



Research Article

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The game study of negotiation after bidding between purchasing agent and supplier for pharmaceutical equipments in China

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ABSTRACT

This paper is to study the mechanism for negotiation after bidding between purchasing agent and supplier for pharmaceutical equipments in China. The paper supposes that after tender the purchasing agent selected a supplier to negotiate the contract according to the price and technical score, and analyzes the sequential games by two parts under a variety of information in symmetry and asymmetry conditions.

Key words: pharmaceutical equipments, purchasing agent, supplier, negotiation after bidding, game theory

INTRODUCTION

In Chinese the purchase of pharmaceutical equipments, tender is an ordinary way to be taken by purchasing agents to choose the supplier. And the progress is always a pressure in almost all projects, so that the tender carries on under the condition that the relevant technical datum and indexes in design phase would not be enough detailed to form the contract [1-5]. When the tender is fulfilled after 2-3 months' tender procedures, the datum and indexes will be more detailed [6-8]. As the above reasons, before purchasing agents offer the notifications of award and sign the contracts, there will be always an activity for them, which is to negotiate with the relevant supplier.

THE CONTRACT NEGOTIATION ANALYSIS AFTER THE BIDDING ACTIVITIES

Background assumptions

This study is based on the assumption of the following background:

(1) Suppose that there are n suppliers were invited to participate in the bidding. After the opening bid, there are a group of business offers, which are respectively: $\{T_1, T_2, T_3, \dots, T_n\}$. The corresponding technical Scores are: $\{P_1 < P_2 < P_3 < \dots < P_n\}$

(2) According to the comprehensive ranking of business and technical score, the purchasing agent selects the Number "2" bidding unit to negotiate with $\text{Max}(T_1/P_1, T_2/P_2, T_3/P_3, \dots, T_n/P_n) = T_2/P_2$, That means the "2" bidding units with the lowest price according to their performances [9-11].

(3) If the contract negotiation is break down, the purchasing agent can select another object of negotiation, while the supplier will lose the bid cost, and all chances of profit. With the fact that suppliers oversupply in China, purchasing agents are always at the psychological advantage position in the contract negotiation process. While this advantage is limited, because the purchasing agent will assume the pressure of progress extension if the bidding results is abolished.

(4) If only the "1" bidding units price is lower than the "2"; and its technical score is not too much lower than "2".

(5) Assuming that there is a reasonable price P_r . And the supplier knows the price, while the purchasing agent may

know or not know very much.

(6) Assuming that the purchasing agent's attitude conclude only two kinds of state, "tough" or "friendly", no intermediate state. "Tough" means that faced with the counter-offer from purchasing agent, the supplier only has two options: acceptance or the breakdown of negotiations, otherwise allows the supplier to bargain.

(7) Assuming that the purchasing agent is under the low understanding degree, and his attitude is friendly, make the sequential game with the supplier. Faced with the quoted price of the supplier, P_2 , purchasing agents firstly propose a counter-offer, P , which is based on P_2 from "2" supplier and P_1 from "1" supplier. Because the purchasing agent's understanding degree is not high enough, according to purchasing agent's counter-offer P , and reasonable lowest price P_r , we can think that if the supplier generate a bidding strategy and adhere to, the purchasing agents will be persuaded by the supplier, supplier's again counter-offer will be the final contract price P_c .

(8) If the purchasing agent with the tough attitude is in an attempt to cover up his "low understanding degree", and refuse to pay the information rent, it will cause the supplier have only two choices: to refuse, or to accept unreasonable low price from the purchasing agents. Even if the supplier accepted the counter-offer, he maybe would lower the quality to recover the original profit.

Analysis of the contract negotiation after bidding

After the tender, there will be a negotiation between the purchasing agent and the supplier about the contract price.

Under the background described as 2.1, the descriptive analysis for the negotiation after bidding shows in Figure 1, the purchasing agent is :

(1) The decision-making process of purchasing agent contract negotiation.

(1-1) If the understanding degree is high, the purchasing agent will directly counter-offer the reasonable lowest price P_r , and tell the Supplier: if you do not accept, there must be other bidders to accept this price. The supplier will accept, then $P_c = P_r$.

(1-2) If the understanding degree is low, there are two choices to the purchasing agent: not to give up a chance, proposed counter-offer P , $P \in [P_1, P_2)$, or to accept the supplier's offer P_2 . In the first choice, , the counter must be less than P_2 , otherwise counter-offer is of no meaning. At the same time, the purchasing agents will choose P_1 as the basis of his counter P . P must be higher than P_1 , although the purchasing agents are "low awareness of information", the purchasing agent is still to pretend to understand relevant information fully. At the same time, the purchasing agents in order to facilitate the calculation, will make hypothesis that $P_r \approx P_1$, then make game analysis to P .

On the one hand, if P , close to P_1 , even $P_1 \leq P_r$, although the purchasing agent can obtain benefits as large as possible, the possibility of exposing the fact, the low understanding degree for the purchasing agent, will also increase. Then the supplier will adhere to convince the purchasing agents to accept P_2 , the purchasing agent will eventually fail to his offer objective. On the other hand, if P , close to P_2 , the purchasing agents also can't reach his bargain objective. So purchasing agent's counter-offer P , will be the result of the game calculation process [12, 13]. And P , will eventually be close the following calculation result:

Assuming that $\Pi(P)$ is a function P , corresponds to the interests of the purchasing agents, the maximum value is:

$$\pi(P) = \left(1 - \frac{P - P_1}{P_2 - P_1}\right) (P_2 - P) \quad (1)$$

As the condition of A step function:

$$\frac{d\pi(P)}{d(P)} = 0 \Rightarrow P = \frac{P_1 + P_2}{2} \quad (2)$$

(1-3) In the condition that the information understanding degree of the purchasing agent is low, the second choice is to accept the supplier's offer P_2 , then $P_c = P_2$.

(2) The decision-making process of supplier contract negotiation

(2-1) After (1-1), with the assumption that the supplier is always in high level for understanding degree, according to

the fact that the purchasing agent is able to give the counter-offer directly to the reasonable lowest price, the supplier will immediately know the purchasing agent also in high level of information understanding degree. So there is no further room for bargaining. Then the contract price will be the reasonable the lowest price, $P_c = P_r$.

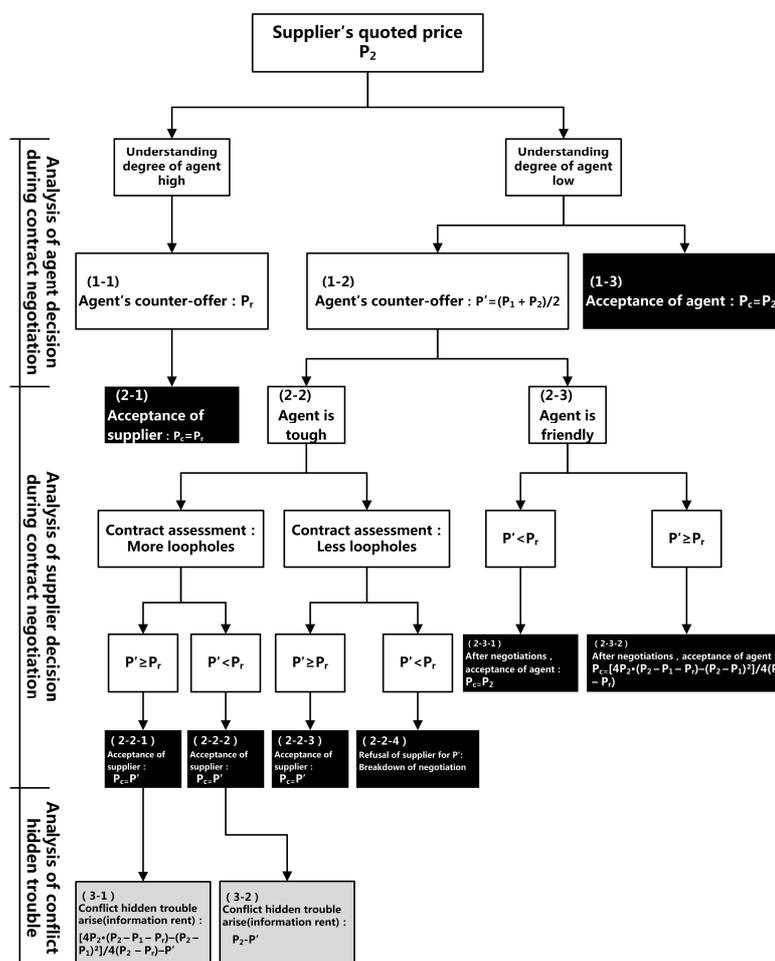


Figure 1: Analysis of contract negotiation process after bidding

(2-2) After (1-2), Purchasing agent counter-offer P' , and shows a tough attitude. That means faced with the counter-offer of purchasing agent, the supplier has only two options: to accept or to breakdown of negotiation. Then the supplier will make a careful assessment on the conditions of contract draft (including the bidding documents) to look for the loopholes.

(2-2-1) If there are enough loopholes in the contract draft, the supplier will accept $P_c = P'$, regardless of the rationality for P' . When $P' \geq P_r$, the supplier will evaluate the revenues of the contract in the future on basis of the following formula, (detail as 2-3-2),

$$[4P_2 \bullet (P_2 - P_1 - P_r) - (P_2 - P_1)^2] / [4(P_2 - P_r)] \quad (3)$$

(2-2-2) If there are enough loopholes in the contract draft, while $P' < P_r$, the supplier will evaluate the revenues of the contract in the future on basis of P_2 .

(2-2-3) If there are no enough loophole in the contract draft for supplier to get additional benefits, and $P' \geq P_r$, the supplier will accept the counter-offer, $P_c = P'$.

(2-2-4) If there are no enough loophole in the contract draft for supplier to get additional benefits, and $P' < P_r$, the supplier will refuse the counter-offer.

(2-3) After (1-2), the purchasing agent counts-offer and shows a clear attitude, one kind of attitude is friendly,

purchasing agent allows the supplier to bargain. So for the supplier, it is important to judge the information understanding degree of the purchasing agent is high or low.

(2-3-1) When $P < P_r$, the supplier can think easily that the information understanding degree of purchasing agent is low, after several rounds of persuade, the final contract price will be P_2 . ($P_c = P_2$).

(2-3-2) When $P \geq P_r$, If the Supplier determine the probability about the information understanding degree of the purchasing agent is high or low by purchasing agent's counter-offer P . The less gap between P , and P_r means the higher degree for purchasing agent information understanding supplier will make judgment, vice versa.

As the purchasing agent information understanding degree is not high enough, the supplier will have more chance to convince the purchasing agent to accept his point of view.

$$\begin{aligned} \Phi &= 1 - (P' - P_r) / (P_2 - P_r), P' \geq P_r \\ 1 - \Phi &= (P' - P_r) / (P_2 - P_r), P' \geq P_r \end{aligned} \quad (4)$$

The game matrix is shown in table 1:

Table 1: The game matrix analysis about the supplier how to counter-offer again according to the counter-offer of the purchasing agent

		purchasing agent	
		Information Understanding High(Φ)	Information Understanding Low($1 - \Phi$)
inter-	offer	$(P_2 - P', 0)$	$(0, P_2 - P')$
supp	agai		
her	supp		

In the high degree of information understanding, the purchasing agents will insist on his counter-offer P , then receive interests in the negotiation, $P_2 - P$. But the supplier has no additional interest in the negotiation. If the information understanding degree of purchasing agent is low, the supplier will persuade the purchasing agent to accept the bidding quoted price, and the purchasing agents will eventually agree. Then the purchasing agents will gain nothing in the contract negotiation, and the supplier will get the relevant interests, $P_2 - P$, in the negotiation.

In according to the probability of the purchasing agent information understanding degree, Φ or $1 - \Phi$, supplier could get the profits though calculation as $(P_2 - P) \cdot (1 - \Phi)$. According to the above hypothesis for bargain between two parts, the contract price, P_c , will ultimately be the following result:

$$P_c = P_2 \cdot (1 - \Phi) + P' \Phi \quad (5)$$

Substituting (4) into (5), then:

$$P_c = [4P_2 \cdot (P_2 - P_1 - P_r) - (P_2 - P_1)^2] / [4(P_2 - P_r)] \quad (6)$$

So that, when $P \geq P_r$, the purchasing agent and supplier going through the sequential game, and full discussion between both sides, the final contract price will converge to the formula (6).

(3) The information rent

This paper points out that, although the purchasing agent counter-offer P , is same, in the difference of purchasing agent information understanding degree, there are of essential differences: There is no information rent as the purchasing agent information understanding is high enough, vice versa. "Information rent" is based on the information asymmetry, information advantageous party has the desire and possibility to get higher profit. But the purchasing agent is always in the dominant situation before contract signing. If the purchasing agent is with a tough attitude, the supplier can't get the information rent temporarily. After signing the contract, the purchasing agent strong position declines, then the supplier will try various devices to obtain information rent.

According to elaborating as above, it is not difficult to calculate the available information rent as (2-3-3), (2-3-4),

(3-1) after (2-2-1), information rent will be:

$$R_1 = [4P_2 \cdot (P_2 - P_1 - P_r) - (P_2 - P_1)^2] / [4(P_2 - P_r)] - P' \quad (7)$$

(3-2) after (2-2-2), information rent will be:

$$R_2 = P_2 - P' \quad (8)$$

CONCLUSION

After bidding, the two parties of the contract deal with the different negotiation results and conflict hidden troubles of supplier, in according to the bidding prices from all units, reasonable lowest price, purchasing agent's information understanding degree, the purchasing agent friendly attitude of or not, and contract draft with enough loopholes or not.

In this paper, we are against that purchasing agents eliminate the information rent through tough attitude, which will make both sides breakout the conflict of interest in the construction stage. Thus, it will go against for quality control, schedule control, even cost control during purchasing pharmaceutical equipments.

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