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# Concessions in Multi-attribute Reverse Auctions and Multi-bilateral Negotiations

Jamshid Etezadi<sup>1</sup>, Dmitry Gimon<sup>1</sup>, Gregory E. Kersten<sup>1</sup>, Pierpaolo Pontrandolfo<sup>2</sup>

<sup>1</sup> InterNeg Research Centre & J. Molson School of Business, Concordia University, Montreal, Canada

<sup>2</sup> Department of Mechanical and Management Engineering, Politecnico di Bari, Bari, Italy

## **Abstract:**

Concessions are a key element of a negotiation. They are made with the aim of moving towards an agreement and convincing the other party to improve their offer. This study analyzes concession making in both auctions and negotiation settings. The findings are based on data obtained from two experiments. The average concession made in the reverse auctions is significantly higher than the average concession made in negotiation. The comparison of the initial and final concessions in negotiations shows that while the number of positive concessions the value of concession, from the perspective of the concession-taker, decreases. The results also show that there is a significant proportion of negative and null concessions both in auctions and negotiations, the percentage of these concessions, however, decreases as the parties move closer to an agreement.

**Keywords:** e-negotiations, multi-attribute auctions, multi-bilateral negotiations, concessions, concession comparison, online negotiation experiments

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## 1. Introduction

Concession in negotiation means accepting a worse value of an issue with the purpose of convincing the other party to improve their offer. It is “a change of offer in the supposed direction of the other party’s interests that reduces the level of benefit sought” (Pruitt 1981, p. 19). Negotiators make concessions in order to move towards an agreement, prevent the counterpart from leaving the negotiation, and encourage the counterpart to reciprocate (Komorita and Esser 1975).

A concession is made by one party but assessed by both. It is therefore possible that what one side may consider a concession may not be seen as such by the other side. In other words, we may have two perspectives on concessions: (1) the concession-maker’s perspective; and (2) the concession-taker’s perspective.

The recognition that concessions are a key element of negotiation is behind behavioral researchers’ interest in concession behaviors (Benton, Kelley et al. 1972; De Dreu and Carnevale 1995; Kwon and Weingart 2004). Most studies, however, focus on single-issue bilateral negotiations in which concession-making is simple and easy to observe. The situation gets complicated in multi-issue negotiations because of the differences in importance each party attaches to individual issues. In experimental studies we may overcome this difficulty by either imposing or asking the participants to use preferences and utility functions.

Walton and McKersie (1965) note that concession making is not a mechanical process. Concessions convey information about negotiators’ utilities and about one party’s perception of another (Rubin and Brown 1975). The interdependence of concession means that negotiators reciprocate in their concessions (Smith, Pruitt et al. 1982), although power has been found to mitigate this effect (Michener, Vaske et al. 1975).

Concession-making depends on the negotiator’s approach. Competitive negotiators try making no concessions at all or as little as possible, unless they are forced to make more significant concessions in order to secure an agreement. Cooperative negotiators make greater concessions at the beginning of the process in order to show their willingness to reach an agreement. With the negotiation progress, they lower their concessions as they are getting closer to their reservation levels.

Time pressure and reservation levels also contribute to concession-making: concession rate was found to be greater when time pressure was high and reservation levels low (Smith, Pruitt et al. 1982). However, in the case of low time pressure, frequent concessions made by one party were not reciprocated (Pruitt 1981). Additionally, negotiation approach affects the timing (when a concession is made) and content (how much is conceded) of concessions (Allen, Donohue et al. 1990; Kwon and Weingart 2004).

## 2. Overview

The data used in this study was obtained from two experiments conducted in 2011; one at a Canadian university and one at an Italian university. In both experiments the participants used one of two systems: Imbins for multi-bilateral negotiations and Iparas for reverse multi-attribute auction.

The case involved a buyer representing a milk producing company who wanted to award a

one-year contract to one of the four nominated transportation companies to deliver a certain amount of milk every month. In granting the contract, the milk producer (buyer) considered three main issues (attributes): The rate for standard delivery, the rate for rush delivery, and the amount of penalties for late or non-delivery. Sellers were representatives of the transportation companies; each company had different preferences over the three issues. For example, for one company the standard and rush rate had high priority and the penalty for delay was less important. For another company the penalty for delay was the most important issue.

In addition, the transportation companies had different utility functions and different reservation values which were based on their breakeven points. The reservation values for the four transportation companies labeled here as A, B, C, and D were 22, 15, 10 and 25 respectively. The goal of the buyer was to select the best company for the milk delivery through negotiation or auction. Both the system and the case are discussed in more detail in (Kersten, Pontrandolfo et al. 2012).

### 3. Concession analysis

A total of sixty-three negotiation experiments were carried out in the Canadian University. In each negotiation one buyer negotiated with four sellers. In about half of these experiments the buyers were trained to enter into the negotiation with a cooperative approach which is associated with a certain degree of openness, reciprocity, and concession-making that initially does not depend on the counterpart and in the later rounds need not be forced by threats and other pressures. For the other half of the experiments the buyers were instructed to follow a competitive approach that generally is associated with secrecy, making no concession as long as possible and exerting pressures on the counterpart to accept the competitor's offer. The sellers were neither trained nor informed about the approach of their counterparts (i.e., buyers).

In addition to the negotiation experiments, twenty-one multi-attribute reverse auction experiments were also carried out. The concession behavior of the bidders has been compared and contrasted with that of the negotiators.

The following summarizes our findings about the concession behavior of users for the experiments conducted in Canada. It is important to note that the systems for both negotiation and auction experiments were equipped with a calculator which could rate the value (utility) of all offers by assigning a score between zero and one hundred, where zero was assigned to the worst possible offer from the point of view of the user and 100 to the best one.

Concession is defined here as the difference between the values of two offers made by the same person. Concession made by one side is evaluated by the opposing side. Therefore, we can distinguish the perspective of concession-maker and concession-taker. (For simplicity, we use the concept "concession" when we talk about the concession-maker perspective.) This duality of perspective means that concessions can be positive, null, and negative. Positive concession requires that the concession-maker decrease his utility and yields an increase of the concession-taker's utility. Negative concession allows the concession-maker to increase utility value while the utility of concession-taker also increases. Null concession yields concession-taker's utility increase but results in no change in the concession-maker's utility.

Table 1 provides a summary of the average concession made in all offers within the experiments by the seller as well as the sellers' concession from the buyer's perspective.

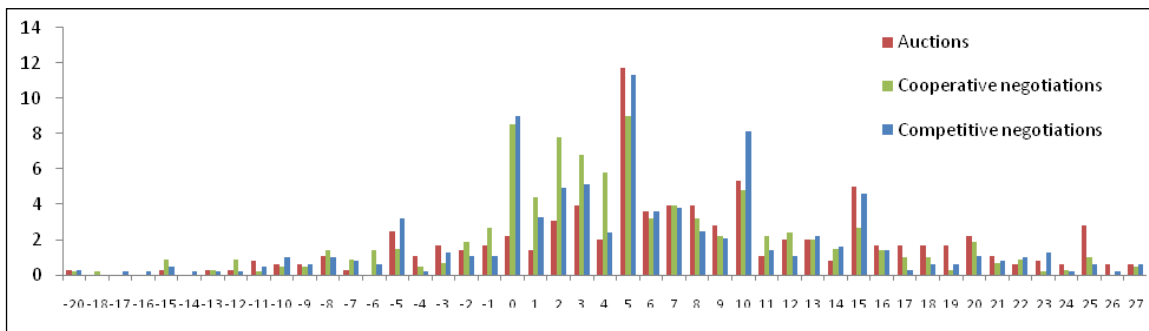
**Table 1.** Average concession made by sellers.

	Auction	Negotiation	
		Coop.	Comp.
Number of instances	21	31	32
Number of offers/bids	435	697	746
Null concession or negative concession	2.2%	8.5%	9%
Avg. number of offers/bids per seller	5.6	6.4	6.5
Avg. seller's concession	13.1	6.3*	6.6*
Avg. seller's concession from buyer's perspective	14.1	6.97*	6.7*

We note that the average concession made in the reverse auctions is significantly higher than the average concession made in negotiation under both conditions (cooperative and competitive buyers' approaches). This is also true for the mean concession from the buyer's perspective.

Table 1 indicates that in auction settings null and negative concessions were made less frequently than in negotiation experiments. Null concessions in auction are possible when the minimum bid increment calculated in one round and used in the next round allow the seller to make bids which do not require decrease of his utility. In such a situation, the winning bid in the previous round does not force bidders to submit bids with a positive concession.

Figure 1 provides a histogram of the concession values. We note that in all three settings, the most popular concession value is around five.



**Fig. 1.** Histogram of the concession values for auctions and negotiations.

An interesting observation in this graph is that in auctions and also in negotiations, high peaks

of concession frequencies correspond to values that are multiples of five. It seems that in both negotiations and auctions where there are potentially 100 units of values to use, five is used as the bargaining unit. Thus, to win the auction or negotiation, it might be wise to have offers that are multiple of five plus one unit more.

## 4. Concession-making in multi-bilateral negotiation

To further analyze the concession behavior of both buyers and sellers, we extracted the characteristics of all the offers made in the cooperative and competitive auction experiments from the database of the two systems into three separate files. After deleting the records of all subjects who exchanged less than three offers, we constructed two measures of concession: one from the difference in the values of the second offer and first offer, and the other one from the difference in the values of the last offer and the one before the last. These are labeled as the first and last concession, respectively. The following results have been obtained from analyses of the first and last concessions.

### 4.1 Buyers' concession behavior

In the competitive setting there were 28 buyers with more than three offers of whom only one made a positive first concession (3.6%). The last concession in the negotiation, however, was made by six buyers (21.4%) buyers. This indicates that the buyers followed the experimenters' instructions.

In the cooperative negotiation setting the buyers also followed our instructions. Five buyers made the initial concessions which decreased their utility by 11.6 units on average. The number of buyers who made concessions increased to 11 in the last round, but the average increase dropped to 4.8 units. The difference between the first and last concessions was found to be statistically significant ( $p$ -value  $< .05$ ).

### 4.2 Sellers' concession behavior

In the competitive setting, a total of 104 negotiations had more than three offers exchanged and for 82 (0.79%) of them the first concession was positive. The overall average value of concession for this group was 16.03 units. No significant difference was detected between the mean concession values of the four sellers companies made in their second offer. Seventy seven percent of this group made a positive concession in their last offer and the overall average value of their concession was 11.15 units.

The average value of the last concession was found to be significantly different for each of the four sellers ( $p$ -value  $< 0.001$ ). The average concession made by each seller was: Seller A = 7.37, Seller B = 17.16, Seller C = 5.28 and Seller D = 17.36 units. Apparently, the concession behavior of negotiators representing companies A and C with regard to the last concession were similar. The same phenomenon was holding for representatives of the two companies B and D.

In the cooperative setting, 98 negotiators had more than three offers exchanged and for 74 of them (0.76%) the first concession was positive. The overall average concession was 11.56 units and similar to the competitive group no difference was detected between the mean values of the seller's concessions. In their last concessions 82 negotiators in this group (84%) had a positive concession with an overall average value of 10.7. Unlike the competitive group, the average values of the last concession for the sellers were not statistically different at the 0.05

level of significance.

Analysis of the auction data revealed that of the 66 auctions, 89.4% of the first concession and 90.9% of the last concession in this group were positive. The overall average value of concessions in this group was 26.74 and 10.63 units for the first and last concession, respectively. No significant differences were found between the average values of the first concession for the four seller groups, but the average values of the last concession for the four groups were found to be significantly different ( $p$ -value  $< 0.05$ ). The average concession for the four groups was: A = 14.88; B = 8.35; C = 8.53; and D = 10.45 units. As previously noted, we observed that in auctions, the decrease of the utility value which is caused by the sellers' first concession is significantly higher than that of negotiations.

To explore the possible relationships between the number of messages sent or received and the amount of the first or last concessions, a correlation analysis was conducted for both competitive and cooperative negotiations experiments. No significant correlations were found between the number of messages (sent, received or total) and amount of concessions (first or last).

It is interesting to note that in various settings we found that between 6 to 14 % of sellers made negative concessions either in their second or their last offer which may be in line with Walton and McKersie's (1965) observations indicating reciprocation.

## 5. Summary and conclusions

Concession analysis can help us to better understand buyers' and sellers' behavior in auction and negotiation settings and to adjust our approach accordingly. A number of observations were made in this study. We found out that the average amount of concession made in auction settings is significantly greater than in negotiation settings. We also noted that at the start of cooperative negotiations, few people make concessions but the amount of the concessions they make is relatively large. However, toward the end of negotiations a larger number of negotiators make concessions but their concessions are significantly lower. These findings together with those indicated in Section 3 can be used in negotiation settings and auctions to modify our behavior during various stages of the process in a fashion that increases our chances of ending with a favorable outcome.

We noticed that the value of the last concession made in competitive negotiations and that of auctions differed for various sellers. We expected this difference to be associated with the reservation value of the company, however, no such relation was found. Additional studies are required to shed further light on these issues.

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