

Opportunity Costs, Leadership, and Cooperation in Strategic Alliances

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Abstract. This paper presents a model of behaviour in strategic alliances, the iterated assurance game model with an exit option. From the literature review and the derived model, several hypotheses are proposed and then tested using Wilcoxon rank sum tests. Data was collected from self-administered questionnaires sent to emails of manufacturing firms in Russia. Results show there is no leadership effect on cooperation in dyadic alliances. Results also show that firms with high opportunity costs are more cooperative than firms with low opportunity costs. These results corroborate previous theoretical findings but challenge previous studies in laboratory experiments. They also suggest new avenues for further research on alliance partners' behaviour.

1. Introduction

While it has been emphasized that alliance members “should anticipate their partners’ behaviour” [1] there are few studies, which have dealt with behaviour in strategic alliance literature [2] and fewer that attempted to model them to better reflect the business situation where an exit option is available, particularly using game theory. Prisoner’s dilemma (PD) has been widely used to model alliance activity [2], [3], [4]. Arend and Seale [2] made a significant contribution by moving from rather abstract models to models that reflect real-world business situations, and by adding an exit option to multi-stage alliance processes. Their model is an iterated prisoner’s dilemma with exit option (IPDEO). However, there have been claims that strategic alliances should be more appropriately characterized as assurance games (e.g. [5]).

2. Model and hypotheses development

Since 81% of all the collaborative agreements are between two firms [6] we model a dyadic strategic alliance as a two-player game. Representation of the iterated assurance game with exit option in each stage is shown in Figure 1.

The choice variable is the firm’s p_i probability of cooperating in a stage. Dynamic optimization with constraint implies working backwards from the last stage to the initial stage. Solving this dynamic problem yields the solution that prescribes equal probability of cooperation in both stages. Another result is that cooperation depends on the level of opportunity costs, i.e., the greater the

opportunity costs, the higher the cooperation, which is consistent with the findings of Arend and Seale [2]. Hence, Hypothesis 1 The firms with high opportunity costs are more cooperative than the ones with low opportunity costs.

		C	D
Opt-in	C	2;2	0;1
	D	1;0	1;1

Opt-out Exit $\alpha; \alpha$

Figure 1. One stage in Assurance game with exit option.

The concept of leadership is crucial in the assurance game. Therefore, the coordination problem in Assurance games consists fundamentally in changing the beliefs that the people involved have about others' beliefs and actions, which is important because, as experiments showed, the actual beliefs about opponent's intentions can result in lower cooperation levels [7]. Hence, Hypothesis 2 Strong leadership increases cooperation from both partners in strategic alliance.

3. Methodology

According to the Russian Federal State Statistics Service, the registered number of firms in manufacturing industries, in 2013, is 254885, and the number of operating firms in 2013 is 10945. A degree of external validity had to be sacrificed and the Russian Chamber of Commerce and Industry (CCI) websites' databases were used to gather data on the firms in the chemical sector, manufacture of coke and refined petroleum products, chemical industry, and manufacture of rubber and plastic products. As a result, 435 email addresses of industrial firms in those sectors were collected from website databases of 29 out of 81 regional CCI (depending on working websites and databases availability) and 91 email addresses were additionally collected from open access database on Russian manufacturers (<http://mogem.ru/katalog>), which make a total of 526 addresses. The questionnaires were sent to those addresses and sample size for this research is 52. The relevant variables for the research are cooperation, opportunity costs, and leadership.

Cooperation. A strategic alliance is a purposive relationship between two or more independent firms that involves the exchange, sharing, or co-development of resources or capabilities to achieve mutually relevant benefits [8]. Therefore, cooperation implies that a firm is willing to put efforts fully as agreed into the alliance and effectively does so. We identify the level of partner cooperation as $Coop_{partner}$ and the level of cooperation from both firms as $Coop_{mutual}$.

Opportunity costs. These are benefits from the next best alternative use of the firm's resources. This alternative use is the closest substitute for the alliance activity. Resource use has similar strategic ends, risks, and commitments (e.g. internal ventures and substantial acquisitions) [2]. Several proxy variables were proposed to measure opportunity costs. Those variables are the corresponding annual interest rate on deposits for non-financial organizations with a duration less than a year (α_1) and two time-related variables, namely, year of firm's registration, as a proxy for firm's age (α_2), and the difference between firm's registration age and the year the strategic alliance (α_3) were formed. The last two time-related variables were chosen in the same vein as in the study of Arora and Nandkumar [9] where they used the number of years of an entrepreneur after his last received degree as a proxy variable for his opportunity costs. We assume that a firm has greater opportunity costs the greater its α_1 and α_3 and the smaller its α_2 .

Leadership. Leadership is one of the mechanisms that can lead to a Pareto-dominant equilibrium in a coordination game. It is important to emphasize that leadership, in a dyadic alliance, implies a situation where one firm plays the role of a leader whilst the other follows. There is some evidence on the effectiveness of leadership by example in the weak-link game, a type of coordination game [10]. The opposite case to leadership in alliance was considered to be equality i.e. the absence of a leader.

We identify the leadership variable as Leader, which is a binary variable, coded as 1 if there was a leader in the strategic alliance and 0 otherwise.

Data analysis. Since the hypotheses involve the identification of the difference between variables, and the available data is ordinal, the Wilcoxon rank sum test was employed (since the samples might be of unequal sizes). The significance level considered here is 5 percent.

4. Results

For Hypothesis 1 if the firm had opportunity costs greater than the mean in the sample, then it was considered as a high opportunity costs firm and vice versa. For the case of α_2 , since α_2 stands for the year the firm was registered, if the firm had opportunity costs lower than the mean in the sample, then it was considered as a high opportunity costs firm and vice versa. The null hypothesis for the Wilcoxon rank sum test was that the distribution of cooperation levels of the low opportunity costs firms was the same as the distribution of the cooperation levels of the high opportunity costs firms. The alternative hypothesis was that this distribution was shifted to the left. The average level of cooperation for high and low opportunity costs are reported in table 1 below.

Table 1. Cooperation level between high and low opportunity costs firms.

	Opportunity costs	Cooperation level	
		Partner (mean)	Mutual (mean)
α_1	High	4.13	8.22
	Low	3.52	7.34
α_2	High	4.16	8.32
	Low	3.58	7.39
α_3	High	4.10	8.25
	Low	3.59	7.41

Table 2 shows significant differences between high and low opportunity costs players in terms of cooperation level in alliances for all six cases providing grounds for not rejecting hypothesis 1. (Note that rejecting the null hypothesis of the Wilcoxon rank sum test means not rejecting our research hypothesis.)

Table 2. Summary of the findings for the hypothesis 1 (H1).

Variables	Test	Statistics	Result (H1)
$Coop_{partner} \sim \alpha_1$	Wilcoxon rank sum	$W = 220$, p-value = 0.015	not rejected
$Coop_{mutual} \sim \alpha_1$	Wilcoxon rank sum	$W = 226$ p-value = 0.021	not rejected
$Coop_{partner} \sim \alpha_2$	Wilcoxon rank sum	$W = 205$, p-value = 0.016	not rejected
$Coop_{mutual} \sim \alpha_2$	Wilcoxon rank sum	$W = 208$, p-value = 0.021	not rejected
$Coop_{partner} \sim \alpha_3$	Wilcoxon rank sum	$W = 225$, p-value = 0.031	not rejected
$Coop_{mutual} \sim \alpha_3$	Wilcoxon rank sum	$W = 224$, p-value = 0.032	not rejected

Table 3 provides information regarding the formal testing of hypothesis 2, which states that strong leadership increases cooperation from both partners in alliance. On average, the level of partner cooperation in strategic alliances with a leader was 3.79 on a five-point scale. This level was the same as the level of partner cooperation in strategic alliances without a leader, on average, after rounding up. Furthermore, the average level of mutual cooperation for strategic alliances without a leader was 7.79 out of 10 and with a leader was 7.63 out of 10. The hypothesis two was rejected. Cooperation level was significantly increased neither in partner cooperation nor in mutual cooperation cases. However, it should be noted that 64 percent of all strategic alliances in the sample had a leader (31 percent had leader represented by a partner firm and 33 percent had a responding firm as a leader).

Table 3. Summary of the findings for the hypothesis 2 (H2).

Variables	Test	Statistics	Result (H2)
$\text{Coop}_{\text{partner}} \sim \text{Leader}$	Wilcoxon rank sum	$W = 309$, p-value = 0.464	rejected
$\text{Coop}_{\text{mutual}} \sim \text{Leader}$	Wilcoxon rank sum	$W = 292$, p-value = 0.342	rejected

5. Discussion

Results for Hypothesis 1, the firms with high opportunity costs are more cooperative than the ones with low opportunity costs, were consistent with the IAGEO model predictions. The hypothesis 1 was supported. This is an interesting result for the theory since it is consistent with both IAGEO and IPDEO [2] models' predictions. However, the laboratory experiments with IPDEO, in [7], showed a complete opposite result, firms with lower opportunity costs were more cooperative than the ones with high level of opportunity costs. Their result is attributed to the deviation of actual players' beliefs from the solution level. In other words, the level of a belief that your partner would cooperate held by players with low opportunity costs exceeded the necessary level required for cooperation and vice versa for the players with high opportunity costs. Our findings showed that high opportunity costs players exhibited higher level of cooperation in comparison with the low opportunity costs ones. One of the explanations for this result could be that there is no distortion of beliefs in the actual world. Corroborating these findings further on the actual partnerships data, on bigger samples, taking into account belief levels, is highly encouraged in further research. For managers, these results imply that they should favor alliance partners with high opportunity costs and whilst in alliance they should monitor opportunity costs of all firms. It should be noted that one of the proxy variables for opportunity costs used in this study was a firm's age. Since one of the implications was to choose partners with high opportunity costs that meant choosing more-experienced "old" firms which was consistent with theoretical modelling IPDEO results [2] but contradicted the prescriptions from laboratory experiments [7] that recommended choosing less-experienced players (i.e. those who have high beliefs of cooperation). Since the findings show that more-experienced players demonstrate higher level of cooperation it might be surmised that their level of actual belief of partner's cooperation was not as low as it had been thought to be. In addition, the higher level of cooperation amongst old firms could be justified, in line with Anand and Khanna [12], who argued that firms could learn to manage strategic alliances as experience accrues. They also found that experienced players are the reason of a greater value creation in comparison with the inexperienced ones in R&D joint ventures. That being said, further research should corroborate this supposition gathering data on the level of belief with level of opportunity costs in regard to cooperation in the actual partnerships. Hypothesis 2, strong leadership increases cooperation from both partners in strategic alliance, was not supported. Albeit there are no studies who focused on the relationship between cooperation in strategic alliances and leadership, our findings contradict propositions from Mariani [13] that states that leadership is a driver of coordination mechanism in inter-network co-opetition as well as propositions from Schweitzer [14] who claims that "leadership behavior facilitates innovation alliance outcome". The particular counterexample for our result is the case where suppliers were supported to make horizontal exchanges by Toyota, who acted as the leading firm [15]. Therefore, the view expressed in Müller-Seitz [16] that leadership in interorganizational networks influence all members in order "to make things happen" should not be dismissed based on these findings only. In addition, further analysis revealed that 65 percent of all strategic alliances in the sample had a leader (32 percent had a leader represented by a partner firm and 33 percent had a responding firm as a leader). The straightforward implication that a presence of a leader in an alliance does not facilitate cooperation should be regarded with caution. The theory tells us that having a leader is beneficial in a strategic alliance and the data showed that in fact firms tend to assign a leader to the strategic alliance more often than not. These results suggest that perhaps the concept of a leadership is more intricate as it was purported to be. Nevertheless, it shows the relevance of modelling strategic alliance as an assurance game rather than prisoner's dilemma since the concept of leadership is vital in the former and has no power in the latter. Further research should take into account behavior of a leader in strategic alliances

since, as our findings showed, having a firm that is regarded as a leader is not enough for high level of cooperation. In summary, testing hypotheses in this study provided several prescriptions for managers i.e. they (a) should favor alliance partners with high opportunity costs (in particular more-experienced partners) (b) should monitor opportunity costs of all firms and employ tactics to increase cooperation through increase of opportunity costs; and (c) should not pursue a necessary presence of a nominal leader.

6. Conclusion

This article explores the under-researched concepts of opportunity costs and leadership in the field of strategic alliances. With an aim to contribute both to the extant literature on strategic alliances and to the practicing managers considering such endeavors, the paper builds a model using game theory (IAGEO) and then tests two hypotheses on: (a) whether opportunity costs affect level of cooperation and (b) whether leadership can elicit cooperation. In particular, a novel model with an exit option addresses the case of diminishing opportunity costs and results are tested against real-world data. The main findings are: (a) high opportunity costs firms have greater level of cooperation in comparison with low opportunity costs firms; and (b) a nominal leader does not secure a high level of cooperation. Several shortcomings and limitations of this study should be noted. First, one of the assumptions of the proposed IAGEO model is that a strategic alliance takes a form of a multi-stage process. In the questionnaire, the projects were not distinguished as multi-stage alliances. Second, the relatively small sample size might result in small insignificant differences depending on which variables were dropped. That might be mitigated by the fact that this is the first attempt to test hypotheses against the real-world data. Third, the proxy variable of opportunity costs in the form of firm's age was chosen to represent opportunity costs based on the assumption that the more mature the firm the greater its opportunity costs. It could be the case that the more mature the firm the greater its experience in mutual projects. However, the same approach was taken in [9]. Fourth, a mere presence of a leader in the alliance might not mean that the leader was effective to encourage cooperation. Further studies should account for leader specific characteristics such as effectiveness. Fifth, competitive advantage was measured using respondents' opinion. Further studies could use both objective and subjective measurements when it comes to determining the extent of competitive advantage creation. There are several avenues for further research that could modify and extend the conclusions from this paper. First of all, future studies might explore whether confirmed hypotheses hold true with other proxy variables for opportunity costs (e.g. hurdle rates) and in larger samples. They could also focus on determining characteristics of a successful leader in an alliance as well as leader specific characteristics that facilitate cooperation. Secondly, another source of contribution could be game theory itself. For example, researchers could shed light on whether firms in other markets behave in accordance with predictions of the theoretical model developed here. Moreover, adding exit option to other game theory models (e.g. chicken game, the frog and the scorpion, battle-of-the-sexes etc.) and comparing their predictions for the case of strategic alliances could extend the scope of the theory. Finally, those predictions could be tested against real world data to benefit practice as well. Further studies of these questions could provide some valuable understanding of how to manage alliances successfully and how to elicit necessary levels of cooperation.

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