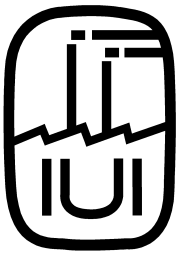

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The Insiders' Dilemma: An Experiment on Merger Formation

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Abstract

This paper tests the insiders' dilemma hypothesis in a laboratory experiment. The insiders' dilemma means that a profitable merger does not occur, because it is even more profitable for each firm to unilaterally stand as an outsider (Kamien and Zang, 1990 and 1993). The experimental data provides support for the insiders' dilemma, and thereby for endogenous rather than exogenous merger theory. More surprisingly, our data suggests that fairness considerations also make profitable mergers difficult. Mergers that should occur in equilibrium do not, since they require an unequal split of surplus.

Keywords: coalition formation, experiment, insiders' dilemma, mergers, antitrust

JEL classification: C78, C92, G34, L13, L41

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1 Introduction

Increased market power is one of the motives for mergers between competitors. Stigler (1950) points out two important obstacles to such mergers, however. First, even if an anti-competitive merger increases aggregate industry profits, it may be unprofitable for the firms involved. The reason is that the increased price triggers new entry and induces existing competitors to increase their production, thereby reducing the merging firms' market share. Second, even if the merger is profitable, remaining outside an anti-competitive merger is usually more profitable than participating, since outsiders benefit from an increase in price, but need not reduce output themselves. Firms may thus not have an incentive to participate in anti-competitive mergers, even if these are profitable, a phenomenon that we call *the insiders' dilemma*.

These obstacles have important implications for competition policy. Anti-competitive mergers are difficult to form, while mergers creating sufficient efficiency gains are not. These considerations suggest that horizontal mergers are primarily formed for other reasons than market power, for instance cost synergies. Allowing competition authorities to control mergers may thwart or delay such gains. Despite its potential importance for merger policy, there does not exist any empirical evidence indicating the strength of the insiders' dilemma, partly due to the difficulty in collecting and interpreting data about mergers that did not occur. Running a laboratory experiment overcomes these difficulties and the purpose of this paper is to test the significance of the insiders' dilemma in such an experiment.[1]

Stigler's first idea has subsequently received partial support in the so-

[1]The previous experimental literature on mergers (Huck, Müller and Normann, 2000) has focused on the effects of mergers and not on the actual merger decision.

called exogenous merger literature. Horizontal mergers are unprofitable in a Cournot oligopoly with constant marginal costs, unless the merger involves a large proportion of all firms (Szidarovszky and Yakowitz, 1982; Salant, Switzer and Reynolds, 1983). However, if the marginal cost is increasing, or if firms compete in prices, mergers are typically profitable (Perry and Porter, 1985; Deneckere and Davidson, 1985). The exogenous merger literature also provides some support for Stigler's second point, showing that outsiders in anti-competitive mergers gain more than insiders. A drawback of the exogenous merger literature, however, is that it builds on the presumption that mergers occur if, and only if, they are profitable. As a result, these externalities are considered to be irrelevant for the merger decision.

More recently, the endogenous merger literature, using non-cooperative models of the acquisition process, indicates that externalities actually are of importance. This literature has formalized the insiders' dilemma. Kamien and Zang (1990, 1991 and 1993) show that a profitable merger from ($n \geq 3$ firm) oligopoly to monopoly may not be an equilibrium. Since each target becomes a duopolist by *unilaterally* rejecting its bid, they will require too large a premium to make an acquisition profitable for a prospective buyer.[2]

This formalization of the insiders' dilemma is best illustrated in an example with three symmetric firms. If there is no merger, every firm earns the triopoly profit denoted T. If there is a merger to duopoly, both firms earn D. If there is a merger to monopoly the firm earns M. Kamien and Zang (1990) consider an acquisition game where all firms simultaneously submit a bid for

[2]Fridolfsson and Stennek (2000) formalize the existence of an insiders' dilemma also in the case of mergers between two firms. In their model of multi-person bargaining, mergers are delayed rather than completely blocked, however. Gomes (2000) shows that the insiders' dilemma may be overcome if firms use contingent bids. Using a cooperative model of the acquisition process, Horn and Persson (2001) argue that firms may be able to overcome the insiders' dilemma.

every other firm and an asking price for his own firm. The firm offering the highest bid above the asking price buys the target firm. The key issue is then whether there exists a Nash equilibrium where one firm buys both competitors to create a monopoly. The answer is that such an equilibrium may not exist, even if the merger would be profitable, i.e. $M > 3T$. To understand why, assume that monopolization is an equilibrium, where the buyer offers b to each competitor. At the same time, both sellers are supposed to announce an asking price $a = b$ (asking for less would be giving money). Each selling firm knows that by raising the asking price somewhat above b, it will become a duopolist and earn D. Therefore, for the acquisition to be an equilibrium, it is necessary that $a = b \geq D$. The buyer does not have an incentive to announce such a high bid unless $M - 2D \geq T$. Thus, monopolization is an equilibrium if, and only if, $M \geq T + 2D$. This condition is more strict than $M \geq 3T$ whenever $D > T$, i.e. whenever a merger to duopoly exerts a positive externality on the outsider.

Kamien and Zang (1993) consider a sequential model, consisting of the static model repeated in a number of periods. The key insight is that the insiders' dilemma remains, although in a weaker form. In a game of two periods, a buyer still needs to pay D for the last firm, but he can buy the first firm for T. Thus, there exists an equilibrium with merger to monopoly if, and only if, $M \geq 2T + D$.

The primary purpose of this paper is to test a particular mechanism, namely Kamien and Zang's formalization of the insiders' dilemma, but it also serves a broader aim. The paper is a first attempt to empirically discriminate between the old exogenous and the new endogenous merger theory. The former builds on the presumption that mergers occur if, and only if, they are profitable. The latter, which is an application of the theory of coalition

formation, indicates that merger incentives are also affected by externalities. We include different treatments where the profitability of the merger is constant, but where the externalities vary. If merger frequencies indeed vary with externalities, this may be taken as support for the endogenous merger theory over the exogenous merger approach. Even more broadly, our paper can be viewed as one of the first attempts to empirically test the theory of coalition formation, since endogenous merger theory is an application of this field.

2 Theoretical Predictions

We will test the insiders' dilemma in two different environments. The first environment concerns simultaneous acquisitions (corresponding to Kamien and Zang, 1990), the second sequential acquisitions (corresponding to Kamien and Zang, 1993). We simplify Kamien and Zang's models in several ways to make them amenable to experimental testing.

There are three players in our model of simultaneous acquisitions: one buyer and two sellers. At date one, the buyer makes an offer b, the same to both buyers. At date two, the sellers simultaneously and independently decide whether to accept or reject the offer. There are three possible outcomes in terms of market structure. If both sellers reject, there is triopoly, and all players receive payoff T. If one seller rejects and the other accepts, there is duopoly. The buyer receives payoff $D - b$, the rejecting seller receives D and the accepting seller, b. If both sellers accept, there is monopoly. The buyer receives payoff $M - 2b$ and the sellers receive b each.[3]

[3] To simplify the analysis we assume that both firms in the duopoly (the merged firm and the outsider) earn the same profit. Although extreme, this assumption is consistent with a homogenous good Cournot oligopoly with constant returns to scale. The assumption is not essential for the insiders' dilemma mechanism, however, and was also used by Kamien

Exactly as Kamien and Zang, we assume that a merger from triopoly to duopoly is not profitable, that is $D < 2T$. A merger from triopoly to duopoly exerts a positive externality on the outsider, i.e. $D > T$. It is also assumed that mergers from duopoly to monopoly and from triopoly to monopoly are profitable, that is $M > 2D$ and $M > 3T$. All these assumptions are consistent with simple oligopoly models.

The equilibrium concept is a subgame perfect equilibrium. Weakly dominated strategies are eliminated.

Proposition 1 *Consider the model of simultaneous acquisitions. If* $M - 2D > T$*, the buyer bids* $b = D$*, both sellers accept the bid, and there is merger to monopoly. If* $M - 2D < T$*, the buyer bids* $b \leq T$*, both sellers reject the bid, and the triopoly remains.*

Proof: At date two, the equilibrium depends on the bid b. If $b \leq T$, rejection is an equilibrium. (If $b = T$ there are also mixed equilibria. We do not consider those, however, since they are in weakly dominated strategies). All players receive T. If $b \geq D$, acceptance is an equilibrium (in weakly undominated strategies). To maximize his payoff, the buyer offers $b = D$. In this case, the buyer receives $M - 2D$ and the sellers receive D. If $b \in (T, D)$, there are three possible equilibria at date two. There are two asymmetric equilibria in pure strategies requiring one seller to accept and the other to reject. There is also a symmetric equilibrium in mixed strategies. The rest of this proof, however, demonstrates that the buyer will not bid $b \in (T, D)$ in equilibrium. First, consider the case of (asymmetric) pure strategies. To maximize his payoff, the buyer offers $b = T + 1$. In this case, the buyer receives $D - T - 1$. By offering $b \leq T$, inducing rejection, the buyer can guarantee himself $T > D - T - 1$. Second,

and Zang.

consider the symmetric equilibrium in mixed strategies, where the probability of acceptance is $p = (b-T)/(D-T) \in (0,1)$. The buyer's payoff is $p^2[M-2b] + 2p(1-p)[D-b] + (1-p)^2 T$. Assume first that $M - 2b > T$, then $M - 2b > D - b$ (since $b < D$ and merger from duopoly to monopoly is profitable, i.e. $M > 2D$), implying that $b = D$ and monopoly is a better choice. Assume next that $T > M - 2b$, then $T > D - b$ (since $b > T$ and merger from triopoly to duopoly is unprofitable, i.e. $D < 2T$), implying that $b = T$ and triopoly is a better choice. QED.

Consider next the model of sequential acquisitions. There are four periods with perfect information, and the buyer can only bid for one firm at a time. At date one, the buyer makes an offer b_1 to the first seller. At date two, the first seller accepts or rejects the offer and at date three, the buyer makes an offer b_2 to the second seller. At date four, the second seller accepts or rejects the offer. If both sellers reject, there is triopoly, in which case all players receive payoff T. If seller i accepts and the other rejects, there is duopoly. The buyer receives payoff $D - b_i$, the rejecting seller receives D and the accepting seller b_i. If both sellers accept, there is monopoly; the buyer receives payoff $M - b_1 - b_2$ and seller i receives b_i.

Proposition 2 *Consider the model of sequential acquisitions. If $M > D + 2T$, the buyer bids $b_1 = T$ and $b_2 = D$, both sellers accept and there is merger to monopoly. If $M < D + 2T$, the buyer bids $b_1, b_2 < T$, both sellers reject and the triopoly remains.*

Proof: At date four, seller two accepts if, and only if, $b_2 \geq D$ (in case seller one accepted) or $b_2 \geq T$ (in case seller one rejected). At date three, the buyer offers $b_2 = D$ in case seller one accepted, since then $M - b_1 - b_2 > D - b_1$ is maximized. In case seller one rejected, the buyer offers $b_2 < T$ since

$D - b_2 < T$ for all $b_2 \geq T$. At date two, seller one accepts if, and only if, $b_1 \geq T$. At date one, the buyer offers $b_1 = T$ if $M - T - D \geq T$ and $b_1 < T$ otherwise. QED.

Finally, we should motivate our key simplifications of Kamien and Zang's models. There are two distinct reasons why a profitable merger may not occur in Kamien and Zang's models. First, there is the insiders' dilemma and second, there is a coordination problem in the allocation of roles. Who should be the buyer and who should be the seller? This is not a trivial problem since different roles yield different payoffs. This is not, however, the problem on which Kamien and Zang have focused. Instead, they eliminate it by studying asymmetric equilibria where the roles are allocated to the firms as part of the equilibrium prescription. Since we only want to test for the importance of the insiders' dilemma, we also wish to eliminate this coordination problem in the experimental design. Since we cannot select an equilibrium, this is done by slightly changing the rules of the game. In particular, we assign roles (buyer and seller) to the different firms as part of the description of the game. Kamien and Zang's models also contain a second coordination problem. Since the split of surplus is determined in the same way as in a Nash demand game, all prices between a buyer's valuation and a seller's reservation price constitute an equilibrium price. To eliminate this problem, we let sellers observe the bids before responding.

3 Experimental Design

The experiment consists of four treatments, summarized in Table 1. Treatments Sim1 and Sim2 concern the simultaneous acquisition game and treatments Seq1 and Seq2 the sequential acquisition game. In all treatments,

$M = 43.5$ and $T = 11.5$ are held constant. Thus, the profitability of a merger to monopoly, that is $M - 3T > 0$, is held constant throughout the experiment. We use the duopoly profit D as a control variable. In the *test treatments* Sim1 and Seq1, the duopoly profit is sufficiently high for endogenous merger theory to predict that no merger occurs, even though a merger to monopoly is profitable. In the *control treatments* Sim2 and Seq2, the duopoly profit is sufficiently low for a merger to monopoly to occur according to endogenous merger theory.

Table 1. Summary of treatments ($T = 11.5$, $M = 43.5$)

Duopoly profit	Simultaneous acquisitions	Sequential acquisitions
High ($D = 21.5$)	-	Treatment: Seq1 Prediction: Triopoly
Moderate ($D = 17.5$)	Treatment: Sim1 Prediction: Triopoly	Treatment: Seq2 Prediction: Monopoly
Low ($D = 12.5$)	Treatment: Sim2 Prediction: Monopoly	-

In the tests, we will investigate if the occurrence of merger to monopoly differs significantly between different pairs of treatments, a test treatment and a control treatment. The procedure for comparing the outcome in test treatments with the outcome in control treatments ensures that the absence of mergers in Sim1 and Seq1 is due to the insiders' dilemma, and not to any other factors that are not part of endogenous merger theory.

The appropriate null-hypothesis is the assertion which should be considered valid, unless evidence throws serious doubts on it. We let exogenous

merger theory provide the null-hypothesis for two reasons. Exogenous merger theory is the more established framework for analyzing mergers and it is also simpler than endogenous merger theory. The null-hypothesis is that there is no difference in the outcomes between any pair of treatments, since the profitability of merger to monopoly is the same in all treatments. The alternative hypothesis is the assertion provided by endogenous merger theory. As indicated in Table 2, we perform three types of comparisons.

Table 2: Summary of tests.

Test	Test treatment	Control treatment
Simultaneous	Sim1	Sim2
Sequential	Seq1	Seq2
Simultaneous vs sequential	Sim1	Seq2

In Section 1, we compare test treatment Sim1 with control treatment Sim2 of the simultaneous game. In Section 4.2, we compare test treatment Seq1 with control treatment Seq2 of the sequential game. In both cases, the alternative hypothesis provided by endogenous merger theory is that the higher duopoly profit in the test treatments reduces firms' incentive to merge from triopoly to monopoly. Finally, in Section 4.3, we compare the simultaneous acquisition treatment Sim1 with the sequential acquisition treatment Seq2. In these two treatments, all profit parameters, including the duopoly profit, are the same. This test will reveal if sequential acquisitions mitigate the insiders' dilemma, as suggested by endogenous merger theory.

We planed to run ten trials of each treatment. New subjects were used in every treatment. Groups of three subjects (one buyer and two sellers) were randomly formed in each trial, which means that each subject only participated in one trial where the subject only played the game once. Since

new subjects were used in each trial, we did not need to use random matching. Subjects first played four rounds of practice without monetary rewards, however. The members of each group were anonymous.

The subjects were recruited from Stockholm University. An announcement was posted at different places allover the University where people were told to send an e-mail to sign up for the experiment. The announcement contained information about a one-hour-experiment, including 15 minutes for instructions and 35 minutes for practice rounds, with a show up fee of SEK 50 (approximately $ 5) and the possibility of making more money. We asked for thirty-three people in each treatment (including three to cover for no-shows). The experiment was carried out in Swedish in March and April 2001, pen-and-paper style.

The procedure was as follows. A single class room was used for each treatment. Participants were randomly given a number (1-30) to allocate their seats in the class room. When all participants were seated, they received instructions, reproduced in Appendix A.1 for simultaneous treatments and Appendix A.2 for sequential treatments. After reading the instructions, each participant received a private answer form, also informing the participant about his role (buyer or seller).

In the simultaneous treatments, each buyer offered one bid on the reply form. Each bid was copied by the experimenter and distributed to two of the sellers. The bid was either rejected or accepted by the sellers on their reply form. Their answers were copied by the experimenter and distributed to the buyer and the other seller in the group. In the sequential treatments, the buyers first offered a bid to one seller and then, after all player had been informed about the response, a possibly different bid to the second seller. After this single round, the participants could, anonymously, convert their

individual profit into cash before leaving the class room. The profits were given in points in the experiment where 1 point = SEK 10 (approximately $ 1).

The buyers' bids are restricted to be non-negative integers, while all profit parameters (T, D and M) are non-integers. As a result, players have strict incentives to follow the equilibrium recommendation, i.e. there exists no node where a player is indifferent between his equilibrium action(s) and some other action. A maximum bid was introduced to ensure that no subject could lose money, including the show-up fee.

4 Results

4.1 Simultaneous Treatments

Treatments Sim1 and Sim2 concern simultaneous acquisitions. As described in Proposition 1, endogenous merger theory suggests a triopoly outcome in the test treatment Sim1, since buyers should offer a bid below the triopoly profit $T = 11.5$, and sellers should reject this bid. In the control treatment, Sim2, the equilibrium outcome is monopoly, since buyers should bid just above the duopoly profit $D = 12.5$, and sellers should accept this bid. A complete description of the raw data is presented in Table 3. Due to no-shows, we could only run nine trials in Sim2. In all tables, bold indicates that behavior or outcome is consistent with the equilibrium in the relevant subgame.

Table 3: Raw data for simultaneous acquisitions										
Sim1										
Bid	15	14	13	13	12	**11**	**8**	**6**	**6**	**0**
Seller	**Yes**	**Yes**	**Yes**	**No**	**Yes**	Yes	**No**	**No**	**No**	**No**
Seller	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**	**No**
Sim2										
Bid	15	14	14	**13**	**13**	**13**	12	7	0	-
Seller	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**No**	**No**	-
Seller	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**No**	**No**	**No**	-

The first test investigates whether there are any differences between the treatments in terms of the resulting market structure (triopoly, duopoly, or monopoly). Table 4 reports the market outcomes for simultaneous treatments.

Table 4: Market outcomes for simultaneous treatments				
Treatment	Monopoly	Duopoly	Triopoly	Total
Sim1	1	4	**5**	10
Sim2	**5**	2	2	9
Difference in frequency (significance level)	0.456** (0.0495)	-0.178 (0.3622)	-0.278 (0.2199)	-

In treatment Sim2, five trials out of nine (56 percent) resulted in a monopoly whereas only one out of ten (10 percent) in Sim1. The last row presents the difference between the two treatment frequencies ($5/9 - 1/10 \approx 0.456$). Although the difference is not as extreme as suggested by endogenous merger theory, it has the predicted sign. There is more monopolization in Sim2 than in Sim1. There is also a difference in the triopoly outcomes; in treatment

Sim1 five trials out of ten (50 percent) resulted in triopoly, whereas only two out of nine (22 percent) in Sim2. This difference also has the predicted sign.

The next step is to test if the differences between Sim1 and Sim2 are statistically significant. Since this and all subsequent tests concern two independent samples, with categorical data (monopoly versus triopoly), and since we will have few observations, the appropriate test is Fisher's exact test (Bradley, 1968). A peculiarity of this test, when there are more than two different outcomes (monopoly, duopoly, triopoly), is that the differences in the frequencies are investigated one by one. We start with the frequency of monopoly.[4] The null hypothesis is that the frequency of monopoly is the same in Sim1 and Sim2. The alternative hypothesis is that the monopoly frequency is larger in Sim2 than in Sim1. The last row in Table 4 indicates that the difference between the two monopoly frequencies (0.456) is statistically different from zero (i.e. positive) at the five-percent level, using a one-sided test.[5] Thus, we can reject the null hypothesis at the five-percent level. The difference in triopoly frequencies is not significantly different from zero.

To acquire a deeper understanding of merger incentives, we proceed to test if buyers and sellers conform to their equilibrium strategies, prescribed by endogenous merger theory. Note that even if the outcome in terms of market structure conforms to the predictions of endogenous merger theory, the strategy profile may not.

[4]To apply Fisher's exact test for 2×2 tables, the 3×2 table must be partitioned (see Bradley, 1968). When testing the difference in monopoly frequency, one starts by comparing the triopoly and duopoly outcomes. If there is no significant difference between the two treatments (10 percent level), the duopoly and triopoly observations are clustered to create a 2×2 matrix (monopoly vs. non-monopoly).

[5]The significance level is the probability that we would observe the actual outcome, or a more extreme outcome, given that the null hypothesis is true. In all tables, stars * (**) indicate that the difference is statistically different from zero and thus, that the null hypothesis is rejected, with a 10 (5) percent level of significance.

Working backwards, we start by analyzing seller behavior. Since sellers find themselves in different subgames depending on the buyers' bids, we need to take the level of the bid into account. We divide bids into the three categories suggested by theory. Bids above the duopoly profit should be accepted and bids below the triopoly profit rejected. For bids between the triopoly and duopoly profits, theory does not deliver sharp predictions. There are three different equilibria in the subgame, two asymmetric pure strategy equilibria and one symmetric equilibrium in mixed strategies. Table 5 aggregates the sellers' behavior in treatments Sim1 and Sim2. Overall, there were 12 bids above the duopoly level, 12 bids at the intermediate level, and 14 bids below the triopoly level.

Table 5: Seller behavior in simultaneous treatments

Bid	Total	Accept	Reject	Difference in acceptance rate (sig.)
$D < b$	12	**11**	1	0.417^{**} (0.034)
$T < b < D$	12	**6**	**6**	0.429^{**} (0.021)
$b < T$	14	1	**13**	-

Table 5 indicates that the sellers' behavior is determined by the level of the bid, as suggested by the equilibrium recommendation. Out of 12 bids above the duopoly profit, 11 were accepted as prescribed by the equilibrium recommendation. Out of the 14 bids below the triopoly profit, 13 were rejected as prescribed.

The next step is to test if the sellers' behavior differs significantly due to the level of the bid. The last column of Table 5 compares the acceptance rate in a given row with that in the following row. The acceptance rate was

42 percent ($11/12 - 6/12 \approx 0.417$) higher for bids above the duopoly profit than for bids at the intermediate level. Similarly, the acceptance rate was 43 percent higher for bids at the intermediate level than for bids below the triopoly profit. Using Fisher's test, we must consider the two differences separately. In the case of the two top rows, the null hypothesis is that the acceptance rate is the same for bids $b > D$ as for intermediate bids, $T < b < D$. The alternative hypothesis is that the acceptance rate is higher when $b > D$. Both differences turn out to be significantly different from zero at the five percent level and thus, we reject the null hypothesis. The sellers' acceptance rate is determined by the bid. In particular, to ensure acceptance, bids must exceed the duopoly profit rather than the triopoly profit, as suggested by endogenous merger theory.

Table 6 summarizes buyer behavior. In treatment Sim1, the equilibrium prescribes that buyers should bid below T to induce rejection. In treatment Sim2, buyers should bid the smallest amount above D. In Table 6, we have lumped all bids above the duopoly profit together since they all indicate an attempt to monopolize the market.

Table 6: Buyer behavior for simultaneous treatments

Treatment	$b < T$	$T < b < D$	$D < b$	Total
Sim1	**5**	5	0	10
Sim2	2	1	**6**	9
Difference in frequency	-0.278	-0.389	0.667**	-
(significance level)	(n.a.)	(n.a.)	(0.0031)	

Table 6 shows that the proportion of low bids ($b < T$) is higher in Sim1 than in Sim2 ($-0.278 \approx 2/9 - 5/10$), and that the proportion of high bids ($D < b$) is higher in Sim2 than in Sim1, as suggested by the equilibrium

recommendation. Fisher's exact test shows that the latter, but not the former difference, is statistically significant.[6] Hence, we reject the null hypothesis that the proportion of high bids is the same in the test treatment Sim1 and the control treatment Sim2, in favor of the alternative hypothesis that the proportion of high bids is larger in Sim2 than in Sim1.

To summarize the analysis of simultaneous treatments, we have found that all differences have the predicted sign, but that not all are statistically significant.

Conclusion 1 *In the simultaneous acquisition game, the duopoly profit affects the behavior of both buyers and sellers, and also the incidence of monopolization. In particular, monopolization is more difficult when the duopoly profit is higher, as suggested by endogenous merger theory.*

4.2 Sequential Treatments

Treatments Seq1 and Seq2 concern sequential acquisitions. As described in Proposition 2, endogenous merger theory suggests a triopoly outcome in the test treatment Seq1, since buyers should offer bids below the triopoly profit $T = 11.5$, and both sellers should reject their bids. In the control treatment Seq2, the equilibrium outcome is monopoly, since buyers should first bid just above the triopoly profit $T = 11.5$ (i.e. 12) and then just above the duopoly profit $D = 17.5$ (i.e. 18), and both sellers should accept their bids. A complete description of the raw data is presented in Table 7. In treatment Seq1, we only have eight trials due to no-shows.

[6] Given our data, Fisher's test is not available for computing significance levels for the differences between Sim1 and Sim2 in terms of the frequencies of low bids ($b < T$) and intermediate bids ($T < b < D$). For example, for low bids to be compared with non-low bids ($b > T$) we have to cluster intermediate bids and high bids. This cannot be done however, since they are significantly different from each other.

Table 7: Raw data for sequential acquisitions										
Seq1										
Bid 1	13	13	13	13	12	**11**	**4**	**0**	-	-
Seller 1	**Yes**	**Yes**	**Yes**	No	No	**No**	**No**	**No**	-	-
Bid 2	**14**	**13**	**13**	**9**	**10**	**6**	**6**	**0**	-	-
Seller 2	**No**	**No**	**No**	**No**	**No**	Yes	**No**	**No**	-	-
Seq2										
Bid 1	16	15	15	14	13	**12**	**12**	5	0	0
Seller 1	**Yes**	**Yes**	**Yes**	No	No	No	No	**No**	**No**	**No**
Bid 2	16	15	8	16	**5**	**3**	**2**	**3**	**5**	**1**
Seller 2	**No**	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**	**No**	**No**

The first test investigates whether there are any differences between treatments in terms of the resulting market structure (triopoly, duopoly, or monopoly). Table 8 reports the market outcomes for sequential treatments.

Table 8: Market outcomes for sequential treatments				
Treatment	Monopoly	Duopoly	Triopoly	Total
Seq1	0	4	**4**	8
Seq2	**0**	4	6	10
Difference in frequency (significance level)	0.000 (1.0000)	-0.100 (0.8158)	0.100 (0.8158)	-

The test treatment Seq1 seems to conform to endogenous merger theory, since subjects do not succeed in monopolizing the market. A potential explanation for this is the insiders' dilemma. Unexpectedly, however, monopoly did not occur in the control treatment Seq2 either. Actually, the frequency

of triopoly is even larger in Seq2 than in Seq1 ($0.100 = 6/10 - 4/8$). The null hypothesis, which entails no difference between the treatments in terms of market structure, cannot be rejected by Fisher's test in any of the three cases. This result casts doubts on the insiders' dilemma as a cause of failure to monopolize the market in sequential games. The lack of monopoly can, however, be explained when analyzing the strategies of the player in more detail.

The primary question is why there is so little monopolization in Seq2. Are the buyers' bids too low, or the sellers' demands too high? If anything, Table 7 shows that buyers have offered more than the equilibrium prescribes. However, some of the first sellers in Seq2 have rejected bids over $T = 11.5$, even though the equilibrium prescribes acceptance. If they had accepted a bid of for example 12, the buyer would (in equilibrium) have offered a bid of 18 to the second seller and thereby monopolized the market. The returns would then have been 12 for seller 1 and 18 for seller 2. The equilibrium in the subgame after seller 1 rejects prescribes the buyer to offer a non-attractive bid to seller 2 and the triopoly would remain. Thus, all will receive 11.5.

One potential explanation for the first sellers' high demands is *fairness* or perhaps *envy*. Seller 1 does not accept 12 if seller 2 gets 18. Seller 1 does not accept an unfair outcome. But what is fair? If there is merger to monopoly, fair might mean that the firms split the surplus equally. In our treatments a fair bid would then be $43.5/3 = 14.5$. Thus, a seller caring for fairness may accept bids above 14.5 and reject lower bids. As can be seen in Table 7, there is indeed a cut-off point between 14 and 15 in the data for treatment Seq2. The problem is that if the buyer has to pay 14.5 to the first seller, while still having to pay the duopoly profit to the second seller (the data suggests that the second seller demands the duopoly profit), the buyer would earn a higher

profit by remaining in the triopoly. This may explain some of the failures to monopolize the market. In particular, the three right-most buyers in Table 7, treatment Seq2, do not seem to have attempted to acquire the other firms. A potential explanation is that the buyers understood seller 1's demand for fairness.

The behavior of the four left-most buyers in Table 7, treatment Seq2, strengthens the fairness argument. They offered bids of at least 14 to the first sellers. All but one also tended to offer fair bids to the second sellers. This (out of equilibrium) behavior may indicate that they intended to monopolize the market with a fair split of the surplus. These four buyers may have been governed by their own preferences for fairness, and not only by taking seller 1's fairness considerations into account. They fail to understand, however, that the second sellers will use their bargaining power and demand the duopoly profit.[7]

Conclusion 2 *In the sequential acquisition game, profitable monopolization did not only fail in the test treatment (with high duopoly profit) but also in the control treatment (with low duopoly profit). The data suggests that fairness might be the reason for this. Mergers that should occur in equilibrium do not, since they require an unequal split of surplus.*

This result shows that including the control treatments in the experiment is crucial. Had we only included Seq1, we would falsely have attributed the failure to monopolize the market in the sequential game to the insiders' dilemma. Instead, we now suggest fairness as a possible explanation for the

[7] Another possible explanation for first-seller behavior is that they reject offers hoping that the other two firms will merge in the second stage. Such a belief could be motivated by allowing for trembles from the equilibrium. However, to motivate the observed cut-off point 14.5, the first-sellers need to believe that the probability of a merger is at least 50 percent.

failure to monopolize the market in the sequential game. We do, however, still consider this to be an open question. Future work on this topic may follow the lines suggested by Fehr and Schmidt (1999).

A related question concerns how the roles are assigned. In our experiment, the roles of buyers, first-sellers and second-sellers were randomly distributed. If these roles had instead been determined by historical profits or some other performance indicator, giving rise to asymmetric strength, fairness considerations might be weaker. It may be accepted that stronger (weaker) firms profit more (less) when each firm has deserved its role in the market. In reality, targets may also reject early offers, hoping to sell out later as a second seller. Such waiting strategies arise in the dynamic acquisition game studied by Fridolfsson and Stennek (2000). These issues are left for future experimental work, however.

One might ask why we do not discuss fairness in the simultaneous treatments. The reason is that our data indicates that fairness is more important in sequential than in simultaneous treatments. This, in turn, may be explained by the fact that the equilibrium only prescribes unequal payoffs to different sellers in the sequential treatments. It might be more surprising, that the sellers in the simultaneous treatments do not appear to have been concerned with the equality between buyers and sellers. Sellers conform to their equilibrium strategy, even though the equilibrium in Sim2 gives the buyer a profit of 17.5, while the sellers only receive 13. This result differs from experiments on ultimatum bargaining which, in the present context, can be considered as an acquisition game with only one seller. A possible reason for this difference is that in an acquisition game with two sellers, the first-mover advantage is not as pronounced. Sellers do receive a share of the surplus since the duopoly profit rather than the triopoly profit is the relevant

threat point.

4.3 Simultaneous vs. Sequential

Finally, we should investigate if sequential acquisitions make monopolization easier as suggested by the endogenous merger theory. Table 9 provides a comparison between Sim1 and Seq2, which have equal profit parameters but different timing in the acquisition procedure.

Table 9: Market outcomes: simultaneous vs sequential

Treatment	Monopoly	Duopoly	Triopoly	Total
Sim1	1	4	**5**	10
Seq2	**0**	4	6	10
Difference in frequency (significance level)	-0.100 (0.5000)	0.000 (0.6750)	0.100 (0.8151)	-

It is immediately clear that there is no significant difference between the two treatments in terms of the resulting market structure.

The reason why profitable monopolization fails in the two treatments is likely to be different, however. In case of simultaneous acquisitions, this is likely to be due to the insiders' dilemma, as argued above. In the case of sequential acquisitions, the data suggests fairness considerations.

5 Conclusions

The purpose of this paper is to test the insiders' dilemma hypothesis in a laboratory experiment. Are profitable mergers to monopoly blocked because it is more profitable for individual firms to unilaterally be outsiders?

Our first two treatments concern simultaneous acquisitions. Although the profitability of a merger from triopoly to monopoly is the same in both the test treatment and the control treatment, the sellers' outside option is different since the duopoly profit is higher in the test treatment. There are significantly less mergers to monopoly when the duopoly profit (threat point) is high, as suggested by the insiders' dilemma hypothesis. Furthermore, data on the buyers' and sellers' strategies suggests that the duopoly profit is an important determinant of merger activity.

The result that merger intensity is not only determined by profitability, but also by externalities, can also be viewed as a rejection of exogenous merger theory in favour of endogenous merger theory. We should point out, however, that our test hinges on Kamien and Zang's model of the acquisition process, while exogenous merger theory is silent on the details of the acquisition process. For this reason, further tests, using other models of the acquisition process such as unstructured bargaining, would be welcome complements to our results.

In the treatments concerning sequential acquisitions, monopoly outcomes were not observed either in the test treatment (with high duopoly profit) or in the control treatment (with low duopoly profit). The failure to monopolize the market in the control treatments indicates that the insiders' dilemma is not an appropriate explanation here. Instead, the data is consistent with the idea that the first seller cares for fairness and does not accept a lower payoff than an equal split of the monopoly profit. Since monopolization at such high acquisition prices is unprofitable to the buyer, the fairness considerations collapse the monopoly outcome. Future experimental work on merger formation could test for fairness using the ideas of Fehr and Schmidt (1999).

It might be questioned, however, if the fairness result is an artifact of

the methodology of running a laboratory experiment with student subjects. Do real-world managers and shareholders care about fairness? Although we cannot provide a conclusive answer in the present paper, we see no reason to exclude this possibility. Managers and shareholders might not use the term fairness, but they do care about relative performance. That is, managers and shareholders do not only care about the profit of their own firm, but also about their performance in relation to other firms within the same industry. It is also interesting to note that Kamien and Zang (1993) probably anticipated the fairness result, saying that "...it is not clear why it should be possible to persuade one owner to sell out first and profit less than the other owner who sells out later, and not vice versa."

References

[1] Bradley, J. V. (1968) *Distribution-Free Statistical Test*, Prentice-Hall, Englewood Cliffs, New Jersey.

[2] Deneckere, R., and C. Davidson (1985), "Incentives to Form Coalitions with Bertrand Competition," *Rand Journal of Economics*, Winter, 16(4), 473-86.

[3] Fehr, E., and K. M. Schmidt (1999) "A Theory of Fairness, Competition, and Cooperation," *Quarterly Journal of Economics*, August, 114(3), 817-68.

[4] Fridolfsson, S. O., and J. Stennek (2000), "Should We Control Mergers?," Discussion Paper 2705, Center for Economic Policy Research.

[5] Gomes, A. (2000), "A Theory of Negotiation and Formation of Coalitions," University of Pennsylvania, September.

[6] Horn, H., and L. Persson (2001), "Endogenous Mergers in Concentrated Markets," *International Journal of Industrial Organization* September, 19(8), 1213-44.

[7] Huck, S., K. A. Konrad, W. Müller, and H. T. Normann (2001), "Mergers and the Perception of Market Power: An Experimental Study," mimeo. Royal Holloway.

[8] Kamien, M. I., and I. Zang (1990), "The Limits of Monopolization Through Acquisition," *Quarterly Journal of Economics*, May, 105(2), 465-99.

[9] Kamien, M. I., and I. Zang (1991), "Competitively Cost Advantageous Mergers and Monopolization," *Games and Economic Behavior*; 3(3), 323-38.

[10] Kamien, M. I., and I. Zang (1993), "Monopolization by Sequential Acquisition," *The Journal of Law, Economics, & Organization*, October, 9(2), 205-29.

[11] Perry, M. K., and R. H. Porter (1985), "Oligopoly and the Incentive for Horizontal Merger," *American Economic Review*, March, 75(1), 219-27.

[12] Salant, S. W., S. Switzer, and R. J. Reynolds (1983), "Losses from Horizontal Merger: The Effects of an Exogenous Change in Industry Structure on Cournot-Nash Equilibrium," *Quarterly Journal of Economics*, May, 98(2), 185-99.

[13] Stigler, G. J. (1950), "Monopoly and Oligopoly by Merger," *American Economic Review*, 40, 23-34.

[14] Szidarovszky, F., and S. Yakowitz (1982), "Contributions to Cournot Oligopoly Theory," *Journal of Economic Theory*, 28, 51-70.

A Instructions

Originally, the instructions were written in Swedish. We include the instructions for the subjects participating in treatments Sim1 and Seq2. For the other treatments, the duopoly profits must be changed.

A.1 Simultaneous Treatments

You are about to participate in an experiment in economic decision making. The experiment will be repeated in 5 rounds. All bids and profits in the experiment are given in points. The first four rounds are practice rounds and will not give any points, that is, you cannot make any money from these. Only the outcome in the last round will give points transferable into money, where 1 point = SEK 10. No one, except the experimenter, will know the decisions and payoffs of other people participating in this experiment. All payments are financed out of a grant from Marianne och Marcus Wallenbergs Stiftelse. You receive SEK 50 each as a show up fee. The experiment will last for about 30 minutes.

People in this room will be divided into groups of three. Each group contains one buyer and two sellers. You will be informed of whether you are a seller or a buyer. The other two members of your group will be unknown to you.

Here is what will happen. The sellers hold one asset each. The buyer can buy these assets from the sellers. One round is divided into two phases:

Phase 1	The buyer offers one and the same bid to the two sellers.
Phase 2	The sellers receive the bid and accept or reject it. No seller can observe the decision of the other seller before he/she
	makes his/her own decision.

The bid must be an integer, minimum 0 and maximum 22.

How many points you receive will be determined by the following:

Buyers

Bought	Your profit
2	43.5-2*your bid (you have to pay the bid to each of the sellers)
1	17.5-your bid (you have to pay the bid to the accepting seller)
0	11.5

Hence, how many points you will receive as a buyer depends on how many assets you have bought and how much you have paid for them.

Sellers

Your answer	Your profit
Yes	You receive the bid.
No	Your payoff depends on the other seller:
	1. If the other seller also rejects = 11.5
	2. If the other seller accepts = 17.5

Hence, how many points you will receive as a seller depends on your own decision and the decision of the other seller (if you reject).

After one round, we will observe your choices and announce your payoffs. Do not talk to the others and make sure that no one can see the choices you make on the reply form or your type (buyer or seller).

How many points you receive can also be illustrated in the following payoff matrix for buyers, offering a bid = b:

The buyer's matrix

		Seller 2	
		Yes	No
Seller 1	Yes	43.5-2b	17.5-b
	No	17.5-b	11.5

How many points you receive can also be illustrated in the following payoff matrix for sellers, receiving a bid = b:

The seller's matrix

		Answer of the other seller	
		Yes	No
Your answer	Yes	b	b
	No	17.5	11.5

A.2 Sequential Treatments

//The first two paragraphs are identical to the simultaneous instruction.//

Here is what will happen. The sellers hold one asset each. The buyer can buy these assets from the sellers. However, it is only possible for buyers to buy one asset at a time, according to the following:

Phase 1	The buyer offers one bid to seller 1.
Phase 2	Seller 1 receives the bid and may accept or reject it.
Phase 3	Buyer and seller 2 are informed about the response of seller 1.
Phase 4	The buyer offers a bid to seller 2.
Phase 5	Seller 2 receives the bid and accepts or rejects.

The bid must be an integer, minimum 0 and maximum 22.

How many points you receive will be determined by the following:

Buyers

Bought	Your profit
2	43.5-bid1-bid2 (you have to pay the bids to each of the sellers)
1	17.5-your bid (you have to pay the bid to the accepting seller)
0	11.5

Hence, how many points you will receive as a buyer depends on how many assets you have bought and how much you have paid for them.

Sellers

Your answer	Your profit
Yes	You receive the bid.
No	Your payoff will depend on the other seller:
	1. If the other seller also rejects = 11.5
	2. If the other seller accepts = 17.5

Hence, how many points you will receive as a seller depends on your own decision and the decision of the other seller (if you reject).

After each round, we will observe your choices and announce your payoffs. Do not talk to the others and make sure that no one can see the choices you make on the reply form or your type (buyer or seller).

How many points you receive can also be illustrated in the following payoff matrix for buyers, offering the first bid = b_1 and the second bid = b_2:

The buyer's matrix

		Seller 2: Yes	Seller 2: No
Seller 1	Yes	43.5-b_1-b_2	17.5-b_1
	No	17.5-b_2	11.5

How many points you receive can also be illustrated in the following payoff matrix for sellers, receiving a bid = b:

The seller's matrix

		Answer of the other seller: Yes	Answer of the other seller: No
You answer	Yes	b	b
	No	17.5	11.5