Analysis on Value added Equilibrium of Enterprise Marketing Networks

,Xiao Hong Qin[1,a*], Yong Hong Du[1,b]

School of Economics and Business xijing University xi'an 710023,China

[a]qinxiaohong12@sohu.com, [b]80477659@qq.com

Keywords: Enterprise marketing networks; Marketing channels; Value added; Game theory Value added Equilibrium

Abstract. Enterprise marketing networks has evolved into complex marketing networks from chain of marketing channel. However, current enterprise marketing networks has studied more limited to game decision-making of the single channel between upstream and downstream members. To considering the marketing channels of enterprise marketing networks has complex competitive relationship, the article has build the enterprise network marketing value equilibrium model, and has studied the different marketing channels of static game decision-making and under asymmetric information and cost game decision making.The article has from an example to explain the model of economic significance.

Introduction

The investigative of enterprise marketing networks is limited a single marketing channels upstream and downstream members decision-making, which studies can be seen as a single marketing channel upstream and downstream enterprises channels Game-making [1,2,3,4,5].The existing examination about enterprise marketing networks has no studied decision-making of across the single marketing channel. As market competition intensifies, the single marketing channel interrelated and intertwined to form a complex marketing network in order to meet the needs of the end customer and get to maximize their own interests. There are variety of competing relationship in enterprise marketing networks, and game theory as an analysis tools are widely to use [6]. Competition and cooperation relationship of enterprise marketing networks are around value creation and value-added. For most enterprise marketing networks, value-added and network surplus is strong positive relationship.The revenue surplus is total profits for the marketing networks all the links shared, which from the difference between the sales revenue and the total cost of enterprise marketing networks sale of the marketing network marketing networks.

The static game decision-making between different marketing channels

Assumptions enterprise marketing networks structure remains unchanged.Assuming enterprise marketing networks has MC_A and MC_B marketing channels which core members respectively is CM_A and CM_B.The value-added of individual marketing channels is ΔV, then:

$$\Delta V = P - \sum C \tag{1}$$

Which P denote the price of product reaches the end users or consumers. $\sum C$ denote total cost of marketing channels, which including the manufacturer's production cost C_p and producers and middlemen (wholesalers, retailers, etc.) production sales cost C_S, warehousing costs C_H ,transportation costs C_T, and other costs C_O, then:

$$\sum C = C_p + C_s + C_h + C_t + C_o \tag{2}$$

Assume that two single marketing channel MC_A and MC_B in the process of market competition, which pursuit of their own value-added to maximize, the objective function is:

$$M\max\pi_i(Q_i,Q)=M\max\left\{(a-b)Q-\left[(C_p)_i+(C_s)_i+(C_h)_i+(C_t)_i+(C_o)_i\right]Q_i\right\} \tag{3}$$

Which $i=A,B$, $Q=\sum Q_A+Q_B$, Q_A and Q_B is respectively product sales of marketing channels MC_A and MC_B, and a、b is constant. a can understanding for the highest price of the product in the market. b can understanding additional sale a unit of product due to price declines (it is impact of sales quantity for sales pricemarginal).

Assumption MC_A costs is $\sum C_A$ and MC_B cost is $\sum C_B$, whch are public knowledge. Two single marketing channel MC_A and MC_B all know own cost and other cost .For single marketing channel MC_A, we seek product sell Q_A^* when achieve their own value-added maximize. Which is equal to seek the first order derivative and second derivative of the formula (3), and satisfies:

$$\left\{\left[a-b(Q_A+Q_B)-\sum C_A\right]\times Q_A\right\}' Q_A=0 \tag{4}$$

$$\left\{\left[a-b(Q_A+Q_B)-\sum C_A\right]\times Q_A\right\}'' Q_A<0 \tag{5}$$

Because the formula (5) is always established when π_A is positive. Can be obtained from the formula (4):

$$Q_A^*=\left(a-bQ_B-\sum C_A\right)/(2b) \tag{6}$$

Similarly can be obtained a single marketing channel MC_B its product sales quantity when it achieve their own added value maximization:

$$Q_B^*=\left(a-bQ_A-\sum C_B\right)/(2b) \tag{7}$$

Formula (6) and (7) simultaneous, respectively to obtain the two marketing channels MC_A and MC_B product sales quantity when maximized their own value-added as follows:

$$Q_A^*=\left(a+\sum C_B-2\sum C_A\right)/(3b) \tag{8}$$

$$Q_B^*=\left(a+\sum C_A-2\sum C_B\right)/(3b) \tag{9}$$

MC_A and MC_B product sales price when realize the maximized value added as follows:

$$Q_A^*=\left(a+\sum C_B-2\sum C_A\right)/(3b) \tag{10}$$

MC_A and MC_B respect profits when achieve added value maximized as follow:

$$\pi_A^*(Q_A^*,Q^*)=P^*Q_A^*-\sum C_AQ_A^* \tag{11}$$

$$\pi_B^*(Q_B^*,Q^*)=P^*Q_B^*-\sum C_BQ_B^* \tag{12}$$

From the formula (8) and (9) we can see that the best product sales of single marketing channel is not only associated with its own costs, but also relate to the cost of other marketing channels (competitors). The single marketing channel greater value-added is that has highest price of in the market and lower own costs and competitors (other marketing channels) higher cost. For example, the member of enterprise marketing networks strengthen information sharing, and implement dynamic order to reduce cost of marketing channels[7,8] .

Game decision-making of different marketing channels under asymmetric information

Assuming MC_A form earlier than MC_B. MC_A cost of $\sum C_A$ is public knowledge. MC_B cost of $\sum C_B$ is private knowledge. MC_A only know that the cost of MC_B may be p and $(1-p)$ probability

of high-cost $\sum C_{BH}$ or low-cost $\sum C_{BL}$. But MC_B know that their own costs is $\sum C_{BH}$ or $\sum C_{BL}$. For single marketing channel MC_A, $\sum C_B$ is random variables, and expectation is $E(C_B) = P\sum C_{BH} + (1-P)\sum C_{BL}$.

In the case of cost information asymmetry, due to MC_A cost $\sum C_A$ is public knowledge. The MC_B objective function:

$$Max\pi_B(Q_B, Q) = Max\left[a - b(Q_A + Q_B) - \sum C_B\right]Q_B \tag{13}$$

To seek the formula (13) for Q_B the first derivative and the second derivatives, and to let the first derivative equal zero, and the second derivative is less than 0, then:

$$\left\{\left[a - b(Q_A + Q_B) - \sum C_B\right]Q_B\right\}' Q_B = 0 \tag{14}$$

$$\left\{\left[a - b(Q_A + Q_B) - \sum C_B\right]Q_B\right\}'' Q_B < 0 \tag{15}$$

Because the formula (15) is always true in the case $b > 0$, so from the formula (14) we available MC_B product sales quantity when add value maximum:

$$Q_B^* = \left(a - bQ_A^* - \sum C_B\right)/(2b) \tag{16}$$

Because MC_A only know probability of MC_B take the high cost $\sum C_{BH}$ or low cost $\sum C_{BL}$, therefore, the MC_A objective function is:

$$Max\pi_A(Q_A, Q) = Max\left\{\left[(a - b(Q_A + Q_{BH}) - \sum C_A\right]Q_A P + Q_A(1-P)\left[(a - b(Q_A + Q_{BL}) - \sum C_A\right]\right\} \tag{17}$$

Q_{BH} and Q_{BL} respectively is product sales of MC_B in the cost $\sum C_{BH}$ and $\sum C_{BL}$; to solute sales of MC_A with maximum value added:

$$Q_A^* = \left(a - \sum C_A - b\left[pQ_{BH} + (1-p)Q_{BL}\right]\right) \tag{18}$$

MC_A and MC_B sales respectively as follow, in the case of game behavior and achieve value-added maximum:

$$Q_A^* = \left(a - 2\sum C_A + \left[p\sum C_{BH} + (1-p)C_{BL}\right]\right)/(3b) \tag{19}$$

$$Q_B^* = \left(a + \sum C_A - 2\sum C_B\right)/(3b) \tag{20}$$

Among $\sum C_B \in \left\{\sum C_{BH}, \sum C_{BL}\right\}$, MC_A and MC_B game decision-making on product sales achieve balanced, MC_A and MC_B the total product sales as follow:

$$Q^* = Q_A^* + Q_B^* \tag{21}$$

In this case the price of the product :

$$P^* = a - bQ^* \tag{22}$$

the corresponding MC_A and MC_B equilibrium value added as follows:

$$\pi_A^*(Q_A^*, Q^*) = P^* Q_A^* - \sum C_A Q_A^* \tag{23}$$

$$\pi_B^*(Q_B^*, Q^*) = P^* Q_B^* - C_B Q_B^* \tag{24}$$

Among, $\sum C_B \in \left\{\sum C_{BH}, \sum C_{BL}\right\}$.

These results suggest that in the case of asymmetric information costs optimal product sales decisions and optimal value-added are consistent with complete information costs.Marketing channels MC_A optimal product sales decisions and optimal value-added with incomplete information different cost information disclosure.Which not only by impact of cost factors, and also depends on forecast competitors cost accuracy.

Numerical example

Assuming marketing channels MC_A and MC_B of enterprise marketing networks are collaborative monopoly a regional marke, the cost MC_A and MC_B respectively is:

$$\sum C_A = (C_p)_A + (C_s)_A + (C_h)_A + (C_t)_A + (C_o)_A = 35+20+10+18+7 = 90$$

$$\sum C_{BH} = (C_p)_{BH} + (C_s)_{BH} + (C_h)_{BH} + (C_t)_{BH} + (C_o)_{BH} = 35+25+12+18+10 = 100$$

$$\sum C_{BL} = (C_p)_{BL} + (C_s)_{BL} + (C_h)_{BL} + (C_t)_{BL} + (C_o)_{BL} = 35+18+8+15+9 = 85$$

The maximum sales price of product on the market is $a = 150$ .Each a unit of product additional sale to drop price is $b = 0.1$.The probability of marketing channels MC_B with high cost for product marketing is uncertainty.We comparative analysis $p = 0.2$ and $p = 0.6$ both cases. Table 1 and Table 2 respectively showed that MC_A and MC_B Optimal product sales strategy and largest value-added when MC_B with C_{BH} and C_{BL} for product marketing.

Table 1 three situations of MC_B with C_{BH} for product marketing

	(1) $\sum C_B$ is $\sum C_{BH}$ and MC_A forecast C_{BH}	(2) $\sum C_B$ is $\sum C_{BH}$ and MC_A forecast C_{BL}	(3) $\sum C_B$ is $\sum C_{BH}$ and MC_A use $E(\sum C_B)$ to calculate	
			$p = 0.2$	$p = 0.6$
P^*	113	118	117	115
Q_A^*	233	183	193	213
Q_B^*	133	133	133	133
		Per unit of product selling prices rise 5 yuan	Per unit of product selling prices rise 4	Per unit of product selling prices rise 2 yuan
π_A^*	5359	5124	5211	5325
π_B^*	1729	2394	2261	1995

From Table 1 we can see three cases if MC_B cost is C_{BH} : The MC_A can get the highest value-added when the MC_A predict correct; When MC_A decision-making is low cost of MC_B , MC_A actual sales of products than optimal sales of products small lead to raise of price in the market. In this case, the MC_A get smallest value-added, while the MC_B get highest value-added; When MC_A to make decision in accordance with expectation value the cost of MC_B , MC_A value-added lesser than forecast correct decisions,but value-added significantly better than prediction errors. While MC_B still benefit from mis-prediction of MC_A , and MC_B enjoy higher market price and value-added .

Table 2 three situations of MC_B with C_{BL} for product marketing

	(1) $\sum C_B$ is $\sum C_{BL}$ and MC_A forecast C_{BL}	(2) $\sum C_B$ is $\sum C_{BL}$ and MC_A forecast C_{BH}	(3) $\sum C_B$ is $\sum C_{BH}$ and MC_A use $E(\sum C_B)$ to calculate	
			$p = 0.2$	$p = 0.6$
P^*	108	103	107	105
Q_A^*	183	233	193	213
Q_B^*	233	233	233	233
		Per unit of product selling prices rise 5 yuan	Per unit of product selling prices rise 6 yuan	Per unit of product selling prices rise 8 yuan
π_A^*	3294	3029	3281	3195
π_B^*	5359	4194	1631	1165

From Table 2 we can see three cases: MC_A can get highest value-added when MC_A prediction correct in the case of MC_B cost is $\sum C_{BL}$; When MC_A accordance with high cost of MC_B decision, MC_A actual sales more than optimal sales to lead lower prices of products in the market , MC_A get lowest value-added but value-added of MC_B also suffer losses due to price reduction of product in market ;When MC_A accord with expectation cost of MC_B to make decision, then MC_A value-added lesser than forecast correct, but significantly better than prediction errors. While MC_B still suffer mis-prediction of MC_A and suffer lower market price and value-added.

Conclusion

If have incomplete cost information marketing channel is not using the expected value prediction of the other costs, only in the accurately predict each other's cost, to obtain the highest value; otherwise, not only will suffer due to inaccurate prediction of low value, and make the other side enjoy market price and relatively high added value.When the full cost information marketing channels the cost is lower than the other side, hope the other party can understand their cost information, this can be avoided because of the other prediction errors and the decision error caused by market prices, and avoid the loss of value added value.

References

[1] Yunlong Gao. Enterprise marketing network design and management [] Beijing: Social Sciences Academic Press,2006.1-4.

[2] Xiaohong Guangqiu Huang.Robustness Analysis of enterprise marketing network based on complex network theory[J]. Business Research, 2010,23 (12) :43-38.

[3] Anna Nagurney, June Dong, Ding Zhang. A Supply Chain Network Equilibrium Model[J].Transportation Research,2002,38(5):281-304.

[4] June Dong, Ding Zhang, Hong Yan, et al. Supply Chain Networks: Decision-Making Under Uncertainty [J]. Annals of Operations Research,2005,135(1):155-180.

[5] Lalonde B J. Supply Chain Management: Myth or Reality [J]. Supply Chain Management Review,2006, 12(1):6-7.

[6] Zhang Xinrui, Wang Hengshan. The complex supply chain network structure model of[J]. industry technology and economy, 2008 (2): 70-81.

[7] Zhang Xinrui, Wang Hengshan. Supply chain network value-added game decision making research on [J]. Business Economics and management, 2009 (7): 70-81

[8] Zhang Tiezhu, Hu Yunquan, et al. The multi-layer planning of decentralized supply chain model of [J]. Natural Science Journal of Heilongjiang University, 2006,23 (3): 302-306