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Keywords: Corporate Finance, Payout Policy, Takeover, Asset Market, Trust Game, Experiment

JEL Classification: C9, C72, D84, G12, G34

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The Takeover Game

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1. Introduction

Shareholders are the owners of the firm. Any misalignment between the interests of shareholders and management is supposed to be resolved through various mechanisms.¹ It is often argued that dividend payments to shareholders are one such mechanism to alleviate this agency problem. Dividends reduce resources that are under the managers' control, thereby reducing managers' power (see Rozeff 1982, Easterbrook 1984, or Jensen 1986).

In reality, small shareholders have little say in the decisions of management (this is an ongoing debate in the literature started by Berle and Means, 1930, in their characterization of “separation of ownership and control”). However, following the recent financial crisis, regulatory reforms have given shareholders more voting power in approving executive compensation and nominating director candidates (e.g., Yermack 2010). While shareholders are occasionally allowed to vote on matters such as board appointments and other issues, the firm is not obligated to present them with choices for every issue of concern to shareholders, nor are all votes necessarily binding on management. In the past, several publicized investor revolts have resulted in varying degrees of success (Dumaine 1987, Epstein 1992, Lazaroff 2004, Peters 2007). Generally, however, it can be said that small investors have little real say in the active management of the firm².

One of shareholders' real powers lies in their ability to sell the firm to a new acquiring firm, or liquidate the firm (e.g., Dumaine 1987), even if management opposes such a move. When shareholders sell the company in opposition to management, this is known as a hostile takeover. A hostile takeover can be conducted in several ways. A tender offer takes place when the acquiring company makes a public offer for shares. Other approaches include a proxy fight, whereby a shareholder majority votes to replace the management with a new one which will

¹ The board structure seems to play a role in solving the free cash problem as discussed in Gillete, Noel, and Rebello (2007).

² However, big investors may have greater influence. For example, the management compensation seems to be lower in firms in which at least one owner possesses more than 5 percent of the shares (Dyl 1988 or Hambrick and Finkelstein 1995).

approve the takeover. Lastly, the acquiring firm may purchase sufficient shares in the open market to influence a change in management; this is known as a creeping tender offer. Our focus is on the standard tender offer.

Under a successful tender offer takeover, shareholders extract higher surpluses by terminating the life of the firm in its current form rather than to just holding shares. According to Manne (1965, p. 113), "Only the takeover scheme provides some assurance of competitive efficiency among corporate managers and thereby affords strong protection to the interest of vast numbers of small, non-controlling shareholders". Martin and McConnell (1991) find that "turnover in the top manager position of target firms increases significantly following takeovers" and that "there is a strong link between top executive turnover and the pre-takeover performance of target firms". Thus, the takeover threat is supposed to be an indirect but effective mechanism for shareholders to renegotiate their contract with management (see also Grossman and Hart 1980, Jensen 1986, Scharfstein 1988). In that sense, Kerschbamer (1998) points out that a takeover threat has an impact not only on a single firm but also on the industry as a whole, putting pressure on the industry to move on from an inefficient (self-dealing) contracting equilibrium to an efficient one.

In the experimental economics literature, there is a developed body of knowledge that can be used to study investor-management interaction. The most natural benchmark is the trust game (introduced by Berg, Dickhaut, and McCabe 1995). In a trust game (or investment game), an investor invests in a company which triples the value of his investment. The manager then decides how much to return to the investor (something akin to a dividend payment), though the manager has dominant strategy of extracting all the profit. An exhausted empirical body of evidence on trust games in a large number of settings and diverse populations finds that investors do place substantial trust in management, from about 30% to 80% of endowments (See for example Füllbrunn, Richwien, and Sadrieh 2011 for an overview of results in trust games). Most managers reward that trust with a small return, although plenty of unscrupulous managers exist, making the

expected return on this investment around zero (investors are on average given the value of their investment back).

While the trust game is useful in studying investor-management interaction, the main incentive for dividend payment in the standard trust game is feelings of positive reciprocity (gratefulness) on the part of managers. While it would be nice to believe that managers feel grateful to investors and therefore reward them with dividends, we take the view that dividend payments may have something to do with managers wishing to keep their jobs and the associated income³.

The environment we study has investors who are initially endowed with shares and cash. The shares generate income but this income can only be distributed to shareholders by the manager, who may also keep as much of the income for himself. Shares may be traded on the open market. Investors who do not trust the manager to distribute income may attempt to sell their shares on the open market and may periodically accept an outside tender offer. Only if the majority of shares vote to accept the tender offer, the firm is taken over. Thus, while trust is a key ingredient in this environment, the direct reciprocity element is not as salient as in the standard trust game. Only after three periods of trading and income distribution, investors receive their first tender offer. Two more tender offers would be received in future periods if investors reject the preceding offers.

Investors face a number of periods in which they can trade, receive dividends and accept or reject tender offers. Thus, there are repeated game interactions. While the subgame perfect equilibrium is zero investment in the finitely repeated game (by backward induction), we know

³ Manager-investor interaction also has a parallel in the centipede game (introduced by Rosenthal 1981). In the centipede game, the last mover has an incentive to defect from the social welfare maximizing action and by backwards induction each player will defect in its turn, resulting in both players forgoing huge sums of money. The evidence suggests that players will move forward some but not all the way. Investor-manager partnership is a little bit like that. Investment is necessary to reap huge potential profits, but management has a strong incentive to engage in self-dealing when given the chance. But management will not do so for a while due to a mix of social contract obligation and a desire to prolong the life of the firm.

from other finitely repeated games that players are able to sustain some periods of cooperation (see e.g. Andreoni and Miller 1993 in prisoner's dilemma situations).

Moreover, the ability of investors to trade shares gives us insights about their beliefs and intentions that are not available in the standard trust game. Ideally, it would be useful to be able to predict the outcome of a hostile takeover based on share prices and this is one of the issues under investigation.

We are interested in several important questions of managerial relevance. First, we would like to know whether dividends are outcomes of strategic considerations by managers. The trust game literature does not allow for strategic considerations because the game ends after the manager's decisions. Here, the manager's decision has consequences and we would like to know whether and how the manager incorporates these consequences into its decision. Indeed, we find that managers strategically raise dividends before tender offers, and that dividends strategically decline over time. We next want to know how investors react to managers' actions and whether they adhere to equilibrium predictions of accepting the first takeover offer. We find that investors are indeed responsive to dividends, and while they do not accept the first takeover offer, they appear to do so with increasing frequency as they gain experience. Lastly, we are interested in the ability of prices to be leading indicators of voting outcomes. We find that prices are certainly informative about future outcomes.

The paper is structured as followed. First we introduce the model along with theoretical predictions in section 2. Then, we explain the experimental implementation in section 3, followed by the experimental results in section 4. We conclude in section 5.

2. Setting

A market consists of at most T periods of trading and dividend payments. There are n traders who own shares in a finitely lived productive asset. Traders can buy and sell shares in every period t in which the asset is available. Shares yield randomly distributed earnings $E_t \geq 0$ with an

expectation of μ in every period. Earnings are distributed to shareholders by a manager. While realized earnings are known to the manager, traders cannot observe earnings. The manager has no influence on asset productivity but determines dividend payments at the end of each period. Earnings can be paid as dividends D_t or as the manager's salary S_t . The dividend per share (d_t) equals the dividend payment divided by the number of shares in the market (k), in other words $d_t = D_t/k$. Given the market ends in period T , the value of a share in period t equals the sum of the expected dividend payments until period T , i.e. $v_t = \sum_{\tau=t}^T E(d_\tau)$.

In some fixed pre-announced periods, prior to the beginning of trading, traders vote to accept or reject a tender offer, where every shareholder receives an invitation to tender their share at price $\hat{p}_t$ per share. Accepting the offer ends the market immediately. When the market ends, the manager receives no further salary nor do the traders receive further dividends. However, the traders uniquely receive the proposed final price per share under the tender offer. Theoretically, traders will vote to accept the takeover offer if the expected value of the share is lower than the current tender offer price; specifically, if $\hat{p}_t > v_t$. The tender offer price is chosen to decrease over time, i.e., $p_t < p_{t-1}$ due to the finite nature of the market. However, in the experimental setting we set the first takeover decision to be later than the first period since otherwise managers would have no possibility to signal their willingness to pay high dividends. Indeed, this signaling or strategic raising of the dividends before the vote is an important question in the present research, and this is one of the primary reason we selected fixed periods for tender offers.⁴

To summarize: (1) in fixed periods traders are given a takeover offer they may accept or reject before the market starts. (2) Traders can buy and sell shares in a double auction market. (3) A manager decides on dividend payments given realized earnings.

⁴ In reality, tender offers do not arrive at regular fixed intervals, although one may think of them as looming in every period. The periods of tender offers in the present setting are fixed and known in advance in order to simplify the analysis. Knowing the period of the vote with certainty in advance makes it possible to compute fundamental values and to conduct fairly straightforward tests of manager signaling.

Depending on other-regarding preferences, there are two possible equilibria to this market. If the manager possesses selfish preferences, then we would expect a selfish equilibrium in which the market cannot be sustained past the first takeover offer. This behavior may be associated with “managerial self-dealing” such as outright theft from the firm, excessive compensation, or issues of additional securities (such as equity) awarded to the management and its relatives (Shleifer and Vishny 1997).

Proposition 1. The Selfish Equilibrium. If managers are selfish, the manager pays no dividends and the traders accept the first takeover offer.

The solution is found through backward induction. In period T , the self-interested manager’s dominant strategy is to extract the full surplus from earnings, leaving zero dividends to be paid to the traders. Anticipating that, traders accept the takeover offer in period T . This unravels all the way to the very first takeover offer in period. That is the traders will always accept the first takeover offer, and the manager would never pay positive dividends. Earnings are extracted only in periods $1, 2, \dots, \hat{t} - 1$, where $\hat{t}$ is the period of the first takeover offer. The manager’s payoff is equal to the extracted earnings while the investors receive the final price times the number of shares they own.

Proposition 2. The Equitable equilibrium. If the manager has sufficient regard for traders, the managers pays a positive dividend and, thus, the traders do not accept early takeover offers.

Assume the “fair distribution” of earnings across market participants is an equal distribution. That means in every period the manager receives a salary of $S^f = \mu/(n + 1)$ and investors receive a dividend of $D^f = \mu n/(n + 1)$. The takeover price is assumed to be below the fair value, i.e. $\hat{p}_t < (T - t + 1)d^f$ because otherwise investors would accept any takeover offer unless the manager has credibly signaled that he has some non-selfish preferences. For example, if the manager has preferences for fairness and can credibly signal a fair dividend payment until the end

of the market in periods $1, 2, \dots, \hat{t} - 1$ then the fair market value in period t equals $v_t^f = (T - t + 1)d^f$. The manager should even pay D^f in the case of zero earnings in a period. This dividend policy is in line with Lintner (1956) who finds that managers are hesitant to make dividend changes that may later need to be reversed. Managers also try to stabilize dividends and avoid dividend cuts. All earnings are extracted and prices equal the fair value, $p_t = v_t^f$. Earnings are extracted in all periods $1, 2, \dots, T$, and the manager's payoff from the salary equals each investor's total dividend payment assuming equally distributed shares.

3. Experimental implementation

In the following we give a brief summary of the experimental setting. The instructions can be found in the appendix. The experiment consists of 4 consecutive distinct markets. One market has a maximum of 8 trading periods and, thus, eight possible dividend payments. In each market, traders face a maximum of three takeover offers after that the market closes. In each period that is reached, three traders can buy and sell shares using a double auction. At the end of every period, each share pays a dividend that is announced by the manager. The manager decides on dividend payments but cannot trade.

In each period that is reached, the manager receives randomly determined earnings that are 2000, 1000, or 0 francs with equal probability such that expected earnings in every period equal 1000. Earnings are only known to the manager. The manager decides on how much of the earnings in a period to pay as dividends. The remaining earnings are the manager's salary. Dividend payments may exceed earnings leaving a zero salary to the manager. However, negative balances will be paid from next period's earnings as long as next period's earnings are positive and thereafter managerial salary can be paid. Hence, the dividend per share in each period equals the amount the manager has decided to pay as dividends divided by the number of shares in the Market.

At the beginning of the market all traders are endowed with money and shares, such that given a fair dividend payment all participants finally are able to receive the same payoff. The manager starts with 4000 francs, while the traders begin with one of three endowment profiles: One trader begins with 4 shares and 4800 francs, one trader begins with 7 shares and 3900 francs, and one trader begins with 9 shares and 3300 francs.⁵ Thus, there are 20 shares in total.

At the beginning of Period 4, 6, and 8 traders can vote to accept a takeover offer. We use a neutral framing in that participants can vote either END MARKET or CONTINUE. Each share entitles its owner to one vote and only if the majority of shares votes to accept, the market ends immediately. Each share then pays a final price per share to its owner; 150 francs in period 4, 90 in period 6, and 30 in period 8.⁶ This market ends immediately such that no further dividends are paid to the traders and no further salary is paid to the manager.

Summing up, a period consists (in that order) of (1) the takeover decision (in period 4, 6, and 8 only), (2) trading in a double auction, and (3) the manager decision. In each session, 16 subjects participated. Participants were randomly and anonymously arranged in 2 groups of 8 participants. This group constellation remained fixed during the entire experiment. Before each market, participants within a group were rearranged into 2 market groups of 4 participants such that everyone was in the role of a manager in 1 of the 4 markets and in the role of a trader in the other 3 markets.⁷

4. Experimental Results

The experiments were conducted at the University of Texas at Dallas with students from the School of Management that never participated in an asset market experiment before. The

⁵ The expected dividend equals 1000 and a fair distribution would be 250 francs to the manager and 750 francs to the traders in every period. This makes a dividend per share of 37.5 francs, i.e. a fair value of $8 \times 37.5 = 300$ francs per share at the beginning of the market. For an overall fair allocation the initial endowment plus the dividend payments or salary, respectively, must be the same for all traders. Thus, given the final allocation is 6000 francs to all participants every trader receives an initial money endowment of $6000 - 300 \times \# \text{ shares}$. The manager receives an initial endowment of $6000 - 250 \times 8$.

⁶ The final price equals 80% of the fair value in the corresponding period.

⁷ As traders participants never met again in another market.

experiment was computerized using zTree (Fischbacher's, 2007). In total we had 7 independent groups with 56 subjects. Each subject received about \$25 for participating in a one and a half hour session. Instructions were read aloud and participants were trained in the market facility before the experiment started.

4.1. Manager's Strategy

We begin by looking at the manager's behavior since ideally rational forward looking investors should anticipate the manager's behavior and price their shares and vote accordingly. From Figure 1 we see that dividend payment clearly rises in period 3 and to a lesser extent in period 5, right before the first two takeover votes in period 4 and period 6. Thus, manager appears to be strategically raising dividends in these instances (one-sided pair wise t-test⁸ p-value = 0.055).⁹ We also see that this tendency is rising across markets (Figure 1c), meaning that as managers accumulate experience they increase the tendency to raise dividend immediately before voting. Thus, we state Result 1.

Result 1. Managers strategically raise dividends before the first voting period.

We next note from Figure 1 that aside from the periods immediately before voting takes place, there seems to be a clear downward trend in dividend payment over time. This is reasonable in that the manager should realistically expect investors to accept the takeover offer with greater probability towards the end of the game.¹⁰ Thus, the manager has a greater incentive to 'defect' to the selfish equilibrium as the end game approaches since his ability to sway the vote through generous dividends decreases.

⁸ 7 sessions $\times$ 4 markets = 28 observations

⁹ In this case, the manager attempts to signal with the higher dividend payment the prospect of higher future dividends. In the finance literature signaling via dividend payments is often discussed in another context. Managers as insiders may choose dividend payment levels to signal private information (see Bhattacharya 1979, John and Williams 1985, Miller and Rock 1985)

¹⁰ Although participants may not see the backward induction argument at the beginning of the experiment it may become clearer at least in period 8.

Figure 1. Dividend payment over time.

(a) Average dividends per share (all markets)

(b) Average dividends per share (all markets)

(c) Average dividends per share in periods 1, 2 and 3

(d) Signaling: Dividend per share difference period 3 minus period 2

(c) Signaling: Dividend per share difference period 3 minus period 2

a) Dividends per share averaged over periods. b) Dividends per share averaged over blocks. We divide the periods into three blocks: block 1 = periods 1-3, block 2 = periods 4-5, and block 3 = periods 6-7. c) Dividends per share separated by markets and averaged over periods. d) Average differences between dividends per share in period 3 and period 2 across markets.

We divide the periods into three blocks, corresponding to a vote at the end of each block (periods 1-3, 4-5, and 6-7) to look at the dividend pattern previous to tender offers over time. We look at the differences in average dividend per share across voting blocks, and find it significantly

declining using a Jonckheere-Terpstra-Test (two sided, $p=0.057$) and a Cuzick Test (one sided, $p=0.039$).¹¹ Thus, we state Result 2.

Result 2. Dividend payments decrease over time.

Combined, Result 1 and Result 2 suggest that dividend payments decrease over time with peaks in periods 3 and 5 indicating some pre-voting strategic increases. The random effects regression in

Error! Reference source not found. combines these two findings.

Table 1. Random Effects Regression: Performance of Dividends.

This is a random effects regression using the Session ID as the group ID (1-7) and Period as the time ID (1-32). The dependent variable in (1) is the average dividend per share (DpS) in each market and in (2) is the difference between consecutive dividend payments ($\Delta_t = DpS_{t-1} - DpS_t$). Thus, a higher Δ_t indicates a faster decrease of dividends. *Market* and *Market Period* provide information in the time trend while the *Pre-Vote-Dummy 3 (5, 7)* equals 1 if the period is a pre-vote-period to the first takeover vote (second, third).

	(1) Dividend per Share	(2) Δ Dividend per Share
<i>Market</i>	0.223 (0.989)	0.565 (1.263)
<i>Market Period</i>	-0.637 (0.583)	-1.048 (0.847)
<i>Pre-Vote-Dummy Period 3</i>	5.882** (2.776)	4.956 (3.421)
<i>Pre-Vote-Dummy Period 5</i>	2.775 (3.400)	4.287 (3.881)
<i>Pre-Vote-Dummy Period 7</i>	-1.090 (4.285)	2.963 (4.937)
<i>Constant</i>	11.50*** (4.285)	-1.136 (4.937)
<i>Observations</i>	159	131
<i>Number of Sessions</i>	7	7
<i>r square overall</i>	0.0499	0.0463

Standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

¹¹ We had 15 markets with 3 blocks to consider in these tests.

From (1), having the dividend per share as independent variable, the *Market* coefficient indicates a weak increase in dividends across markets while dividends within a market seem to decrease over time which supports Result 2. From (2), having the difference between consecutive dividends per share payments as independent variable, the *Market* coefficient indicates the decline of dividends to be increasing within markets but decreasing across markets. However, none of these coefficients is significantly different from zero. The positive Pre-Vote-Dummy coefficients for the takeover in period 4 and 6 support Result 1. Dividend payments in period 3, i.e. before the first takeover period, are significantly higher in (1), although not in (2). Note that only for the first takeover we can use all sessions since for later takeover periods the number of observations sharply declines.

The takeover threat supposed to be an indirect but effective mechanism for shareholders to renegotiate their contract with management (see also Grossman and Hart 1980, Jensen 1986, Scharfstein 1988). If so, managers should increase their dividends over time to avoid the takeover. However, Figure 1c and regression results in **Error! Reference source not found.** suggest that dividends basically do not increase over time. Since managers do not learn to increase dividends over time, it seem to call into question the disciplinary role of takeover threats.

4.2. Investor Behavior

Before we look at the results, it is important to characterize what investors *should* do in regards to voting, taking manager average actions as expectations. Recall that the takeover offer entitles each share to 150 francs in period 4, 90 in period 6, and 30 in period 8. These takeover offers mean that an investor should be indifferent between any of these three takeover offers and an expected dividend per share of at least 30 per period. In period 8, there is one dividend payment left, and the takeover offer is 30. In period 6, the takeover offer is 90 and there are two dividend payments left before the next takeover offer of 30. So the difference is 60 over two periods, or 30

per period. The same computation applies for period 4's takeover offer. Hence, as long as the expected dividends per share payments exceed 30 investors should reject the takeover offer.

In looking at manager's actions, the average dividend in any period never exceeds 15, half the amount required for indifference, although there is some variance. Offers of 30 or higher are nearly never observed. Thus, theoretically, it should never be optimal for investors, from a selfish profit maximizing perspective, to reject any takeover offer. It is possible that investors have naïve or unrealistic expectations that cause them to reject takeover offers. However, since dividends sharply decline over time, investors should be more likely to reject takeover offers in earlier periods than those in later periods. Thus, we make two predictions.

1. Earlier period takeover offers are more likely to be rejected than later ones.
2. Early takeover offers are less likely to be rejected as investors gain experience.

Figure 2. Number of rejected takeovers.

(a) Frequency of rejected takeover offers by takeover period

(b) Average number of rejected takeover offers by market

a) shows the average frequency of rejected offers in each takeover period. b) shows the average number of rejected takeover offers by market, i.e. investors can reject three times (period 4, 6, 8), 2 times (period 6, 8), one time (period 8) or never.

As Figure 1 shows, we find relatively little evidence for the first conjecture. This is because of investor inertia. Thus, conditional on having rejected a takeover offer, investors are more likely to

reject again. So if we look at acceptance conditional on having reached a node, simple inertia generates the opposite trend to what we conjectured. Unconditional on reaching the node, however, the trend is reversed because the majority of investors never reach period 6 and even fewer investors reach period 8.

However, the second claim is strongly supported as can be seen in Figure 2. The number of rejected takeover offers significantly declines over markets using a Jonckheere-Terpstra-Test (two sided, $p=0.018$) and a Cuzick Test (one sided, $p=0.015$). We state this as Result 3.¹² Note that results 3 calls into question the disciplinary role of takeover threats. If managers respond to takeover threats with increasing dividends, the rejection rate of takeovers should be expected to increase with experience.

Result 3. Early takeover offers are less likely to be rejected as investors gain experience.

As Figure 3 suggests, investors respond to dividends. It suggests that higher dividend payments increase the probability of a rejection. The spearman rank correlation between the average block 1 dividend and the vote to accept the first takeover offer equals -0.25 and shows a significant correlation between the propensity to reject the first offer and the dividend payment.¹³ We can reject the hypothesis that the average block 1 dividend is independent of the probability to reject ($p = 0.063$). Thus, we state Result 4.

Result 4. Investor's propensity to accept takeover offers is responsive to dividends.

¹² 7 sessions $\times$ 4 markets = 28 observations

¹³ The data consists of 56 takeover situations (4 markets $\times$ 7 sessions $\times$ 2 groups). We correlate dividend payments in period 1-3 vs. the vote to accept that is either 1 or 0.

Figure 3. Relationship between dividends per share and the takeover decisions.

The figure shows the average block dividends separated by the post-block voting results.

4.3. Market Behavior

Figure 4 depicts the average number of executed transactions before the first takeover vote. The figure shows that trades decrease within and across markets. When the average number of executed trades per session and markets is the dependent variable (87 observations), the coefficients for market ID (coefficient = -0.450, p-value = 0.0003) and period ID (coefficient = -0.527, p-value 0.012) are significant. We state this as Result 5.

Result 5. Trade volume declines within and across markets.

The large number of trades early on could be an indicator of heterogeneous trader beliefs (theoretically, two shareholders need to have opposing beliefs in order to trade with each other) in the early part of a market. The declining trade volume over time in a market could thus be viewed as converging trader beliefs over time.

Figure 4. Trade Volume

The figure shows the average number of executed trades in periods 1 to 3.

To gauge whether the market reflects reasonable valuations, we need to determine a benchmark market value for an asset that reflects some reasonable expectations for dividends. We call this assessed market value the ‘fair market value’. The fair market value equals the ‘fair dividend per share’ times the number of remaining dividend payments. We begin with the assumption that the fair dividend per share is the divided amount that would equally divide all firm profits among the four participants (the three traders and the manager). The expected earnings in a period equals 1000 dividing it four ways means that traders would get three-fourth of that amount. Since there are 20 shares, the fair dividend per share would be $d^f = 1000 \times 3/4 \times 1/20 = 37.50$. Hence, the fair market value in period t equals $v_t^f = (9 - t) \times 37.5$.

Overall, we find that the market initially overprices the assets relative to the fair market value. The bubbly markets do not appear to correct themselves but this is expected given the short horizons and the small number of players. However, after about two repetitions, the market closely tracks the fair market value in the first four periods (after that, the data is very thin and

reflects a selection bias¹⁴ as well). Thus, it appears that markets exhibit a reasonable degree of confidence in future dividend payments.

When price is the dependent variable, neither the lag dividend (p-value=0.431) nor a dummy for a positive lag dividend (p-value=0.932) are significant as explanatory variables using a random effects model regression. We obtain similar results if we replace price with investor willingness to pay, i.e. bids (p-values 0.766 and 0.917 for lag dividends and lag dummy, respectively). Thus, we can state Result 6.

Result 6. Prices are not responsive to manager's recent dividend payment

Figure 5. Median prices and fair value (averaged over markets and sessions)

However, we find that price is a good predictor of the investors' intention to accept the takeover target. Figure 6Figure 5 shows the average prices before takeover decisions. It seems that the market can anticipate the result of the voting before the voting takes place. At least in period 3, prices should be at about 150 (plus expected dividend in period 3) if the takeover is predicted to

¹⁴ Selection bias implies that since most groups would accept the takeover offer in period 4, the remaining groups represent the most optimistic of investors.

be successful. Otherwise, if traders predict the dividend stream to be sufficiently high, prices should exceed the tender offer price assuming the takeover not to be successful.¹⁵ Simply, the hypothesis is that higher prices reflect the traders' willingness to reject the takeover. Indeed, prices are higher if the voting is about to end in a rejected takeover offer. The t-test comparing average period 1 to 3 prices when accepted (35 observations) to average period 1 to 3 prices when rejected (21 observations) suggests significantly higher prices when an offer is about to be rejected (one sided, $p=0.010$). The same test for period 6 with the average price of all first 5 periods (in total 21 observations) leads to no significant differences. However, testing the same for the takeover in period 8 using average price from period 1 to 7 (in total 15 observations) again yields a significant difference (one sided, $p = 0.072$). The results are in line with evidence shown in the Figure 6. Thus, we can state the last result.

Result 7. Prices predict investors' voting outcomes

Figure 6. Relationship between prices and the takeover decisions

The figure shows the average prices before takeover offers separated by voting results.

¹⁵ Samuelson and Rosenthal (1982) consider price movements before tender offers. Tender offers are conditional on current market prices. Since they are usually above current market prices, prices tend to increase to the tender offer if a successful takeover is predicted. In our case it is the other way around since takeover offers are even below the fair market valuation.

5. Conclusions

The present study is an attempt to incorporate a hostile takeover into an asset market experiment with potential trust between investors and a manager. The takeover feature, along with the open market for shares, gives us the possibility of quantifying trust with market prices as a proxy. We found that despite the unique subgame perfect equilibrium outcome in which the first takeover offer is accepted and no dividends are ever paid out the market often survives takeover offers 37.5% of the sessions survived the first takeover offer and 27% survived the second. These do not appear to be due to investor mistakes in that they were shown to be sensitive to dividend payments by managers.

Managers in turn seem to be very aware of the relationship between dividends and investor acceptance of takeover offers. First, managers pay positive dividends, which in itself go against equilibrium predictions. Second, managers appear to pay positive dividends due to strategic reasons rather than social preferences alone. This is manifested in a dramatic rise in dividend amount immediately before voting periods. That is, managers appear to do so strategically taking into account periods in which takeover offers will be made. Lastly, we see that market prices are both remarkably confident and informative. Prices appear to track fair market value and appear to indicate investors' intentions. While prices are not directly responsive to dividends (although takeover offer acceptances are), we find that market prices are a good indication of when investors intend to accept the takeover offer. Thus, the effect of dividends in prices is not direct but is rather mediated by the effect of dividends on voter intentions, which are translated to market prices.

Combined, these results suggest that, as conjectured in the literature but not previously shown, the takeover threat seems to translate into potential investor power over management. Specifically, managers anticipate investors' responsiveness to dividends, as evidenced by their strategic pre-voting peaks in dividend payments and investors seem to be responding to such

actions. Thus, investors could potentially exercise some disciplinary power over management. However, we could find no empirical indication that investors actually use this potential disciplinary power over management to their advantage in a manner that results in management taking actions more favorable to investors over time. That is, managers do not learn to increase dividends across markets (result 2) and early takeover offers are less likely to be rejected with experience (result 3). The implication is that even in the presence of the takeover's disciplinary power, it does not seem to be the case that investors use this threat effectively to their advantage.

A related experimental study of a different takeover setting was conducted by Oprea (2008) with a two person takeover game that has more of a dictator game flavor. In that game, the investor's only possible action is to accept or reject a takeover offer. No trading is possible. The manager's choice is more complicated than in our setting in that the manager decides both on the withdrawal amount from the firm's reserves and the divided distribution to the investor. Similar to our findings, Oprea (2008) showed that a takeover threat decreased the manager's self-dealing in high cash flow situations. However, in low-cash flow situations, he found that managers withdrew too much from the firm's reserves in order to award dividends and signal generosity. What Oprea's setting was unable to explore is that relationship between the managers' decisions and price, and the possibility of using price as a predictor for investors' intentions.

The present study was largely an investigation of a particular setting—the takeover game—rather than a comparison of institutions, but clearly the goal of the present research agenda is to identify institutions which would best alleviate the agency problem. The takeover threat is not the most attractive mechanism for shareholder control because takeovers can be inefficient. In theory, dividends are the primary mechanism by which investors can reduce the agency problem (as discussed in the introduction), but to generate positive dividend payments one would require a mechanism through which investors can pressure management to award dividends. In the present, the pressure mechanism was the threat of accepting a takeover offer. Investor revolts

that result in a management shake-up are another potential mechanism, and this is a mechanism that received a lot of attention following the recent financial meltdown. There was also a lot of attention paid to regulatory curbs on management compensation following the financial meltdown, but there is no evidence that we know of that this has been effective in reducing agency issues (although it appears to be politically appealing in a number of countries).

However, before these various institutions could be compared in the laboratory, one would need to understand the basics in conducting such research and the present study is intended to establish some of these benchmarks. While we are encouraged at the degree of strategic behavior on the part of managers, responsiveness to managerial actions on the part of investors, and the ability of prices to serve as leading indicators for takeover outcomes, we are somewhat discouraged by the relatively weak relationship between prices and dividend payments. We know from a large asset market experimental literature as well as from a large empirical literature on stock market prices that the correlation between dividend payments and stock prices is weak if there is one at all, but this is an aspect of this research that we find puzzling and would like to address with future designs.

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Appendix

INSTRUCTIONS

1. General Instructions.

This is an experiment in the economics of market decision making. If you follow the instructions and make good decisions, you might earn a considerable amount of money, which will be paid to you in cash at the end of the experiment. The experiment will consist of a sequence of trading periods in which you will have the opportunity to buy and sell shares. Money in this experiment is expressed in francs (100 franc = 75 cent).

2. How To Use The Computerized Market.

The goods that can be bought and sold in the market are called Shares. On the top panel of your computer screen you can see the Money you have available to buy shares and the number of shares you currently have.

Selling a share. You may sell shares that you own. When you sell a share, your Shares decrease by 1 share and your Money increases by the sale price. You may sell a share by pressing the "SELL" button or by making an offer to sell and having someone select your offer. You may sell shares as long as you have more than 0 shares.

To make an offer to sell a share, use the text area entitled "Enter Ask Price". In that text area you can enter the price at which you are offering to sell a share, and then select "Submit Ask Price". Please submit an Ask Price now. Note the Ask Prices you submit have to be lower than the current lowest Ask Price. You will notice that a number of ask prices appear in a table called "Ask Price". The lowest ask price will always be on the top and highlighted.

Buying a share. When you buy a share, your Shares increase by 1 share and your Money decreases by the purchase price. You may buy a share by pressing the "BUY" button or by making an offer to buy and having someone select your offer. You may buy shares as long as your Money is greater than the price and you have fewer than 4 shares.

To offer to buy a share, use the text area entitled "Enter Bid Price". In that text area you can enter the price at which you are offering to buy a share, and then select "Submit Bid Price". Please submit a Bid Price now. Note the Bid Prices you submit have to be higher than the current highest Bid Price. You will notice that a number of bid prices now appear in a table called "Bid Price". The highest bid price will always be on the top and highlighted.

By now, there are both Bid Prices and Ask Prices listed in their respective tables. You may press the BUY or SELL buttons to accept the best offer from the corresponding table. Please do so now.

Notice that all recent prices are provided in the table "Purchase Price".

You will now have a practice period. Your actions in the practice period do not count toward your earnings and do not influence your position later in the experiment. The goal of the practice period is only to master the use of the interface. Please be sure that you have successfully submitted bid prices and ask prices. Also be sure that you have accepted both bid and ask prices. You are free to ask questions, by raising your hand, during the practice period.

3. Trader and Manager.

Participant Roles. Participants in this room will be organized into trading groups of 4 participants. Three participants in a group are in the role of *Trader*. The fourth is in the role of *Manager*. Your role will be indicated shortly on your screen. The experiment consists of four markets, with each market lasting 8 trading periods. The groups and the roles change each market. You will be in the role of a Manager in 1 of the 4 Markets and in the role of a Trader in the other 3 Markets. Each market, the groups are reshuffled and you will meet another participant only in one market.

Traders. In each period, there will be 90 seconds for trading, in which Traders may buy and sell Shares, using the mechanics we just practices. There are 10 Shares in the Market. Shares are assets with a life of 8 periods. Shares in your inventory carry over from one period to the next. Traders may receive Dividends for each Share in their inventory at the end of each Period.

Manager. The Manager decides on Dividend Payments but cannot trade. At the beginning of each Period, the Manager receives *Earnings* that are randomly determined by the computer. *Earnings* are 200, 100, or 0, with equal likelihood for each. Thus, the average *Earnings* in each period is 100. The Manager decides on how much of the *Earnings* in a period to pay as Dividends. The remaining *Earnings* are the Manager's *Salary* and are added to the Manager's Balance. The manager may choose to pay Dividends that are higher than the Earnings. If he chooses to do so, he will not get a Salary for the current period in which dividends exceed earnings. The outstanding balance will be paid from next period's earnings as long as next period's earnings are positive and thereafter managerial salary can be paid. Total dividend payments cannot exceed 200 and can be no more than 100 francs above earnings.

At the end of the Period, each Share pays a *Dividend per Share*. The *Dividend per Share* equals the amount the Manager has decided to pay as Dividends divided by the number of Shares in the Market. The *Dividend per Share* is announced by the manager after trading is finished for the period and is between 0 and 20 per share. Thus, the expected value of one Share is the sum of expected *Dividends per Share* if no Takeover is expected. If a Takeover is expected, the expected value of one Share is the sum of expected *Dividends per Share* until the Takeover plus the Takeover Price.

4. Vote To END MARKET

At the beginning of Period 4, the Traders can vote to END MARKET. Each Share entitles its owner to one vote. Only if the Majority of shares (more than 5 shares) votes to END MARKET the Market ends after the Dividend payment in Period 4. Each Share then pays a *Takeover Price* of 20 francs to its owner at the end of Period 4. After Period 4, no further Dividends are paid. A similar voting also takes place in Period 6 and Period 8. The Takeover Price is 15 francs in period 6 and 10 francs in period 8.

5. Endowment And Market Payoffs

Summing up, a period consists of (1) the trader's voting to END MARKET or CONTINUE (only in Period 4, 6 and 8). If the market does not end, then (2) trading follows and (3) the Manager decides on Dividends.

At the beginning of each Market, Money and Shares are provided to the Traders such that one Trader has 2 Shares and 480 francs and two traders have 4 Shares and 360 francs.

At the beginning of each Market, the Manager's Balance equals 400 francs.

The Trader's payoff in one market will be the Money at the end of the market, i.e. Money at the beginning, plus Dividends per Share received in each period, plus Money received from sales of Shares, minus Money spent on purchases of Shares, plus the Takeover Price if the majority votes to END MARKET.

The Manager's payoff in one market will be the Balance at the beginning (400 francs) plus the sum of all Manager's salaries in each period in the market. The manager's per period salary is:

(If there is no outstanding balance and the no vote to END MARKET)

Manager Salary in this period = Earnings in this period – Dividends in this period.

Otherwise, **Manager Salary in this period = 0.**

Your final earnings of the experiment will be the sum of your payoff from being a Trader (in 3 markets) and from being a Manager (in 1 market).

Note again, in every market the composition of traders is new and you never meet the same trader again in another market.