the online trader depends on the income they received; the avail of the government is the summation of the social welfare besides the online trader.

(8) Seen from the virtual market, the online traders can divided into two types which are the trustworthy strategy and dishonesty strategy, so does the online supervisors which have the supervision and no supervision strategy.

2.2.2 The basic model of the online trader and supervisor's evolutionary game

We can establish the evolutionary game's basic model of the online trader and supervisor, according to the basic of the establishment of the evolutionary game basic model formed by the E-commerce trust (picture 1).

Combine with the basic assumption of the model, analyses and explains the game strategy of the evolutionary game model and the expectation income of the online trader and supervisor. This is the basic of the evolutionary game.

When the online trader is dishonest and the online supervisor is supervisory, suppose the online trader and supervisors' expectation income respectively are E_t and E_a , according to the above analysis and assumption (2), (3), (4) and (7), there are:

$$E_t = f\Phi - \beta f^2 \Phi P\delta \qquad (1)$$

$$E_a = -\alpha f\Phi + \mu\beta f^2\Phi p - cp \qquad (2)$$

When the online trader is dishonest and the online supervisor is no supervisory, according to the above analysis and assumption (2), the expectation income of the two sides respectively are $^{f\Phi}$ and $^{\alpha f\Phi}$.
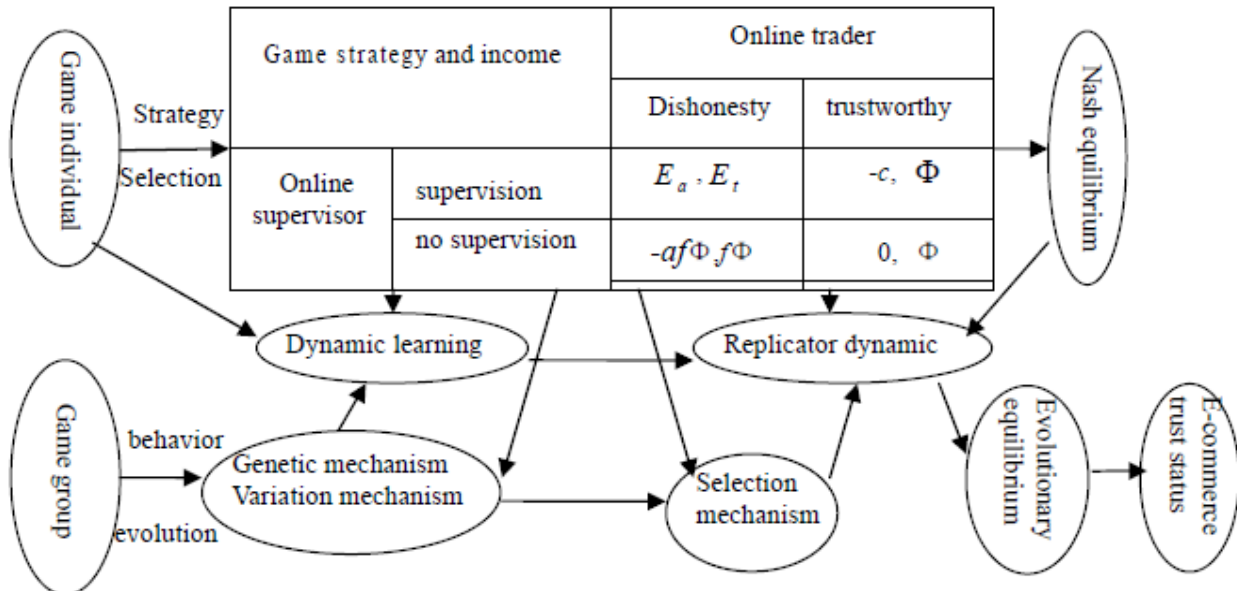

Figure 1 - Online Trader and Supervisor of the Basic Model of the Evolutionary Game

When the online trader is trustworthy and the online supervisor is supervisory according to the above analysis and assumptions (2) and (3), the both them expectation income respectively are $^{\Phi}$ and $-^{c}$.

When the online trader is trustworthy and the online supervisor is no supervisory, according to the analysis and assumptions (2), the expectation income of the two sides respectively are Φ and 0.

The core of the evolutionary game basic model of the online trader and supervisor is the replicator dynamic principle which can be called the replicator dynamic principle formed by the E-commerce. According to the replicator dynamic model (Taylor and Jonker, 1978),which is increase ratio of the person who use one strategy(such as online trader who take trustworthy strategy) equal to the difference between the obtained payment and average payment when use the strategy(trustworthy) in the process of the evolution game of the online trader and supervisor. It essentially reveals the group behavior selection mechanism and evolutionary trend of the bounded rationality online trader and supervisor.

3 Analysis of the Evolutionary Game Formed by the E-Commerce Trust

According to the basic model of the online trader and supervisors' evolutionary game, we can establish the gene replicator dynamic equation (for short the evolution differential equation formed by the E-commerce trust) of the online traders group and supervisors group, analyse the evolution process of the online traders group and supervisors group, further explain trustworthy behaviour and the evolutionary game mechanism formed by the e-commerce trust.

3.1 The evolution differential equation formed by the E-commerce trust

3.1.1 The expectation avails of the different game group

Suppose *A* is the proportion number of the online supervisor who take the supervision strategy on the online trader, the proportion who take no supervision strategy is (*1-A*), *F* is the proportion of online trader who take dishonesty strategy, then (*1-F*) is the proportion who take trustworthy strategy. Therefore, combine with the above evolutionary game model, the expectation avail of the two game sides who take the supervision strategy and no supervision strategy and the average avail of the whole online supervisors group are as follows:

The expectation avail of the person who takes supervision strategy is $u_a = FE_a + (1-F)(-c)$ (3)

The expectation avail of the person who takes no supervision strategy is $u_{-a} = F(-\alpha f \Phi)$ (4)

The average avail of the whole online supervisor group is $\bar{u}_a = Au_a + (1-A)u_{-a}$ (5)

So does the online trader:

The expectation avail of the person who takes dishonesty strategy is $u_{ft} = AE_t + (1-A)f\Phi$ (6)

The expectation avail of the person who takes trustworthy strategy is $u_{ht} = A\Phi + (1-A)\Phi = \Phi$ (7)

The average avail of the whole online trader group is $\bar{u}_t = Fu_{ft} + (1-F)u_{ht}$ (8)

3.1.2 The evolution differential equation group formed by the E-commerce trust

According to the replicator dynamic theory formed by the E-commerce trust and the expectation avail of different game groups, we can establish the evolution differential equation formed by the E-commerce trust .The essence of it is equation group which is constituted by the online supervisor group and online trader group evolution differential equation.

1) The evolution differential equation of the online supervisor group

According to the replicator dynamic principle formed by the E-commerce trust and combine with formula (3), (4), (5), we can establish the evolution differential equation of the online supervisor group which is constituted by supervision strategy group and no supervision strategy group different equation.

The evolution differential equation of the group who take supervision strategy is

$$\frac{dA}{dt} = A(u_a - \bar{u}_a) \tag{9}$$

The evolution differential equation of the group who take no supervision strategy is

$$\frac{d(1-A)}{dt} = (1-A)(u_{-a} - \bar{u}_a) \tag{10}$$

The (9) and (10) formula respectively describe the evolution process of the online supervisor who prepare to take supervision strategy and no supervision strategy, reveals the evolution power and interpret the contain ideal of the evolutionary game basic model. In other words, if the result of the supervision or no supervision strategy superior to the average level, then the proportion of the online supervisor who take this strategy will be increase in the whole supervisors group. This reflects basic idea of the evolutionary game (Christie, Daniel, 2005).

2) The evolution differential equation of the online trader group

According to the replicator dynamic principle formed by the E-commerce trust and combine with formula 6, 7, 8, we can establish the evolution differential equation of the online trader group which is constituted by the dishonesty strategy group and trustworthy strategy group evolution differential equation.

The evolution differential equation of the group who take dishonesty strategy is

$$\frac{dF}{dt} = F(u_{fi} - \overline{u}_t) \tag{11}$$

The evolution differential equation of the group who take the trustworthy strategy is

$$\frac{d(1-F)}{dt} = (1-F)(u_{ht} - \overline{u}_t) \tag{12}$$

The formula (11) and (12) respectively describe the evolution process of the online trader group who prepare to take dishonesty strategy and trustworthy strategy, reveals the evolution power and interpret the contain idea of the evolutionary game basic model. In other words, if the result of the dishonesty or trustworthy strategy superior to the average level, then the proportion of the online trader who take this strategy will be increase in the whole traders group. This reflects basic idea of the evolutionary game (Christie, Daniel, 2005).

3) The evolution differential equation of the E-commerce trust

When analyse the behaviour evolvement of the online supervisor group, the essential of the formula (9) and (10) are equivalent and when analyse the behaviour evolvement of the online trader group, the essential of the formula (11) and (12) are also equivalent. So the evolution differential equation formed by the E-commerce trust are constituted by the online supervisor group evolution differential equation (9) or (10) and online trader group evolution differential equation (11) and (12), it can be expressed as follows:

$$\begin{cases} \dfrac{dA}{dt} = A(u_a - \overline{u}_a) & (13) \\[2mm] \dfrac{dF}{dt} = F(u_{fi} - \overline{u}_f) & (14) \end{cases}$$

Put the relevant variables of the formula (11) and (12) into the formula (13) and (14), we can have the final expression of the evolution differential equation formed by the E-commerce trust after simplify it.

$$\begin{cases} \dfrac{dA}{dt} = A(1-A)(F\mu\beta f^2 \Phi p - Fcp + Fc - c) & (15) \\[2mm] \dfrac{dF}{dt} = F(1-F)(-A\beta f^2 \Phi p\delta + f\Phi - \Phi) & (16) \end{cases}$$

The formula (15) can be called the basic expression of the evolution differential equation of the online supervisor group. The formula (16) can be called the basic expression of the evolution differential equation of the online supervisor group.

3.2 Analysis of the evolutionary game process formed by the E-commerce trust

3.2.1 The evolutionary equilibrium of the game model formed by the E-commerce trust

Then according to the evolutionary differential equation formed by the E-commerce trust, analyse the conditions of the ESS which formed by the different game group through evolutionary game (Joe Root, 2006) and further interpret the condition of the E-commerce establishment. The ESS actually is a game balance and this research can be called the evolutionary equilibrium of the game model formed by the E-commerce trust. (For short the evolutionary game).

Definition 1 Evolutionary equilibrium is the state which the proportion of different group in the participant of the E-commerce game remain unchanged.

Definition 2 Bilateral evolutionary equilibrium is the state which the proportion of the different group in the online trader group and online supervisor group remain unchanged. It is obvious that and there is:

$$\begin{cases} \dfrac{dA}{dt} = A(1-A)(F\,\mu\beta\,f^2\Phi p - Fcp + Fc - c) = 0 & (17) \\ \dfrac{dF}{dt} = F(1-F)(-A\beta f^2\Phi p\delta + f\Phi - \Phi) = 0 & (18) \end{cases}$$

Definition 3 Unilateral evolutionary equilibrium is the state which the proportion of the different group in the online trader group and online supervisor group remain unchanged. Obviously, the formula (17) is the unilateral evolutionary equilibrium of the online supervisor group and the formula (18) is the unilateral evolutionary equilibrium of the online trader group.

Now spread the analysis according to this and explain the process of the evolutionary game formed by the E-commerce trust and the required condition of the evolution balance.

3.2.2 Analysis of the evolution differential equation based on the online supervisor

When the proportion of the different online supervisor group keeps the stable state, the behaviour of the online supervisor group evolve into unilateral evolutionary equilibrium. From the formula (17), we can learn that:

$$F = \frac{c}{(\beta\mu f^2\Phi p - cp + c)} \tag{19}$$

Or

$$A = 0 \qquad \left(F \neq \frac{c}{(\beta\mu f^2\Phi p - cp + c)} \right) \tag{20}$$

Or

$$A = 1 \qquad \left(F \neq \frac{c}{(\beta\mu f^2\Phi p - cp + c)} \right) \tag{21}$$

The formula (19) means that all the value of A is stable state; the practical meaning is that there is no difference between the online supervisor who take the supervision and no supervision strategy when the proportion of the group who take the dishonesty strategy is $\frac{c}{(\beta\mu f^2\Phi p - cp + c)}$ (As the picture 2 black lines shown).

The formula (20) and (21) indicate that only $A=0$ (means there is no online supervisor takes the supervision strategy) or $A=1$ (means all the online supervisor take no supervision strategy) is the two stable state of A. But the required condition of the two stable condition (the structure of the online supervisor group that the value range of F) is different.
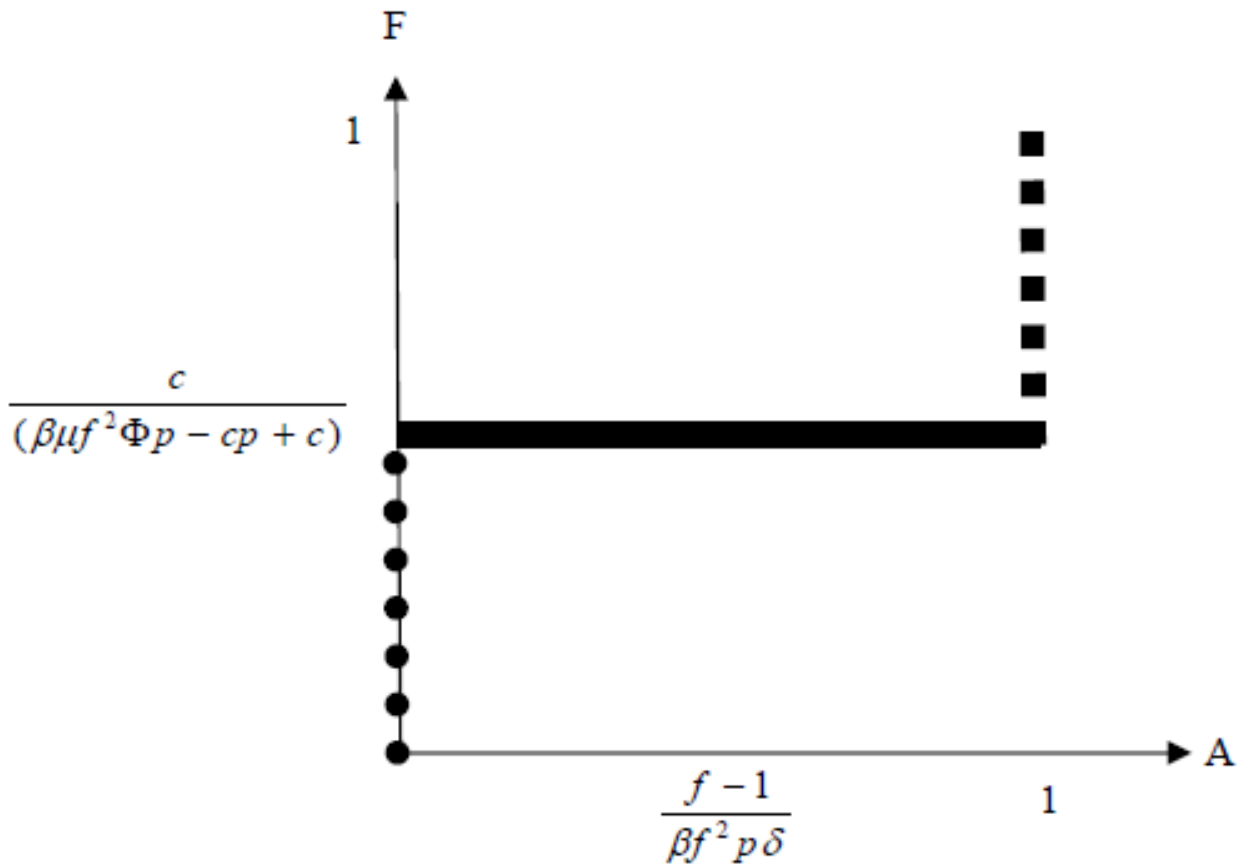
Figure 2 - Online Trader and Supervisor of the Evolutionary Game Dynamic Analysis

By the formula (13), $< \frac{c}{(\beta\mu f^2 \Phi p - cp + c)}$ then $\frac{dA}{dt} = A(u_a - \bar{u}_a) < 0$. The expectation income of the online supervisor who takes the supervision strategy is less than the average income of the whole groups. In general conditions, there is no online supervisor choose the supervision strategy.

Therefore, only *A=0* the stable condition is the ESS (achieve the unilateral evolution stable) of the online supervisor group. Seen from the genetic mechanism of the evolution game and variation mechanism and in the stable state that *A=1*, once occurs variation (the online supervisor take the no supervision strategy), the other online supervisor will through dynamic study and take the no supervision strategy one by one (because they can get the higher income), actually *A=1* is not stable in this circumstance; when in the *A=0* stable state, once occur variation (online supervisor take supervision strategy), the other supervisor will through dynamic study and don't take the supervision strategy(because they can't obtain higher income), that is to say, *A=0* the stable state have stronger robustness and can resist the invasion of the variation person, meantime, it can be achieved in the dynamic strategy adjustment.

Therefore, when $F < \frac{c}{(\beta\mu f^2 \Phi p - cp + c)}$ *A=0* is an ESS (unilateral evolution balance) of the online supervisor (as the picture 2 dotted dashed shown). The economy meaning is no online supervisor take the supervision strategy when the proportion of the dishonesty below $\frac{c}{(\beta\mu f^2 \Phi p - cp + c)}$ in the online trader group.

Similarly, if $F > \frac{c}{(\beta\mu f^2 \Phi p - cp + c)}$, A=1 is an ESS (as the picture 2 square dots dashed shown), the economy meaning is the entire online supervisors will take supervision strategy when the proportion of the dishonesty group higher $\frac{c}{(\beta\mu f^2 \Phi p - cp + c)}$ in the online trader group.

As the above, the boundary point of A=0 and A=1 two evolution stable strategy is $F = \frac{c}{(\beta\mu f^2 \Phi p - cp + c)}$ we can learn from that the more net income the online supervisor obtain (the greater punishment gene, the more transfer gene, the greater dishonesty level of the online trader, the more trustworthy income of the online trader), the smaller cost of the online supervisor, the smaller boundary point, the smaller proportion of the online traders who take dishonesty strategy, the greater supervision power of the online supervisor. It is not difficult to understand about the effect from the practice of E-commerce, such as the greater dishonesty of the online trader, the online supervisor will be naturally increase the intensity of supervision; the smaller supervision cost of the online supervisor that means the cost of the online supervisor paid is small and will be naturally increase the intensify of supervision.

3.2.3 The analysis of evolution differential equation based on the online trader

The behaviour of the online trader group wills evolvement into unilateralism evolution balance when the proportions of the different groups retain the stable state. From the formula (18), we can learn that:

$$A = \frac{f-1}{\beta f^2 p \delta} \qquad (22)$$

$$\text{Or} \quad F = 0 \qquad \left(A \ne \frac{f-1}{\beta f^2 p \delta} \right) \qquad (23)$$

$$\text{Or} \quad F = 1 \qquad \left(A \ne \frac{f-1}{\beta f^2 p \delta} \right) \qquad (24)$$

The formula (22) means that all the value of F is the stable state; the practice meaning is that there is no difference between the online trader who take the dishonesty strategy and trustworthy strategy when the proportion who takes the supervision strategy is $\frac{f-1}{\beta f^2 p \delta}$. (As the picture 3 black lines shown).
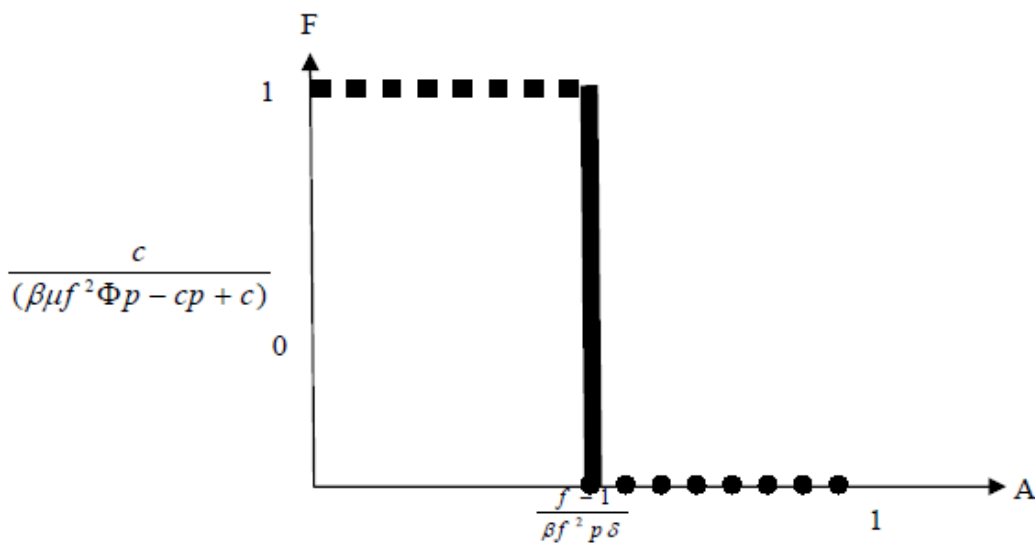

Figure 3 - Online Trader and Supervisor of the Evolutionary Game Dynamic Analysis

The formula (23) and (24) shown that only $F=0$ (means no online trader choose dishonesty strategy and can establish a high level E-commerce trust) or $F=1$ (means all the online bargainers choose dishonesty strategy and can establish a lower level E-commerce trust) is the two stable state of F. But the required condition of the two stable state (the group structure of the online supervisor group that the value range of A) is different.

By the formula (14), if $A > \frac{f-1}{\beta f^2 p \delta}$, then $\frac{dF}{dt} = F(u_{fi} - \bar{u}_t) < 0$. The expectation income of the online trader group who take the dishonesty strategy is lower than the average income of the total group. In normal circumstances, there is no online trader who choose the dishonesty strategy, so the stable state that F=0 is an ESS of the online trader (achieve unilateralism evolution balance). Seen from the genetic mechanisms and variation mechanisms of the evolutionary game, in the $F = 1$ stable state once occurs variation (online bargainers take trustworthy strategy),other online trader will through dynamic study and take the trustworthy strategy one by one (because they can obtain the high income), the $F = 1$ is not stable in this circumstances. While when in the $F = 0$ stable state, once occur aberrance (online trader take dishonesty strategy), other online trader through dynamic study and don't take the dishonesty strategy one by one (because they can't obtain the higher income), that is to say, the $F = 0$ stable state have robustness and can resist the invasion of the variation person, meantime, it can be achieved in the dynamic strategy adjustment.

Therefore, when $A > \frac{f-1}{\beta f^2 p \delta}, F = 0$ is an ESS of the online trader (unilateral evolution balance) (as the picture 3 dot dashed shown). The economy meaning is the behaviour of the online trader evolve into trustworthy when the proportion of the online supervisor group who take the supervision strategy is higher than $\frac{f-1}{\beta f^2 p \delta}$, then form a high level E-commerce trust.

Similarly, if $A < \frac{f-1}{\beta f^2 p \delta}, F = 1$ is an ESS (as the figure 3 square dots dashed shown). The economy meaning is the behaviour of the online trader evolve into dishonesty when the proportion of the online supervisor group who take the supervision strategy is lower than $\frac{f-1}{\beta f^2 p \delta}$, then form a high level E-commerce trust risk.

As the above, the boundary point of the two evolution stable strategy that F=0 and F=1 is $A = \frac{f-1}{\beta f^2 p \delta}$. We seen from that the more punishment and supervision intensity of the online supervisor, the bigger the discount gene of the online trader, the smaller the boundary point, the smaller the proportion of the online supervisor who take the supervision strategy, the lower dishonesty power of the online trader. It is easy to understand the relation from the practical of E-commerce, such as the more punishment and supervision intensity of the online supervisor, the online trader will be naturally dishonesty. The bigger discount gene of the online trader and means the online trader more attention the current profit, and it will be actually take dishonesty strategy.

3.2.4 The dynamic analysis of the online trader and supervisors' evolutionary game

Based on the analysis of the evolution differential equation based on the online trader group and online supervisor group, we can spread the dynamic analysis of the evolutionary game on the online trader and supervisor, that is to say, the relationship of evolutionary game (replicator dynamic) which based on the proportion change of the above two types can be displayed in the two dimensions plane with two proportions as coordinate. (As the picture 4 shown).

From the picyure4, we can learn that the third strategy combination is an ideal combination and also the result which we want to, that is to say, the online trader tend to trustworthy, and the online supervisor tend to no supervision; The E-commerce trust is established naturally. However, it is not stable formulated under the inaction supervision in this circumstance. Seen from the angle of biological evolution search stable point, there is no one ESS composed by the two sides. Actually, the rational online trader tend to choose dishonesty strategy when the online trader trend to choose trustworthy strategy and the online supervisor tend to choose the no supervision strategy; therefore, it is difficult to find the third strategy combination in practice.
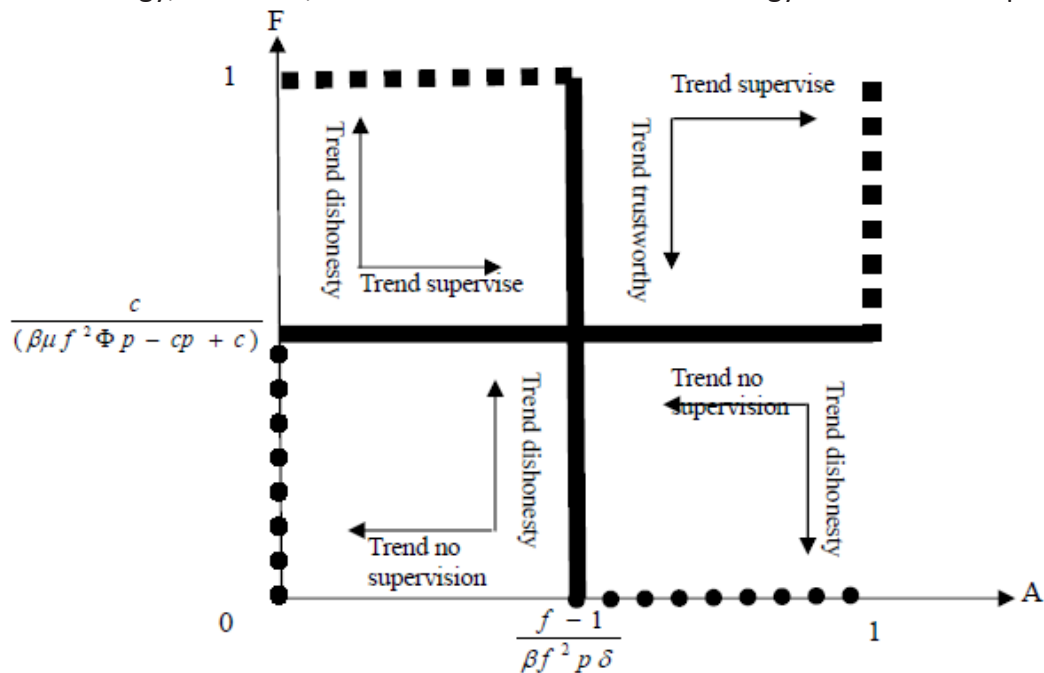

Figure 4 - Online trader and supervisor of the evolutionary game dynamic analysis

In the constrain of the game scene , it is necessary for formulating E-commerce trust well to make the evolutionary game of the two sides develop tended to excellent balance as F=0. From the picture 4, we can learn that the third strategy combination is a more realistic. It requires that the online supervisor must strengthen supervision which accord with realism development of the current E-commerce. In addition, if want to achieve this effect, we can improve the trustworthy income of the online trader and the level punishment of the online supervisor, etc.

4 Conclusion

This research through the study on the evolutionary game mechanism formed by the E-commerce trust reveals that the establishment of the E-commerce trust is the result of the game between the online trader and supervisor. The game of the two sides is a typical evolutionary game and through dynamic study, genetic, variation and selection mechanism happen correspond behaviour evolvement base on the income of variety strategies; The core mechanism of the behaviour evolutionary game is the replicator dynamic of the online trader and supervisor. The replicator dynamic of the two sides can be express by evolution differential equation which can form the ESS and achieve evolution balance when it reach zero.

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