Research on Price Formation of International Business Negotiation Based On Game Theory

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Abstract: The paper starts with the price negotiation part of international business negotiation and uses game theory to analyze the process of international business negotiation. The article will analyze the game nature of the international business negotiation process, and based on this, the game model of the international business negotiation process. Utilizing Rubin Stein's rotating bidding model to analyze the game solution of the benefit sharing "1" and the expected price, and using the utility theory to obtain the possible solution points of the international commercial price negotiation under the condition of payment. Finally, through the analysis of the game solution of international business negotiations, the paper discusses the effective strategies and suggestions that the negotiating parties should take in order to obtain more benefits in the process of international business negotiation.

1. Introduction

Game theory was originally used in competitive competitions and conflicts of strong competition, and in recent years, game theory is slowly being used in business activities. In business negotiations. Prices are generally the focus of the parties to the negotiations. This paper focuses on the formation of prices in business negotiations from the perspective of game theory. This kind of research will help the negotiating parties master the process of understanding price formation. A rational analysis of the negotiations to improve the efficiency and profitability of the negotiations.

2. Application of Game Theory in International Business Negotiation

International business negotiation is the main content and core of international business theory. It refers to the business activities of individuals or groups in different countries or regions in international business activities to discuss and negotiate to meet a certain need or achieve a certain goal. The general term. Its distinctive features are international, commercial and confrontational. The essence of the business negotiation process is the game process of the parties (or parties). During the negotiation, all parties make full use of the skills and strategies to learn and obtain the most favorable trading conditions on the premise of pursuing their best interests. However, due to the different economic and cultural, political, linguistic and living habits of different countries and regions, the complexity and difficulty of negotiation are far greater than domestic negotiations. Therefore, before the negotiation, we must fully prepare and rationalize the layout [1]. In the negotiation process, we must have clear objectives, be flexible, proactive, and correctly use the ideas and methods of game theory to strive for the most favorable conditions and avoid trade risks to the maximum extent. Goods, payment, transportation, insurance, etc.), to obtain the best expected benefits.

2.1 Hypothesis of the International Business Negotiation Process

This paper will make the following assumptions about the international business negotiation process in question:

Hypothesis 1: There are only two players in the negotiation process, Sally (S) and Burt (B).

Hypothesis 2: Sally and Burt are in equal status, and there are no social factors that influence the decision of two people.

Hypothesis 3: Negotiation is purely commercial in nature, and price is a major consideration for both parties.

Hypothesis 4: There is no international standard price or guidance price for the subject matter of the transaction.

Hypothesis 5: People in both bureaus are rational and aim at maximizing their own interests.

International business complex game. Negotiation can be a multi-participant negotiation, but we only consider the situation of two people here, which is also the most common situation in international business negotiations. The two do not necessarily refer to two people. The person here can be an agent of a company or institution, or a representative of the alliance. We exclude interference from outside the negotiations and from the internal influences of the alliance in the hypothesis, and only analyze the process of the international business negotiations itself. The significance of Hypothesis 4 is to make international business negotiations possible and meaningful. Hypothesis 5 is very important and is the basis for building a game theory model. This is because the game makers study the interaction of decision makers' behaviors from the economic rationality, not from the perspective of psychology or sociology [2]. In addition, in this article, we only discuss the situation of a dynamic game, not considering repeated games.

2.2 Game Model of Price Formation Process in International Business Negotiation

For the entire basic game process of business negotiation, we can describe the following: First, Sally bids P_1^*, Burt chooses to accept the offer or does not accept. If Burt accepts Sally's offer, the negotiations are over. If Burt chooses to reject, then Burt gives the offer P_1^*, which Sally can choose to accept or not. If you accept Burt's offer, the negotiations are over. If Sally rejects Burt's offer, then Sally re-offers the offer P_2^* so repeatedly. In the Nth game, if the party making the choice accepts the offer from the other party, the negotiation ends and the transaction is concluded at the price. If the other party's offer is rejected, the negotiation ends and the two sides make a profit of zero [3].

This paper uses the Bertrand oligopoly model to analyze the price strategies of both parties. There is a strong substitution between the products operated by the two companies at A and B, but they are not completely replaced. When the prices are different, the higher prices will not be completely sold. When the prices of A and B are P_1 and P_2, respectively, assuming that the two companies have no fixed cost, I assume that the marginal production costs are C_1 and C_2, respectively. The benefit functions of both parties are:

$$u_1(P_1, P_2) = P_1 q_1 - c_1 q_1 = (P_1 - c_1)(a_1 - b_1 P_1 + d_1 P_2) \tag{1}$$

$$u_2(P_1, P_2) = P_2 q_2 - c_2 q_2 = (P_2 - c_2)(a_2 - b_2 P_2 + d_2 P_1) \tag{2}$$

We directly analyze this game using the response function method. The above two equations respectively derive the partial conductance for P_1 and P_2, and let the partial derivative be 0, thus obtaining:

$$\frac{\partial u_1}{\partial P_1} = a_1 + b_1 c_1 - 2b_1 P_1 + d_1 P_2 = 0 \tag{3}$$

$$\frac{\partial u_2}{\partial P_2} = a_2 + b_2 c_2 - 2b_2 P_2 + d_2 P_1 = 0 \tag{4}$$

It is easy to find the response functions of the two vendors to each other's strategy (price):

$$P_1 = Q_1(P_2) = \frac{1}{2b_1}(a_1 + b_1 c_1 + d_1 P_2) \tag{5}$$

$$P_2 = Q_2(P_1) = \frac{1}{2b_2}(a_2 + b_2c_2 + d_2P_1) \tag{6}$$

Nash equilibrium $\left(P_1^*, P_2^*\right)$ must be the intersection of two reaction functions, that is, must satisfy:

The above calculation results show that the ideal state of Nash equilibrium is that the two sides are equally divided into the market. When one party is not satisfied with the market share, it can adjust the price. However, when the price of the product falls close to the purchase cost of the product, the space for the price reduction of the e-commerce company will basically disappear, and the price war will be difficult to adopt. Only when home appliance companies improve their operations, reduce transportation costs, and improve management levels, new price wars are likely to break out [4].
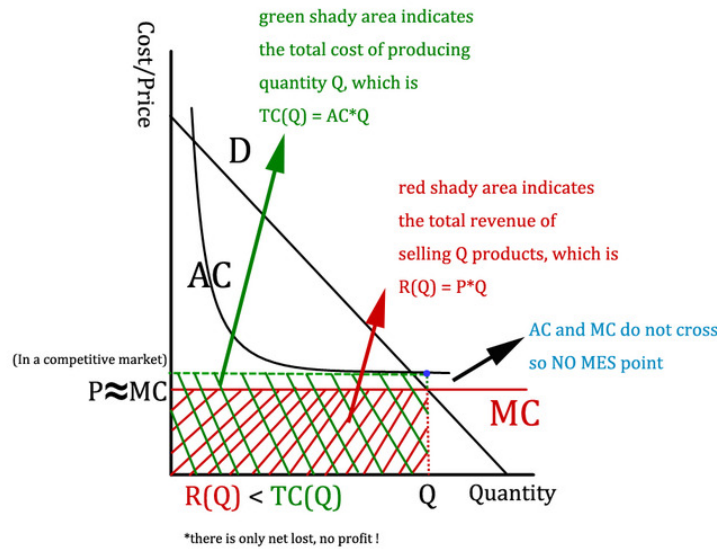

Fig. 1 Process diagram for the formation of international business negotiation prices

3. Stage observable action game model

Games can be divided into cooperative games and non-cooperative games. The difference between the two lies in whether the parties can reach a binding agreement when they act. If there is, it is a cooperative game, and vice versa is a non-cooperative game. This paper focuses on market competition from non-cooperative games. Participants in international business negotiations are buyers and sellers. In this model, it is assumed that: (1) When buyers and sellers choose actions in stage k, they know that the other party has selected all the previous stages *0, 1, 2, k-1* action; (2) both buyers and sellers act simultaneously at stage k. Of course, simultaneous actions here do not preclude participants from taking turns taking action.

Because the buyer knows how much he is willing to pay, it is assumed that the buyer has complete information in the price negotiation; since Party *A* is not sure of Party *B's* willingness to bid, it is assumed that Party *A* has incomplete information in the negotiation. We assume in the model that the seller predicts that the buyer's willingness to purchase is between P_1 and P_2 ($P_1 < P_2$). In this way, the seller's action selection set S_1 only has a quote in the initial stage, and the action selection set in other stages is {accept, counter-offer}, and the buyer's action selection set is {accept, counter-offer}. In the initial phase of the multi-stage game (stage 0), the seller selects the corresponding action from the selection set S, that is, a price P_0, $P_0 \in (P_1 < P_2)$ is issued for the buyer to accept or counter-offer. If the buyer accepts the game is over, if the buyer rejects the seller's price, then in the second phase of the negotiation, the buyer proposes a price for the seller to accept

or counter-offer. If the seller accepts the counter-offer then the game ends and if the seller rejects, then he will propose a new price in the next stage [5]. By analogy, this is a perfect information game.

From this model we can see that: (1) the game in the negotiation will lead to inefficiency, the negotiation will be delayed to the second stage, which is a non-efficiency behavior, because the proceeds will be discounted; (2) although the buyer is low The buyer of the price, but if the seller predicts that the buyer is a high-priced buyer, then the buyer's payment will be increased. Because the seller with incomplete information is in the first quotation, if the probability of the buyer being a high-priced buyer is high, he will raise the price and make the price close to P_2. After the buyer makes a counter-offer action to disclose some information. And then make a second quotation, you can see that the buyer's ability to pay the counter-offer is very passive.
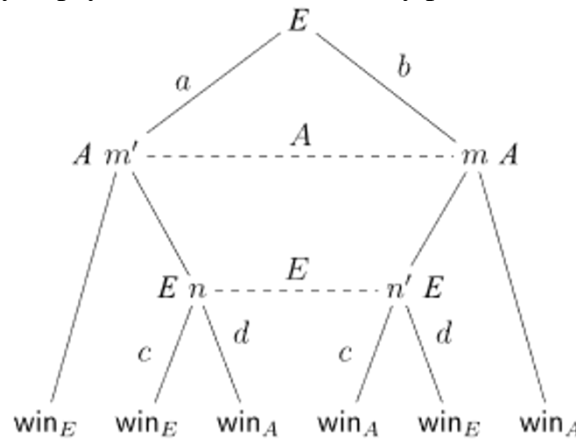

Fig. 2 Stage observable action game model

4. Negotiation study on joining payment terms

Due to the particularity of international trade, payment terms are closely related to prices, and they are often another important factor in international business negotiations after price. However, the choice of payment terms depends more on the preferences of the players. The preferences of the players in the payment conditions are often related to their situation. Factors affecting the preferences of the players in the payment conditions generally include the financial environment and financial risks of the world and the country, the financial status of the company, the size of the transaction, the credit status of the other company, and the expectations of the exchange rate. For the game solution of international business negotiations that join the payment terms, the following analysis is made using a similar Edgeworth box diagram.
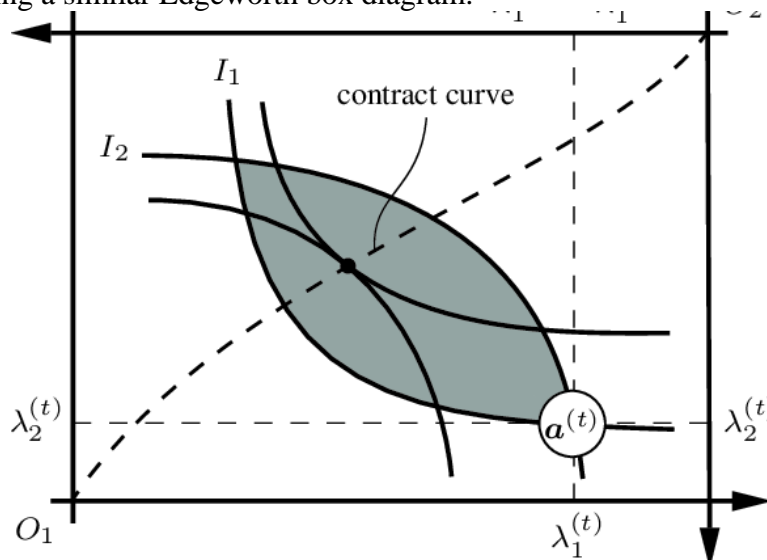

Fig.3 Ech worth box type pricing game

5. Game Theory Related Recommendations for International Business Negotiation

5.1 Accurate estimation of information factors

Information is the center of things to deal with, the key to the door to success. Information often affects our judgment of things and influences our final decision. The mastery of the negotiation information can be said to be the key to the success of the negotiation. In the initial stage of the negotiation, it is the value declaration stage of the negotiation. At this stage, the negotiating parties should fully communicate their respective interests [6]. The negotiating parties can only rely on the known information and experience. To guess the unknown information, eliminate all kinds of interference information, and find out the real needs of the other party. With the deepening of the negotiations, various information began to be disclosed continuously, and the negotiations entered the stage of creating value. The two sides communicated with each other, affirmed their respective interests, understood the actual needs of the other party, and began to find the best solution. Precisely grasp more information as much as possible before the negotiation, especially a reasonable estimate of the other's budget. Decisions are made reasonably based on the estimates of the pair, and estimates of prevention against each other are continually corrected during the negotiation process.

5.2 Reasonable grasp of the dominant forces of negotiation

Unlike the traditional concept, how strong a party is in the negotiation does not depend on how much the group he represents is larger than the group represented by the opponent. According to the above game analysis of the negotiation, we can see that when the other party makes a high price or a low price, in addition to considering their own interests, they must also consider the opponent's price budget, and in the case of the expected budget of the opponent's price. Under the pursuit of maximum benefits, based on this decision. Then, the opponent's expectations of himself and his own expectations of the opponent become crucial. To this end, various methods and conditions are used to influence the formation of accurate predictions of opponents' own actions, to interfere with the opponent's accurate judgment of their true intentions, and to grasp the strong bargaining power. In various ways and conditions, purposefully let the opponent believe in some of his actions (or true or false), so that he can accurately predict the opponent's actions, thus making himself in a more advantageous position in the negotiations.

5.3 Deadline

In real-world negotiations, the order of bidding is rarely strictly fixed. We can see from the above game analysis that the final stage t revenue depends on who made the offer in the t-1 stage. If you just give a quote at the "last minute" before the deadline, then your opponent may have no choice but to accept your offer. Because if he refuses, then the deadline is passed, the negotiations are forced to stop, and he will receive 0 gains. As a good negotiator, it must pay attention to the important role of the deadline in international business negotiations, and be good at using the role of the deadline, and strive to give a quotation just before the deadline, in order to obtain more favorable conditions for benefit sharing. It is necessary to prevent opponents from taking advantage of the important role of the deadline. This requires negotiators to consider the issue from the perspective of the opponent during the negotiation process, clearly recognize the decision-making situation of the previous rounds, and understand all possible reactions of the opponent to any possible situation [7].

5.4 Pay attention to the cost of delay

Through the analysis of the above game solution, we can see that in the formation of the game equilibrium solution, there is always a very important variable, that is, the latest compromised price of both parties, the value is between (0,1), the more vivid here is called the cost of delay. The costs associated with the delay can affect the terms of the agreement as it affects the parties' judgments on the requirements or expectations of the opponent. The more patience your opponent has, the more likely it is to reach an agreement that is more beneficial to you. As a good negotiator, you must think

about how you can reduce your own "impenitentness" by preparing in advance, and how to increase the "impenitentness" of the other party through some methods.

6. Conclusion

Above we discuss the simple model in business negotiation based on the ideas and methods of game theory. On this basis, some problems can be further studied, such as: knowing each other's retention price; only one party knows the other party's reserve price; knowing each other's reserve price with a certain probability; both parties show at the same time the bottom solution; the situation of negotiating with multiple merchants at the same time.

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