

Incentives and control for information revelation - an empirical study

Clemens van Dinther, Tobias Conte, Georg Baust

FZI - Forschungszentrum Informatik Karlsruhe, Haid-und-Neu-Str. 10-14, {vanDinther,Conte,Baust}@fzi.de

1. Introduction

The asymmetric distribution of information amongst the participants in a supply network can have a negative impact on the efficiency. The “Bullwhip effect” is a prominent example for the negative impact of information asymmetry in supply networks (Hau et al. 1997). Consider a series of companies in a supply chain in which each company orders goods from its upstream partner. In such a chain, the incoming orders from the downstream partner serve as information for the production and inventory management. As long as future demand is estimated on basis of the incoming orders the demand estimation is subject to uncertainty, i.e. the order information can be misinterpreted. These wrong demand uncertainties and variabilities tend to be magnified in upstream direction. This phenomenon is called Bullwhip effect since the amplitude of a whip increases down its length.

It can be shown that the Bullwhip effect can be diminished by reducing the demand uncertainty through additional (more accurate) information, i.e. information exchange upstream in the supply chain (cp. Lee, Padmanabhan and Whang 1997; Lee, So und Tang 2000).

Since the Bullwhip effect magnifies costs upward in the chain, partners in the supply chain benefit differently: The information provider does not receive a direct benefit from information sharing, whereas the information receiver can realize cost savings. Thus, cooperation is subject to difficult negotiations on the supply chains’ profit allocation.

Rief and van Dinther (2007) were able to show, that negotiation on the profit distribution lead to better results, if the partners reveal their (private) information about cost savings and information provision costs (not taking into account the bargaining power of the participants). The remaining question from their study is how it can be assured that the participants truthfully report their private information. On the one hand, it is possible to overcome such a problem with trust which can be built for example on reputation. On the other hand, if control of the truthful reporting is possible the partner might use penalties. In this paper we focus on the problem of control. We summarize the main issues in the following research questions:

- Since control is not free of charge: How much would participants accept to pay for effective control mechanisms?
- How do player appreciate control?
- What is the impact of control on the negotiation results?

In order to answer these questions, we have extended the experimental model presented by Rief and van Dinther (2007).

The model description is sketched in Section 2. In Section 3 we present the main results of the empirical study and finish up with a conclusion and an outlook on further research work.

2. Model for Empirical Study

For the negotiation scenario we extend the model of Rief and van Dinther (2007). They model the negotiation as a Reverse Ultimatum Game (RUG) as introduced by Gneezy et al. (2003). In a classic Ultimatum Game (UG) two players, a proposer and a responder, negotiate for the shares of a commonly known amount of money q (cp. Güth et al. 1982; Rubinstein 1982). The proposer offers a distribution $(p, q-p)$ between proposer (p) and responder ($q-p$) which the responder can either accept or reject. The RUG extends the UG in that way that if the responder rejects the distribution then the proposer is given the opportunity to offer a new distribution $(p_{new}, q-p_{new})$ such that $p_{new} < p$. The negotiation ends if either the responder accepts the offer or the responder does not offer a new distribution.

The model of Rief and van Dinther (2007) use a RUG approach but in their model p (the networks profit which was realized through cooperation) is not commonly known. They were able to show that if p is revealed the more frequently the negotiations were successful. The main problem is that the players benefit from untruthful information revelation.

Therefore, in the current model we introduce the option of control. Both participants are offered to buy control from an external institution. In that case, it is guaranteed that the revealed information is correct. Thus, the players face the decision to either play the game without additional information or to reveal the correct p from an external auditor. The players were asked to offer the auditor a share of her own profit as a multiple of 5%. The auditor accepted all offers with a percental share greater than 15%.

3. Evaluation

The experiment was conducted as an internet game with 95 participants. The role of the players was arbitrarily drawn before the start of the game. There were 51 proposers and 44 responders.

A majority of 28 proposers (54.9%) have submitted bids for external control from which 13 have submitted successful bids larger than 15% profit share. The average offer was 17.32% profit share. A significantly larger majority of 34 responders (77.2%) have asked for external control from which only 14 have submitted successful bids. The responders offered on average 17.35% of their profit. There is no difference in the average willingness to pay observable.

Comparing the group of proposers who did not acquire additional information and the group of proposers who revealed the correct information we observe a greater rate of successful cooperation negotiations in the informed group (48.6%) versus 40.19% in the uninformed group.¹ The average payoff of the proposers in successful negotiations is 6.61 for the uninformed group compared to 6.79 for the informed group. The average payoff over all negotiations (incl. unsuccessful negotiations) is 2.65 for the uninformed group compared to 3.30 for the informed group.

Regarding the uninformed and informed group of responders we observe significantly higher rate of successful cooperation negotiations for the informed group (62.18%) compared to the uninformed group (33.07%). The average payoff of successful negotiations increases from 2.63 (uninformed) to 24.4 (informed) currency units. The average payoff over all negotiations (incl. unsuccessful negotiations) is 2.44 (uninformed) compared to 2.57 (informed) currency units.

The presented results show that a significantly larger part of the responders are willing to pay for the information revelation. Obviously, responders try to improve their bargaining situation through additional information which is true at least for the rate of successful negotiations. The increase in the success rate is statistically significant. Consequently, the bargaining situation is improved for information revelation from the responders' point of view. The comments of the participants support these findings since the responders were aware of having a worse bargaining power due to the information they were endowed with.

4. Summary and conclusions

In the present paper we presented a model for negotiations to cooperate in a supply chain. The model is based on work by Rief and van Dinther (2007). In our study we were interested if and how much the participants are willing to pay for control of the counterparty. The control of the counterparty reveals the correct information about the expected profit resulting from the cooperation in the supply network.

To study the problem we applied an internet experiment. The results of this experiment show that responders are more likely to pay for control. We also observe that the responders can improve their bargaining situation (and the negotiation results respectively) if they acquire the correct information.

The experiment shows no significantly different results in the participants' willingness to pay. An interesting aspect is furthermore, that the proposer also profits from an informed responder since the rate of successful negotiations increases and as a result the expected payoff as well. One main result of the study is that control might lead to a better information distribution among participants, and consequently, increases the probability of successful negotiations as well as the expected payoff of all participants.

Unfortunately, the basic population is not large enough. As such, the experimental results are not representative in general. Nevertheless, the results indicate which issues are to be studied in future work.

Since the results show that informed responders lead to better results for both roles, we should focus on mechanisms which give incentives for proposers to reveal their information truthfully. The main objective is, whether or not incentive mechanisms can be found which lead to truthful information revelation on both sides.

What is not considered in the model yet, is the bargaining power of the participants. In reality, big players have a greater bargaining power in such cooperation negotiations compared to small players although the small players might possess the relevant information. Next models should include different bargaining powers in order to distinguish various negotiation scenarios.

5. References

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¹ The difference in the rate of successful negotiations is not statistically significant.