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Research on Coopetition Strategy in IPTV Between SARFT and Telecom Operators in China

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Abstract

In order to promote rapid development of IPTV, we need to coordinate the coopetition relationship between SARFT and telecom operators. Considering the substitution effect of IPTV to traditional TV, the paper builds a coopetition model and explores their choices of coopetition strategy and optimal yield decisions under the different level of profit-sharing based on Stackelberg game.The results show that:SARFT should provide IPTV with most program resources.The optimal coopetition strategies are different if the profit-sharing that SARFT gets is at different stages. The profit-sharing between SARFT and telecom operators should be controlled in the neighborhood of seven-three to choose the mutual cooperation strategy, getting the highest profit than others under the optimal coopetition stategies that they select when the profit-sharing is at other stages.

Key words: SARFT; Telecom Operators; IPTV; Coopetition

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INTRODUCTION

IPTV combines the advantages of radio and television media and network, and provide customers with high quality services as online consulting, online shopping etc. In China, the State Administration of Radio, Film, and Television (SARFT) holds the licese and is in charge of the integrated broadcast rights of IPTV, the telecom operators(TC) occupies the broadcast channel with the resources of Internent broadband exports and Internet Date Center(IDC), it can promote rapid development of IPTV if they cooperate with each other. However, they are independent and array with each other at present, the coopetition relationship between them is always difficult to reconcile, resulting in the slow development of IPTV in China (Deng, 2011).

Scholars conducted some researchs on the coopetition relationship between them. Focusing on the acces to policy, QIN Zi-xing et al (2008) built a competive model and applied the modified Stackelberg game in analyzing the optimal yield under the lax and strict control policy, drawing the conclusions that lax control policy was favorable for IPTV expanding in the phase of promotion. Hu-Lei et al (2011) took the mobile TV as example after getting consumer'optimal consumption flow based on the utility fuction and built a cooperative modle to analyze their optimal price strategy based on Stackelberg game where SARFT was the leader.

However, these studies had only focused on the competition or cooperation and not involved in the situation where both competiton and cooperation existed. Base on the policy of Triple-play in China, the TC who meets the requirement can engage in the production of radio and television programs in additon to current political affairs. Namely, TC can invest into making content and provide to the integrated broadcast platform of IPTV to compete with SARFT while he is cooperating with SARFT to develop IPTV, but the audit and broadcast of content are still controlled by SARFT. The SARFT can develop IPTV through Two-way network reconstruction while he is cooperating with TC. Yu Tongshenet al (2011) considered the policy and analyzed their choices

of propeling strategy. But they only brifely discussed their strategy in theory based on pigs'payoffs and didn't have the deeply quantitative analysis on the coopetition relationship. So, the article builds a coopetition model where both competiton and cooperation exist and discusses their choices of coopetition strategy and optimal yield decision under the different level of profit-sharing based on Stackelberg games, hoping to enrich the theoretical research and pomote the healthy and rapid development of IPTV in China.

1. THEORETICAL BASIS AND THE DESCRIPTION OR ASSUMPTIONS OF THE MODEL

1.1 Introduction to the Theory of Coopetition

In actual operations, competition and cooperation among enterprises usually occur at the same time, the profit comes from not only the competition, but also the cooperation. Hamel et al (1989) firstly concerned that the enertprises could carry out both competition and cooperation among them during the management. Brandenburger et al (1996) defined it as "coopetition" firstly and applied game theory in describing the phenomenon that both competiton and cooperation exist. However, Bengtsson et al (2000) indicated that the coopetition was a behavior that the competing companies in the industry cooperated in the activities away from the customers and competed in the activities close from the customers.

For the coopetition types, it is mainly classified according to the characteristics of competition. Wilkinson et al (1994) took the relationship between the supply chain upstream and downstream as pointcut and divided it into four kinds: coopetition pattern under high cooperation and high competition, partner pattern under high cooperation and low competition,conflict pattern under low cooperation and high competition, dependent pattern under low cooperation and low competition. Luo et al (2005) took the horizontal relationship as pointcut and divided the coopetition relationship among the multinational corporation and its major competitors into four kinds: cooperative pattern under high cooperation and high competition, partner pattern under high cooperation and low competition, battle pattern under low cooperation and high competition, isolated pattern under low cooperation and low competition.

1.2 Description of the Model

In China, SARFT holds the licese and is in charge of the integrated broadcast rights of IPTV, TC occupies the broadcast channel with the resources of Internent broadband exports and IDC, they can mutually cooperate to develop IPTV. Meanwhile, SARFT can develop IPTV itself through Two-way network reconstruction, and TC can invest into making content and provide to the integrated broadcast platform of IPTV to compete with SARFT. So, the coopetition between them can be sloved rely on the coopetition theory. As shown in Figure 1, SARFT cooperates with TC through the profit-sharing, SARFT is responsible for providing content and gets β of the income, TC is responsible for conveying and gets (1-β) of the income, we suppose the yield is q_1.SARFT also can process the Two-way network reconstruction at the unit cost c_3, we suppose the yield is q_3. TC also can make content at the unit cost c_2, we suppose the yield is q_2.

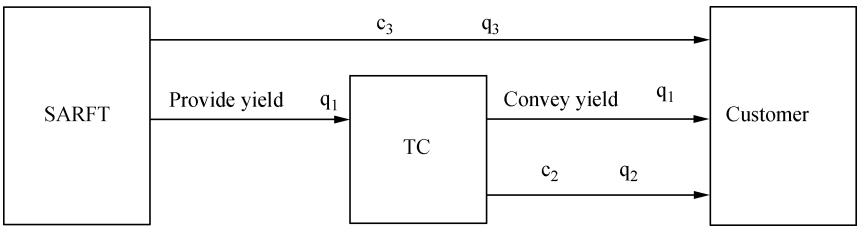

Figure 1
The Model of Coopetition Strategy Between SARFT and TC

1.3 Assumptions of the Model

(1) The price of IPTV meets the inverse demand function P (Q) =a-bq, a>0, b>0.

(2) The development of IPTV will bring competition to traditional TV resulting in the loss of users. We assume the loss of profit to traditional TV is the strictly negative correlation with the yield of IPTV and the coefficient values is –k. In other words, each unit increaces of IPTV, the loss of the average profit to the traditional TV is k;

(3)Without loss of generlity, we assume $a>>c_2$, $a>>c_3$, $a>>k$.

(4)SARFT has the advantage in contenrt and doesn't need fees in content to launch IPTV. TC has the advantage in channel and doesn't need fees in coverying.

(5)The article focuses on the coopetition relationship. We don't consider the impact of the integrated broadcast rights on the content which TC provides in order to facilitate the analysis. In other words, we assume the content which TC provides to the integrated broadcast platform of IPTV passes the audit and is allowed to play.

2. ANALYSIS OF THE COOPETITION STRATEGY BETWEEN SARFT AND TC

2.1 Coopetition Model

The demand of SARFT is the converying channel and TC's is the content. So, SARFT would certainly hand his whole or a part of content over TC to convery if only the profit-sharing is suitable when TC is willing to convery them. SARFT controls the integrated broadcast rights and TC needn't fees in converying, so TC would certainly apply his whole or a part of channel in converying content if only the profit-sharing is suitable when SARFT is willing to provide content.

So, their profit-functions are:

$$\pi_G = \beta q_1 (a - bq_1 - bq_2 - bq_3) + q_3 (a - bq_1 - bq_2 - bq_3 - c_3) - k(q_1 + q_2 + q_3) \quad (1)$$

$$\pi_D = q_2 (a - bq_1 - bq_2 - \mathrm{b}q_3 - c_2) + (1-\beta) q_1 (a - bq_1 - bq_2 - bq_3) \quad (2)$$

SARFT has rich resource in content and can invest into Two-way network reconstruction. TC

also can invest in making content, but it can't be comparable with SARFT's content in a short term. So, SARFT is the leader and TC is the follower. According to the Stackelberg game, the follower (TC) decides his yield based on the leader's (SARFT's) and the leader will also adjust his output after predicting the follower's (TC's).

In the coopetition relationship, SARFT and TC have two choices: competition and cooperation as shown in Table 1. There havn't cooperation if both of them choose competition, so q_1=0.SARFT wouldn't invest into Two-way network reconstruction if TC chooses competition and SARFT chooses cooperation, so q_3=0. TC wouldn't invest into making content if TC chooses cooperation and SARFT chooses competition, so q_2=0. Both of them will cooperate with each other to develop IPTV if both of them choose cooperation. At that time, TC wouldn't invest into making content, SARFT wouldn't invest into Two-way network reconstruction, q_2= q_3=0.

Table 1
The Choose of Coopetition Strategy

TC \ SARFT	Competition	Cooperation
Competition	q_1=0	q_3=0
Cooperation	q_2=0	q_2=q_3=0

2.2 Solution

(1)Highly Competitive Pattern where both TC and SARFT are in competiton

TC will invest into making content and SARFT will invest in Two-way network reconstruction if they choose competition, there don't exist any cooperation, so q_1=0. The advantage of this pattern is that it can help speed up the enterprise transformation of SARFT and enhance its market-oriented experience. Meanwhile, it contributes for further subdividing the consumer markte, reducing market monopoly, improving the service quality and reducing service cost. The disadvantage is that SARFT'content can't be used by TC needing TC to invist into making and TC's network can't be used by SARFT needing SARFT to invist into Two-way network reconstruction, resulting in advancing their cost to develop IPTV, and eventually leading to SARFT'finanical pressure, their advantage of resources can't be effectively shared, wasting the resources and so on. This pattern can be referred to as Highly Competitive Pattern because the degree of competition in this pattern is the highest, their profit-functions are:

$$\pi_{G1} = q_3 (a - bq_2 - bq_3 - c_3) - k(q_2 + q_3) \quad (3)$$

$$\pi_{D1} = q_2 (a - bq_2 - \mathrm{b}q_3 - c_2) \quad (4)$$

As the follower, TC will decide his yield based on SARFT's and SARFT will adjust his yield after predicting the TC's, TC'goal is to maximize profit, his optimal choice meets:

$$\partial \pi_{D1} / \partial q_2 = a - bq_2 - \mathrm{b}q_3 - c_2 - bq_2 = 0 \quad (5)$$

So, $q_2=(a-c_2-bq_3)/(2b)$ (6)

SARFT aims at profit maximization and decides his optimal yield rely on TC'reflection function as the leader:

$$\partial \pi_{G1} / \partial q_3 = a - bq_2 - bq_3 - c_3 - bq_3(\partial q_2 / \partial q_3 + 1) - k(\quad q_2 / \quad q_3 \quad 1) \quad 0$$

$$k(\partial q_2 / \partial q_3 + 1) = 0 \quad (7)$$

$$\text{So:} \begin{cases} q_3 = \dfrac{a + c_2 - 2c_3 - k}{2b} \\ q_2 = \dfrac{a - 3c_2 + 2c_3 + k}{4b} \end{cases} \quad (8)$$

Substitute q_2, q_3 into the profit-functions of SARFT and TC, we can get

$$\begin{cases} \pi_{D1} = \dfrac{(a - 3c_2 + 2c_3 + k)^2}{16b} \\ \pi_{G1} = \dfrac{(a + c_2 - 2c_3)^2 - (6a - 2c_2 - 4c_3)k + k^2}{8b} \end{cases} \quad (9)$$

(2)Lowly Cooperative Pattern where TC is in competition and SARFT is in cooperation

SARFT won't invist in Two-way network reconstruction and gets profit only by providing TC with content and TC will not only cooperate with SARFT by converying but invist into making content to develop IPTV himself when TC chooses competition and SARFT chooses cooperation, so q_3=0. The advantage of this pattern is that SARFT avoids the finanical pressure in a short time helping exert his advantage of content. The disadvantage is that the IPTV of SARFT competely relys on TC going against the enterprise transformation. Meanwhile, TC will invist in making content adding the cost of IPTV. This pattern can be referred to as Lowly Cooperative Pattern because TC who has extesive

experience in market not fully focuses on the cooperation and the degree of cooperation in this pattern is low, their profit-functions are:

$$\pi_{G2} = \beta q_1 \left(a - bq_1 - bq_2\right) - k(q_1 + q_2) \tag{10}$$

$$\pi_{D2} = q_2 \left(a - bq_1 - bq_2 - c_2\right) + (1-\beta) q_1 \left(a - bq_1 - bq_2\right) \tag{11}$$

Similarly, we get their optimal production decisions and their profits:

$$\begin{cases} q_1 = \dfrac{a + c_2 - \mathrm{k}}{2\beta b} \\ q_2 = \dfrac{(3\beta - 2)a - (2+\beta)c_2 + (2-\beta)k}{4\beta b} \\ \pi_{G2} = \dfrac{(\mathrm{a} + \mathrm{c}_2)^2 - (6a - 2\mathrm{c}_2)k + k^2}{8\mathrm{b}} \\ \pi_{D2} = \dfrac{\beta(a+k)^2 + (8+\beta)c_2^{\,2} + (8-14\beta)\mathrm{a}c_2 - (8-2\beta)kc_2}{16\beta b} \end{cases} \tag{12}$$

Now, the price of IPTV is: $P=a-bq_1-bq_2= (a+c_2+k)/4$

The price must be higher than k, so $a+c_2>3k$ (13)

(3)Lowly Competitive Pattern where TC is in cooperation and SARFT is in competition

When TC chooses cooperation and SARFT chooses competition, TC won't invist in making content but only gets profit by converying content and SARFT will not only cooperate with TC but also invist in Two-way network reconstruction to develop IPTV himself, so $q_2=0$. This pattern has some advantages as following: Firstly, TC who has extesive experience in market fully focuses on the cooperation and contributing to the consumer market development and degree of cooperation. Secondly, the whole content comes from SARFT fully exerting his adavantage of content to provide consumer with high quality of service. Thrid, SARFT' marketing pressure is small to develop IPTV himself and contributing to his enterprise transformation and accumluating experience gradually. The disadvantage is that the degree of market competition is low and it is not conducive to upgrading the products and improving the level of service. This pattern can be referred to as Lowly Competitive Pattern because TC who has extesive experience in market fully focuses on the cooperation and SARFT who is in the enterprise transformation develops IPTV independently and the degree of competition is low, their profit-functions are:

$$\pi_{G3} = \beta q_1 \left(a - bq_1 - bq_3\right) + q_3 \left(a - bq_1 - bq_3 - c_3\right) - k(q_1 + q_3) \tag{14}$$

$$\pi_{D3} = (1-\beta) q_1 \left(a - bq_1 - bq_3\right) \tag{15}$$

In this pattern, there is no decision of TC and his profit fully relys on q_1 and q_3. As the leader of

Stacklberg game, SARFT'profit fulluy depends on his own decision variable; SARFT takes it as goal to maxmize profit. Their profit and q_1 or q_3 are:

$$\begin{cases} \mathrm{q}_1 = \dfrac{(1-\beta)a - (1+\beta)c_3 + (1-\beta)k}{b(1-\beta)^2} \\ \mathrm{q}_3 = \dfrac{\beta(\beta-1)a + 2\beta c_3 - (1-\beta)k}{b(1-\beta)^2} \\ \pi_{G3} = \dfrac{\beta a c_3 - (1-\beta)ak + kc_3}{b(1-\beta)} - \dfrac{\beta {c_3}^2}{b(1-\beta)^2} \\ \pi_{D3} = \dfrac{(1-\beta)(a+k)c_3 - (1+\beta){c_3}^2}{b(1-\beta)^2} \end{cases} \tag{16}$$

(4)Highly Cooperative Pattern where both TC and SARFT are in cooperation

TC won't invist in making content and SARFT won't invist in Two-way network reconstruction

when they both choose cooperation, they cooperate mutually to develop IPTV, SARFT is responsible for providing content and TC for converying, so $q_2=q_3=0$. The advantege is that it's easily to carry out, TC doesn't have to spend resources on making content and SARFT doesn't have to spend huge fund in constructing network, it fully realizes the complementation of their strengths and their cost are lower. Meanwhile, TC who has extesive experience in marke is responsible for developing the market and SARFT who has the advantage on content is responsible for providing content, it contributes to the rapid development of IPTV. The disadvantage is that SARFT doesn't involve in market against accumulating experience. Meanwhile, it easily forms market monopoly against upgrading product and improving the level of service. This pattern can be referred to as Highly Cooperative Pattern because there doesn't have any competition and the degree of cooperation is higer, their profit-functions are:

$$\pi_{G4} = \beta q_1 \left(a - bq_1\right) - kq_1 \tag{17}$$

$$\pi_{D4} = (1-\beta) q_1 \left(a - bq_1\right) \tag{18}$$

In this pattern, there is no decision of TC and his profit fully relys on q_1. As the leader of Stacklberg game, SARFT'profit fulluy depends on his own decision variable, SARFT takes it as goal to maxmize profit, his optimal decision meets:

$$\partial \pi_{G4} / \partial q_1 = \beta(\mathrm{a} - bq_1) - \beta b q_1 - \mathrm{k} = 0 \tag{19}$$

$$\text{So, } q_1 = (\beta a - \mathrm{k})/(2\beta b) \tag{20}$$

Substitute q_1 into the profit-functions of SARFT and TC, we can get

$$\begin{cases} \pi_{G4} = \left(\beta a - \mathrm{k}\right)^2 / (4\beta \mathrm{b}) \\ \pi_{D4} = (1-\beta)\left(\beta^2 a^2 - k^2\right) / (4\beta^2 b) \end{cases} \tag{21}$$

2.3 Discussion

We get the conditions for existence of the four patterns during getting their optimal solutions,

Highly Competitive Patter's is $a+c_2-2c_3-k>0$, $a-3c_2+2c_3+k>0$, Lowly Cooperative Pattern's is $a+c_2-k>0$, $\frac{2a+2c_2-2k}{3a-k-c_2}<\beta<1$, Lowly Competitive Patter's is $\frac{a-k-2c_3+\sqrt{(a-k-2c_3)^2+4ak}}{2a}<\beta<\frac{a-c_3+k}{a+c_3+k}$, Highly Cooperative Pattern's is $\beta>k/a$. As $a \gg c_2$, $a \gg c_3$, $a \gg k$, we assume $a+c_2-2c_3-k>0$, $a-3c_2+k>0$,

and

$$k/a<(2a+2c_2-2k)/(3a-c_2-k)<(a-k-2c_3+\sqrt{(a-k-2c_3)^2+4ak})/(2a)<(a-c_3+k)/(a+c_3+k).$$

Firstly, we discuss the choice of optimal coopetition strategy of SARFT.

Assume TC chooses competition, so

$$\pi_{G2}-\pi_{G1}=\frac{(a+c_2)^2-(6a-2c_2)k+k^2}{8b}-\frac{(a+c_2-2c_3)^2-(6a-2c_2-4c_3)k+k^2}{8b}=\frac{(a+c_2-k-c_3)c_3}{2b} \tag{22}$$

As $a+c_2-2c_3-k>0$, $a+c_2-c_3-k>0$ must be right and $p_{G2}>p_{G1}$. That is to say, the optimal choice of SARFT is cooperation when TC chooses competiton; we compare q_1 with q_2,

$$q_1-q_2=\frac{a+c_2-k}{2\beta b}-\frac{(3\beta-2)a-(2+\beta)c_2+(2-\beta)k}{4\beta b}=\frac{(4-3\beta)a+(4+\beta)c_2-(4-\beta)k}{4\beta b} \tag{23}$$

$(4-3\beta)a+(4+\beta)c_2-(4-\beta)k$ is the decreasing function of β, and $(4-3\beta)a+(4+\beta)c_2-(4-\beta)k= a+5c_2-3k$ when β=1.We can get $a+c_2>3k$ from formula (13), so $a+5c_2-3k>0$.Namely $q_1>q_2$ when β=1, so $(4-3\beta)a+(4+\beta)c_2-(4-\beta)k>0$ must be set up, namely $q_1> q_2$ must be set up.

So, when TC chooses competition, the optimal strategy of SARFT is cooperation and provides IPTV with most program resources.

Assume TC chooses cooperation, so

$$\pi_{G4}-\pi_{G3}=\frac{(\beta a-k)^2}{4\beta b}-\frac{\beta ac_3-(1-\beta)ak+kc_3}{b(1-\beta)}+\frac{\beta c_3^2}{b(1-\beta)^2}=\frac{[(1-\beta)\beta a+(1-\beta)k-2\beta c_3]^2}{4\beta b(1-\beta)^2}\geq 0 \tag{24}$$

Namely, when TC chooses cooperation, the optimal stategy of SARFT is cooperation, and TC

won't invist in making content and they cooperate to develop IPTV. Above all, we get conclusion1:

Conclusion 1: SARFT'ideal strategy is only cooperation with TC and don't need to develop IPTV by himself and provides IPTV with most program resources.

Now, it has been given SARFT chooses cooperation, TC chooses his optimal stategy based on the relative size between p_{D4} and p_{D2}. He will choose cooperation when β meets $p_{D4}>p_{D2}$ and their optimal coopetition strategy between TC and SARFT is (cooperation, cooperation). He will choose competition if β meets $p_{D4}<p_{D2}$ and their optimal coopetition strategy is (competition, cooperation).

3. NUMERICAL SIMULATION ANALYSIS

The article designs a numerical simulation to visually observe the effect of profit-sharing on their choices of coopetition strategy. Assume a=350, b=0.2, c_2=15, c_3=10, k=5, Table 2 shows the effect of the variation of βon TC'profit and SARFT's in the four patterns.

Firstly, let us observe their choices of optimal coopetition strategy.

When $\beta\leq k/a$, the conditions for existence of Lowly Competitive Patter and Lowly Cooperative Pattern and Highly Cooperative Pattern don't set up, they can only choose competition. Such as in Table 2, there only has the profits of Highly Competitive Patter when$\beta\leq 0.01$.

When $k/a<\beta\leq\beta_{x1}$(x1 refers to any value but not a specific value,below x2、x3 are the same meaning),the conditions for existence of Lowly Competitive Patter and Lowly Cooperative Pattern don't set up and they choose from Highly Cooperative Pattern and Highly Competitive Patter. SARFT' profit in Highly Competitive Patter is higher than it in Highly Cooperative Pattern, but TC's is opposite. So, SARFT tends to choose Highly Competitive Patter and TC tends to choose Highly Cooperative Pattern. There is no equilibrium in theory. But in actual operation, as the leader, SARFT can don't provide TC with content but develop IPTV himself through Two-way network reconstruction. Then, TC has to choose making content himslef to compete with SARFT and it is impossible to allow SARFT to develop IPTV himself. Actually, neither SARFT nor TC is able to develop IPTV himself. SARFT' profit will be less than zero and less than it in Highly Competitive Patter if TC develops IPTV himself, so SARFT will join in competition forming Highly Competitive Patter. The profit of TC will be less than zero and less than the profit in Highly Competitive Patter if SARFT develops IPTV himself, so TC will join in competition forming Highly Competitive Patter. Meanwhile, Highly Competitive Patter is more stable than highly cooperative Pattern. So, their final strategy still is competition. Such as in Table 2, $p_{D1}<p_{D4}$,$p_{G1}>p_{G4}$, and they finally choose Highly Competitive Patter when$0.02\leq\beta\leq 0.45$.

Table 2
The Effect of the Variation of βon TC'profit and SARFT's in the Four Patterns

	Highly Competitive Patter		Lowly Cooperative Patter				Lowly Competitive Patter				Highly Cooperative Patter		
β	π_{D1}	π_{G1}	q_1	q_2	π_{D2}	π_{G2}	q_1	q_3	π_{D3}	π_{G3}	q_1	π_{D4}	π_{G4}
0.01	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	(0)	*	*
0.02	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	250	73500	250
0.03	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	458	114851	1260
0.05	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	625	133594	3906
0.10	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	750	135000	11250
0.15	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	792	128976	18802
0.20	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	813	121875	26406
0.25	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	825	114469	34031
0.30	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	833	106944	41667
0.35	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	839	99365	49308
0.40	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	844	91758	56953
0.45	**34031**	**68063**	*	(0)	*	*	*	(0)	*	*	847	84134	64601
0.50	34031	68063	*	(0)	*	*	*	(0)	*	*	850	**76500**	**72250**
0.55	34031	68063	*	(0)	*	*	*	(0)	*	*	852	**68860**	**79901**
0.60	34031	68063	*	(0)	*	*	*	(0)	*	*	854	**61215**	**87552**
0.65	34031	68063	*	(0)	*	*	*	(0)	*	*	856	**53568**	**95204**
0.70	34031	68063	1286	2	35817	76813	*	(0)	*	*	857	**45918**	**102857**
0.75	34031	68063	1200	88	34531	76813	*	(0)	*	*	858	**38267**	**110510**
0.80	34031	68063	1125	163	**33406**	**76813**	*	(0)	*	*	859	30615	118164
0.85	34031	68063	1059	229	**32414**	**76813**	*	(0)	*	*	860	22962	125818
0.90	34031	68063	1000	288	**31531**	**76813**	*	(0)	*	*	861	15309	133472
0.94	34031	68063	957	330	**30893**	**76813**	*	(0)	*	*	862	9185	139596
0.945	34031	68063	952	335	**30817**	**76813**	124	717	1240	140279	862	8420	140361
0.95	34031	68063	947	340	**30742**	**76813**	(0)	*	*	*	862	7655	141127
0.96	34031	68063	938	350	**30594**	**76813**	(0)	*	*	*	862	6124	142658
0.97	34031	68063	928	360	**30449**	**76813**	(0)	*	*	*	862	4593	144189
0.98	34031	68063	918	369	**30307**	**76813**	(0)	*	*	*	862	3062	145719
0.99	34031	68063	909	378	**30168**	**76813**	(0)	*	*	*	862	1531	147250

Note: Record: (0) means the value isn't larger than zero; it has no sense in actuality. * means the production of TC or SARFT is smaller than zero; there is no realistic basis of the profit.

When $\beta_{x1}<\beta\leq (2a+2c_2-2k)/(3a-c_2-k)$, the conditions for existence of Lowly Competitive Patter and Lowly Cooperative Pattern don't set up. Their profits in Highly Cooperative Pattern are higher than them in Highly Competitive Patter, both of them tend to choose Highly Cooperative Patter and cooperate with each other to develop IPTV. As in Table 2,$p_{D1}<p_{D4}$,$p_{G1}<p_{G4}$ when $0.5\leq\beta\leq0.65$,

Namely their profits are the largest in Highly Cooperative Pattern at that time.

When $(2a+2c_2-2k)/(3a-c_2-k)<\beta\leq\beta_{x2}$, the conditions for existence of Lowly Competitive Patter don't set up. At present, SARFT will choose cooperation to get more profit no matter TC chooses cooperation or competition. But TC'profit in Highly Cooperative Pattern is higher than it in Lowly Cooperative Patter. So they will cooperate with each other finally. Such as in Table 2, $p_{G2}>p_{G1}$,$p_{D4}>p_{D2}$ if $0.7\leq\beta\leq0.75$. Namely, both TC and SARFT choose cooperation.

When $\beta_{x2}<\beta<(a-k-2c_3+\sqrt{(a-k-2c_3)^2+4ak})/(2a)$, the conditions for existence of Lowly Competitive Patter still don't set up. SARFT'optimal strategy is cooperation, but TC' profit in Lowly Cooperative Patter is higher than it in Highly Cooperative Patter. Finally SARFT chooses cooperation and TC chooses competition forming Lowly Cooperative Patter. Such as in Table 2, $p_{G2}>p_{G1}$,$p_{D2}>p_{D4}$ if $0.8\leq\beta\leq0.94$. At present, SARFT only cooperates with TC, TC not only cooperates with SARFT but also makes content himself to develop IPTV.

When $(a-k-2c_3+\sqrt{(a-k-2c_3)^2+4ak})/(2a)<\beta<(a-c_3+k)/(a+c_3+k)$, all the conditions for existence of the four patterns set up. SARFT will choose cooperation if TC chooses competition and still choose cooperation if TC chooses cooperation. As TC' profit in Lowly Cooperative Patter is higher than it in Highly Cooperative Patter. Finally SARFT chooses cooperation and TC chooses competition. Such as in Table 2, $p_{G2}>p_{G1}$,$p_{G4}>p_{G3}$,$p_{D2}>p_{D4}$ ifβ=0.945,they will choose Lowly Cooperative Patter checking the Conculsion 1.

When $\beta>(a-c_3+k)/(a+c_3+k)$, the conditions for existence of Lowly Competitive Patter don't set up. So SARFT chooses cooperation and TC chooses competition forming Lowly Cooperative Patter. As in Table 2,$p_{G2}>p_{G1}$,$p_{D2}>p_{D4}$ if$\beta\geq0.95$, namely their optimal choice is Lowly Cooperative Patter.

Observe β_{x1},β_{x2}, we can get

$k/a < \beta_{x1} < (2a+2c_2-2k)/(3a-c_2-k) < \beta_{x2} < (a-k-2c_3+\sqrt{(a-k-2c_3{}^2+4ak})/(2a)$.

$a \gg c_2, a \gg k$, so $(2a+2c_2-2k)/(3a-c_2-k) \approx 0.7$. Let $\beta_{x1}=0.7-\xi_1$, $\beta_{x2}=0.7+\xi_2$ (ξ_1 and ξ_2 are constant),

so when $\beta \in (0.7-\xi_1, 0.7+\xi_2)$ (in other words, the profit-sharing between SARFT and TC is in the neighborhood of seven-three), both of them will cooperate with each other.

Above all, SARFT and TC will choose Highly Competitive Patter when $\beta \le 0.7-\xi_1$ and Highly Cooperative Patter when $0.7-\xi_1 \le \beta \le 0.7+\xi_2$ and Lowly Cooperative Patter when $\beta \ge 0.7+\xi_2$. Meanwhile, we find their profits are the highest in Highly Cooperative Patter than others under the optimal coopetition stategies that they select when the profit-sharing is at other stages. The optimal profit is shown in Figure 2.

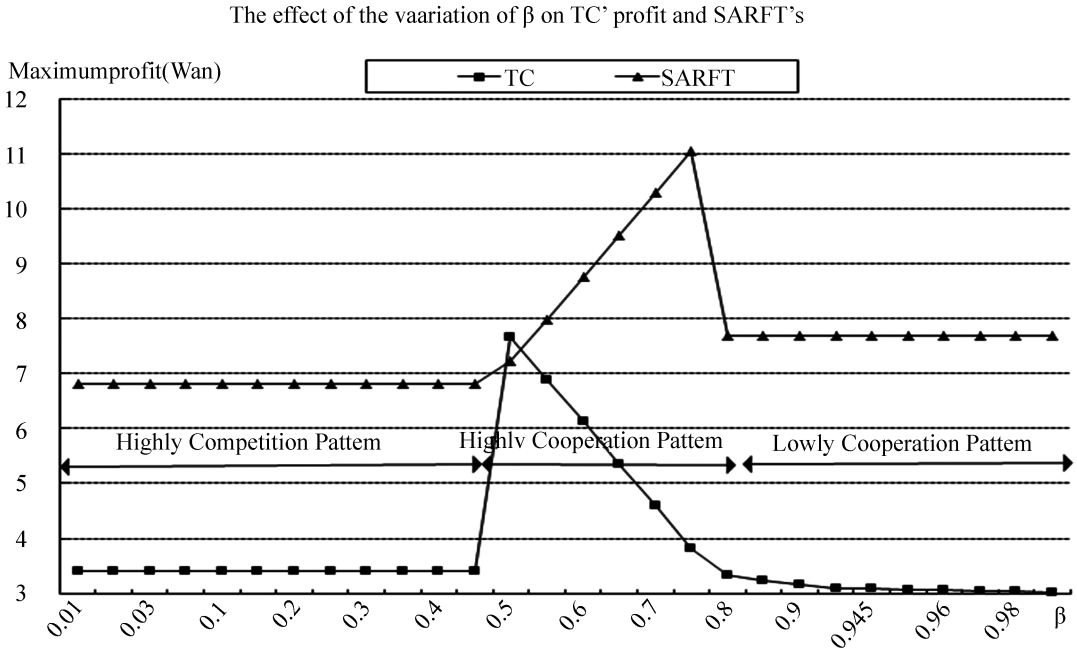

Figure 2
The Effect of the Variation of β on TC'Profit and SARFT's

Secondly, the paper will discuss their optimal yield. If $\beta \le 0.7-\xi_1$, all of them will choose competition. At present, SARFT'yield is 850 units and TC's is 412.5 units which he makes himself, so SARFT provides the most program resources. If $0.7-\xi_1 < \beta \le 0.7+\xi_2$, both of them will choose cooperation, SARFT provides the content and TC is responsible for converying, all the content comes from SARFT. If $\beta > 0.7+\xi_2$, SARFT will choose cooperation and TC will choose competition forming Lowly Cooperative Patter. Such as in Table 2, q_1 is always higher than q_2, SARFT also provides the most program resources.

CONCLUSION

The article embarks from the plight of IPTV development in China and builds a coopetition model between SARFT and TC based on the profit-sharing and explores their choices of coopetition strategy and optimal yield decisions under the different level of profit-sharing based on Stackelberg games. The conclusion is as follows:

The SARFT should provide IPTV with most program resources. Both SARFT and TC should choose competition if the profit-sharing between SARFT and TC is under the neighborhood of seven-three. Both of them should choose cooperation if the profit-sharing is in the neighborhood of seven-three. Their optimal coopetition strategy is (cooperation, competition) if the profit-sharing is above the neighborhood of seven-three. Meanwhile, their profits are the highest if both of them choose cooperation than others under the optimal coopetition stategies that they select when the profit-sharing is at other stages, they shoule controll the profit-sharing into the neighborhood of seven-three to choose the mutual cooperation strategy.

In Highly Cooperative Patter, SARFT is responsible for providing contene and TC is responsible for converying. For SARFT, his biggest advantage is content compared with TC. He should keep this advantage and fouse on improving the quality of program and developing new programs. He should adhere to the principle that content and service are supreme to improve the quality of program and increase the types of interactive program finally developing to the value-added service. For TC, he occupies the broadcast channel with the resources of the Internet broadband exports and Internet Date Center. He should speed up the construction of broadband network with the attitude of runner improving the carrying capacity of broanband and network speed to ensure the stability of network.

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