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An Analysis of Pricing Strategies in the Process of Business Acquisition

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Abstract

In the process of enterprise merger, how to make transaction price much more rational has become a difficult problem theoretically and practically. This article applies the method of game theory to analyze the equilibrium price between the buyers and the sellers or just the buyers existing in enterprise merger market, and then puts forward the optimal bidding strategies in the merging process. Moreover, it also indicates that Bayesian balance lies in the competition between the buyers, while the best response of every game player is that its quotation should be half of its evaluation of the merged enterprise.

Keywords: Enterprise merger, Equilibrium price, Game theory, Bayesian balance

1. Introduction

Enterprise merger, as one kind of economic behavior, is that an enterprise acquires other enterprise's controlling rights completely or to a certain degree by means of property right transaction in order to enlarge its business scope, reinforce its economic strength, improve its overall competency and finally realize its enterprise management strategy and goal(Fred, Weston and Merger, J., 1998). This article analyzes the price bidding and demanding strategies of the merging enterprise and the merged enterprise during the merging.

In the merging process, transaction price is the core issue to the merging enterprise and its target enterprise. And as the business of enterprises, enterprise merger surely takes enterprise value as the exchange basis, but actually, it shows the irrational behaviors of the buyer-enterprise or the seller-enterprise. Against this background, this article applies game theory method to analyze the bidding and demanding strategies of the merging enterprise and the merged enterprise in order to provide instructions to determine the transaction price in enterprise merging activities.

2. Equilibrium price analyses during the competition between the buyers and the sellers

From a practical point of view, there mainly exist two kinds of enterprise merger, one of which is the hostile takeover, and the other is the intentional one. When an enterprise has realized the danger of the former, it will take series of measures to defend against the acquiring side. However, both the buyers and the sellers of the latter, although their returns or starting point is quite different, have the same will to merge. Furthermore, no matter what the merging mode appears, the solution to the problem is sure to be decided on both sides' determining the transaction price.

Now suppose there are 2 enterprises—the merging enterprise and the merged enterprise, who negotiate with each other mainly aiming at the transaction price, and formulate the following rule: No matter either side puts forward the proposal, it is possible for its opponent to accept or reject. If one side accepts, then the negotiation will end; otherwise, if one side put forward an improved plan, then it's the other party's turn to choose whether accept or reject. Moreover, both sides would bid alternately till any side accepts the other's plan. For the convenience to study, we assumes as follows:

Hypothesis (hereafter abbreviated as)

H1: The merging enterprise (assumed as game player 1) and the merged enterprise (known as game player 2) are economically rational.

H2: The transaction takes the manner of purchase-merger.

H3: Because of the negotiating cost and interest loss of every more phase of bargaining to be continued, the returns of both sides should be discounted once, and the discounting ratio is β (0< β <1). Thus, any game player is surely willing to accept, if its profit in the phase when its opponent bids is more than that of its self in the next phase.

Suppose the market value of target enterprise is V, and then the buyer's potential evaluation of the seller is V_{buyer}. Moreover, in every phase, the buyer's bidding is V_i, while the seller's demanding price is V_j, i=1, 3, 5, j=2, 4, 6…Our principle is that, with the increased number of bargaining times, we could find the concluding price P at last and make it as the balancing solution. And usually when the transaction is concluded, we would get $P \le V_{\text{buyer}}$, which makes the above problem to convert into a bargaining game on in an infinite phase.

First, this article introduces the idea suggested by Shaked and Sutton on solving this kind of game problem, whose gist is that the result of the third phase (if it could reach the third one) or the first phase is the same (Xie, Shiyu, 1999; Lin, Lei and Qian, Liu, 1999), then this essentially forms a game of 3-phase transaction price. Upon the above-mentioned conclusion, now further suppose there is a solution to the problem inferred by induction. Based on the former supposition, if the buyer and the seller close the deal with the same price P (the bidding of the merging enterprise that should be accepted by the merged enterprise at the moment), the highest demanding V_2 of the merged enterprise in the second phase that could be accepted by the merging enterprise is sure to make its returns to satisfy

$$\beta(V_{\text{buyer}} - V_2) = \beta^2(V_{\text{buyer}} - P) \tag{1}$$

And while the gains of the merged enterprise is $\beta[(1-\beta)V_{\text{buyer}} + \beta P - V]$, the above equation should be

$$V_2 = (1-\beta)V_{\text{buyer}} + \beta P \tag{2}$$

Thus, the bidding of the merging enterprise makes the merged enterprise to gain $\beta[(1-\beta)V_{\text{buyer}} + \beta P - V]$, and the returns of itself should be more than $\beta^2(V_{\text{buyer}} - P)$, at this time

$$V_1 - V = \beta[(1-\beta)V_{\text{buyer}} + \beta P - V] \tag{3}$$

should be satisfied. As noted above, for a 3-phase game is equal to the former one in an infinite phase starting from the first phase, then we could get

$$P - V = \beta[(1-\beta)V_{\text{buyer}} + \beta P - V] \tag{4}$$

and

$$P = \frac{(\beta V_{\text{buyer}} + V)}{(1+\beta)} \tag{5}$$

which stands for the balanced bidding of the merging enterprise in the first phase. By now, the returns of both sides should be $[\frac{(V_{\text{buyer}} - V)}{(1+\beta)}, \frac{\beta(V_{\text{buyer}} + V)}{(1+\beta)}]$.

3. The bayesian balance in the competition between the buyers and the sellers

The competition between the buyer and seller mainly is mainly embodied in 2 or more than 2 merging enterprises' contending for a target enterprise, and the key to this problem is still the determination of transaction price(Zhou, Ruiling and Chen, Hongmin, 2005). And under such circumstances, the competition turns into the game between the buyers. For the convenience to study, we further make such assumptions as follows:

H1: There are only 2 merging enterprises called as game player1 and game player 2, and both of them have equal economic rationality.

H2: No foul behaviors exist in the competition.

H3: Only 2 game players are accepted to use linear function strategy and both of their evaluations are mutually independent and standard distributed between [0, 1].

H4: The value of the merged enterprise is decided, and the conspiracy between the merged enterprise and some of the buyers doesn't exist.

Symbol description:

V_i stands for game player i's the evaluation of the merged enterprise, and A_i=[0, ∞]stands for action space.

b_i stands for the marked price of game player i, and P is its deal price .

u_i stands for the income function of game player i, and θ_i is the type space [0, 1].

$b_i(V_i)$ is one of the strategies of game player i, while both a_i and c_i are the coefficients of linear function.

Based on these hypotheses, problems stated above are practically non-cooperation games with incomplete information, named as static Bayesian balance (Sun, Jing and Gao, Jianweim, 2006), and at the moment we could get to know the function of game player i is

$$u_i = u_i(b_i, b_j, V_i) = \begin{cases} V_i - b_i & b_i > b_j \\ \dfrac{(V_i - b_i)}{2} & b_i = b_j \\ 0 & b_i < b_j \end{cases} \tag{6}$$

In this formula, when $i = 1$, we could get $j = 2$; when $i = 2$, $j = 1$ could be reached.

Theoretically, we have known earlier that the strategy of game player 1—$b_1(V_1)$ and that of game player 2—$b_2(V_2)$ should be the best response to each other in a Bayesian balance. Correspondently, the intact expression should be the following: if strategies portfolio ($b_1(V_1)$, $b_2(V_2)$) is a Bayesian balance, to every type of every game player—$V_i \in [0,1]$, $b_i(V_i)$ should satisfy

$\max[(V_i - b_i)P\{b_i > b_j\} + \dfrac{(V_i - b_i)P\{b_i = b_j\}}{2}]$. And in this formula, $b_i = b_i(V_i)$, $b_j = b_j(V_j)$, i, j =1,2

According to the above hypotheses, let $b_i(V_i) = a_i + c_i V_i$, and $a_i < 1$, $c_i \geq 0$. In order to search for the strategy portfolio to constitute Bayesian balance from strategy space, let's suppose the strategy of game player j is $b_j(V_j) = a_j + c_j V_j$, then for any given V_i, game player i's best response should satisfy:

$$\max[(V_i - b_i)P\{b_i \geq a_j + c_j V_j\} + \frac{(V_i - b_i)P\{b_i = b_j\}}{2}] \tag{7}$$

For V_j is standard distributed, $b_j = b_j(V_j) = a_j + c_j V_j$ is the same. And because $P\{b_i = b_j\} = 0$, the above formula is then turned into

$$\max[(V_i - b_i)P\{b_i \geq a_j + c_j V_j\} + \frac{(V_i - b_i)P\{b_i = b_j\}}{2}] = \max[(V_i - b_i)P\{\frac{(b_i - a_j)}{c_j} > V_j\}] =$$

$$\max[\frac{(V_i - b_i)(b_i - a_j)}{c_j}] \tag{8}$$

Hereinafter, first order condition is $b_i = \dfrac{(V_i + a_j)}{2}$, that is to say, the response of game player i to game player j's strategy of standing at $a_j + c_j V_j$ should be $b_i = \frac{(V_i + a_j)}{2}$. In addition, we should pay attention to the existing possibility— $V_j < a_j$ because of $b_i = \frac{(V_i + a_j)}{2} < a_j$. Practically, game player i could not win the tender, so $b_i = \frac{(V_i + a_j)}{2}$ is not the best response. In brief, the best response of game player i is

$$b_i(V_i) = \begin{cases} \frac{(V_i + a_j)}{2} & V_i \ge a_j \\ a_j & V_i < a_j \end{cases} \tag{9}$$

By mathematical analysis, in order to guarantee both sides' strategies to be strictly linear functioned, we require $a_j \le 0$, then at the moment the best response of game player i is still

$$b_i(V_i) = \frac{(V_i + a_j)}{2} \tag{10}$$

However, when it is compared to $b_i(V_i) = a_i + c_i V_i$, we could get $a_i = \frac{a_j}{2}$ and $c_i = \frac{1}{2}$. By the same analysis, when $a_i \le 0$, we could get $a_j = \frac{a_i}{2}$ and $c_j = \frac{1}{2}$ — the best response of game player j. If we form equitation simultaneously with the result noted above and that of game player i 's best response, then when $a_i = a_j = 0$ and $c_i = c_j = \frac{1}{2}$ ($i, j = 1, 2$), we could get $b_i(V_i) = \frac{V_i}{2}$, which shows the best response of every game player is that its quotation should be half of its evaluation of the merged enterprise.

4. Conclusions and revelation

This article applies game theory method to analyze Equilibrium Price between the buyers or between the buyer and the seller existing in enterprise merging market and then arrives at the optimal bidding strategy in the merging process. The research shows that Bayesian balance lies in the competition between the buyer and the seller, that is, every game player's best responses is that his quotation should be half of its evaluation of the merged enterprise.

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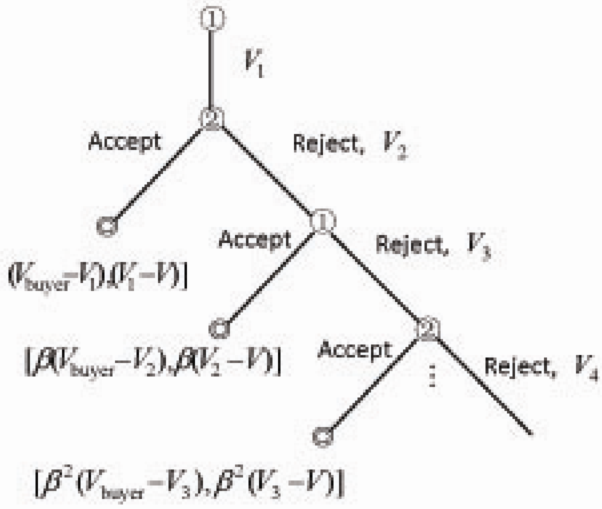

Figure 1. A game expansion model of transaction price in an infinite phase