Takeover Threat, Managerial Incentives, and the Term Structure of Investment*

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Abstract

It has been argued that takeovers distort managerial incentives in terms of shortening the investment horizon. This paper attempts to show that a threat of takeover does not necessarily lead to managerial myopia. We assume that in a well functioning stock markets, current prices reflect the relevant information to uninformed traders about the future profitability of the firm. Hence, the probability of takeover will be a function of future earnings as well. A manager may have an incentive to shift his resources to the long term projects simply because the equilibrium price is determined by future earnings and he can affect the probability of takeover by increasing the equilibrium price through the long run investments.

1 Introduction

Increasing takeover activities in US corporations in 1980s draw the attention of researchers in corporate finance to the costs and benefits of takeovers. Those who support liberal takeover policy argued that takeovers provide a control mechanism for incumbent management of a diffusely held companies. Managers who would otherwise pursue their own interest will be disciplined

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to act in the interest of the shareholders when they face an increasing threat of takeover. Hence from a social welfare point of view takeovers are beneficial because they help to reduce the moral hazard problem between the managers and shareholders. (Manne [5], Grossman and Hart [1], Grossman and Hart [2], and Scharfstein [6]).

On the other hand the opponents claimed that there is a large distributional effects of takeovers. In most cases, the appropriate rents enjoyed by stakeholders of the company, such as managers, workers, suppliers or local communities, are shifted to the raider and shareholders in the event of a takeover (Shilefer and Summers [8]).

Another frequent critique to takeovers is that they cause a distortion on managerial incentives in terms of shortening the investment horizon. This is because the long term projects are undervalued by stock market, hence firms which are undertaking such projects suffers low stock prices and be attacked by a raider. In order to prevent takeover attempts, managers will invest in short term projects in order to keep the stock prices in the market sufficiently high (Stein [10], and Schnitzer [7]).

This paper focuses on the last critique to takeovers and attempts to show that it is not always obvious that the manager gives up long term projects in anticipation of a takeover. In contrast, he might even invest more on the long term project in order to decrease the probability of takeover.

2 The Model

Consider a firm owned by a large number of shareholders. The model has three periods, $t = 0, 1, 2$. In period 0 the firm is established and shareholders hire a manager. The manager is hired from a competitive labor market and accepts any contract which provides him at least his outside utility, which can be normalized to zero. After the firm is established, th firm operates for two periods (period 1 and period 2) at the end of which, the firm is liquidated and all earnings net of the salary of the manager is distributed to the shareholders. Immediately after the manager is hired, he decides on the allocation of his constant amount of time, K, on two types of actions, e_1 and e_2. e_1 stands for effort/time allocated for short term projects/investment and e_2.denotes the effort/time allocated to long term projects.[1] The manager

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[1]K could also be interpreted as total cash available for invetment purposes assuming that there is no borrowing from outside.

allocates his fixed amount of time into either enhancing short-term earnings or improving the long term value of the firm.

The net returns from actions (gross of payments to the manage) e_1 and e_2 are denoted by $q_1(e_1)$ and $q_2(e_2)$,respectively. The returns from short term investment, $q_1(e_1)$, accrues at the end of period 1 and the returns from long term investment, $q_2(e_2)$, accrues at the end of period 2. It is assumed that $q_i(0) = 0, q_i'(e_i) > 0, q_i''(e_i) < 0$ $q_i(e_i) > 0$ for all $e_i > 0$ and $i = 1, 2$. It is also assumed that marginal return to long term investments are greater than marginal returns from short term investments, $q_2'(e) > q_1'(e)$. There is no discounting between the two periods. For simplicity we will restrict the form of available contracts to the linear compensation schemes. The manager's contract is non-negotiable and consists of a flat salary, W, and a bonus from short term (first period) and long term (second period) earnings.[2] Let a be the percentage of first period returns he receives, b be the percentage of second period returns, with $0 \leq a, b \leq 1$. It is assumed that the manager is paid $W + aq_1(e_1)$ at the end of period 1[3] and the residual $bq_2(e_2)$ of his compensation at the end of period 2. The manager is assumed to be risk neutral. He chooses e_1 and e_2 to maximize his lifetime income subject to his time constraint. The manager's problem is

$$\max_{e_1, e_2} \quad I = W + aq_1(e_1) + bq_2(e_2)$$
$$s.t. \qquad e_1 + e_2 \leq K. \tag{P1}$$

Let e_1^*, e_2^* be the solutions to problem P1. The first-order condition to poblem P1 is

$$-aq_1'(K - e_2^*) + bq_2'(e_2^*) = 0.$$

The second-order condition is satisfied by the concavity assumption on the return functions.

Proposition 1: If $a = b$ then $e_2^* > e_1^*$.

If $a = b$ then $q_2'(e_2^*) = q_1'(e_1^*)$ which in turn implies $e_2^* > e_1^*$ by the assumption that long term projects bring higher returns on the margin $(q_2'(e) > q_1'(e)$ for all $e > 0)$. Therefore if long run projects are more profitable than short run projects on the margin and manager's shares from

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[2]A linear compensation contract can be justified on the grounds that the agent is risk neutral and is exposed to limited liability constraint, hence making him residual claimant is not possible.

[3]After the manager is paid in the first period, the firm distributes the residual as a dividend.

earnings are the same in each period he would choose to invest more on the long term projects than short term projects.

2.1   Threat of Takeover with Exogenous Probability

In the base model there is complete certainty about future. Now we introduce a threat of a takeover of the firm by a raider. Suppose that the manager anticipates a takeover with probability $\pi > 0$, which could take place right after the returns to short term investment, $q_1(e_1)$, is collected. and he is paid $W + aq_1(e_1)$. The probability of takeover is given exogenously. At the beginning of period 2 a raider arrives and decides to takeover the firm or not. If the takeover succeeds the incumbent manager is fired, if not he continues to work under the conditions of the initial contract. The manager's lifetime income is

$$E(I) = W + aq_1(e_1) + (1 - \pi) bq_2(e_2).$$

The manager solves the following problem

$$
\begin{array}{cc}
\max_{e_1,e_2} & W + aq_1(e_1) + (1 - \pi) bq_2(e_2) \\
s.t. & e_1 + e_2 \le K.
\end{array}
\tag{P2}
$$

Let $\widehat{e}_1, \widehat{e}_2$ be the solutions to problem P2. The first-order condition to the problem P1 is

$$-aq_1'(K - \widehat{e}_2) + (1 - \pi) bq_2'(\widehat{e}_2) = 0.$$

Proposition 2: If $a = b$ the $\widehat{e}_1 > e_1^*$.and $\widehat{e}_2 < e_2^*$.

Note that if $\pi = 0, \widehat{e}_i = e_i^*$ for $i = 1, 2$. Using Implicit Function Theorem

$$\frac{\partial e_2}{\partial \pi} = -\frac{-bq_2'(e_2)}{aq_1''(K - e_2) + (1 - \pi) bq_2''(e_2)} < 0$$

(by the concavity of the return functions the denominator is nonzero at the equilibrium.)   Therefore if $a = b$ the $\widehat{e}_1 > e_1^*$.and $\widehat{e}_2 < e_2^*$. If there is a possibility of a takeover in the beginning of period 2, the manager's decision on how to allocate his fixed amount of time/effort/cash into projects with different horizon is biased towards short term projects whenever $a = b$. In other words, the manager can give up some part of relatively profitable investment opportunities in the presence of a threat of a takeover.

2.2 Threat of Takeover with Endogenous Probability

The possible takeover will depend on how the firm is managed. In this respect the assumption of exogenous probability of takeover is not realistic. Similar to Grossman and Hart [1] we assume that the probability of takeover is endogenous. After the first period returns are realized, a raider comes and observes $q_1(e_1)$ and he figures out $q_2(e_2)$. The best the raider can do if he takes over the firm is $v = q_2(e_2^*) + \theta$ where θ is the raider's improvement value. Let $\theta > 0$ and be deterministic. The shareholders will sell their shares if the raider offers a tender price p such that $p \geq v - \rho$, where ρ is the dilution factor which is determined in corporate charter by initial shareholders. Any tender price p such that $p < q_2(e_2)$ is eliminated because such a price will not be accepted by any shareholder. Hence the tender price is $p = \max\{v - \rho, q_2(e_2)\}$.

Takeover has a random cost $\widetilde{c}$. with a probability density function $f(c)$ and c is always nonnegative. The raiders's profit is

$$v - p - \widetilde{c} = v - \max\{v - \rho, q_2(e_2)\} - \widetilde{c} = \min\{\rho, v - q_2(e_2)\} - \widetilde{c}.$$

The raider will takeover the firm as long as his expected profits are positive. Therefore the probability of takeover is

$$\Pi(\rho, q_2(e_2)) = prob(\min\{\rho, v - q_2(e_2)\} - \widetilde{c} > 0).$$

Given the possibility of takeover, the manager solves the following problem

$$\begin{aligned} \max_{e_1, e_2} \quad & W + aq_1(e_1) + [1 - \Pi(\rho, q_2(e_2))]\, bq_2(e_2) \\ s.t. \quad & e_1 + e_2 \leq K. \end{aligned} \tag{P3}$$

Let $\bar{e}_1, \bar{e}_2$ be the solutions to problem P3. We will solve the problem in two cases.

2.2.1 Case 1 $\min\{\rho, v - q_2(e_2)\} = \rho$

In this case the probability of takeover is

$$\Pi(\rho, q_2(e_2)) = prob(c < \rho)$$

which is independent of the manager's actions. Therefore we have the following result. When $\min\{\rho, v - q_2(e_2)\} = \rho$, $\bar{e}_1 = \widehat{e}_1 > e_1^*$ and $\bar{e}_2 = \widehat{e}_2 < e_2^*$. If the dilution factor is set very high, then the manager cannot affect the probability of takeover through his actions. So the manager invests more on the short term projects and less on the long term projects.

2.2.2 Case 2 $\min\{\rho, v - q_2(e_2)\} = v - q_2(e_2)$

In this case the probability of takeover is

$$\Pi(e_2; \rho, v) = prob(v - q_2(e_2) - c > 0) = prob(c < v - q_2(e_2))$$

Notice that $\Pi_v > 0, \Pi_{e_2} < 0, \Pi_{e_1} > 0$.

The manager's problem is

$$\begin{aligned} \max_{e_1, e_2} \quad & W + aq_1(e_1) + [1 - \Pi(e_2; \rho, v)] bq_2(e_2) \\ s.t. \quad & e_1 + e_2 \le K \end{aligned} \tag{P4}$$

The first-order condition of the problem P4 is

$$-aq_1'(K - \bar{e}_2) + bq_2'(\bar{e}_2)[1 - \Pi(\bar{e}_2; \rho, v)] - bq_2(\bar{e}_2)\Pi'(\bar{e}_2; \rho, v) = 0.$$

We want to compare $\bar{e}_2$ to e_2^*. We know from problem P1 that

$$-aq_1'(K - e_2^*) + bq_2'(e_2^*) = 0.$$

Then

$$bq_2'(e_2^*)[1 - \Pi(e_2^*; \rho, v)] - bq_2(e_2^*)\Pi'(e_2^*; \rho, v) \lessgtr bq_2'(e_2^*)$$

if

$$-\frac{\Pi'(e_2^*; \rho, v)}{\Pi(e_2^*; \rho, v)} \lessgtr \frac{q_2'(e_2^*)}{q_2(e_2^*)}.$$

Let $\varepsilon_\pi = \left[\Pi'(e_2; \rho, v)/\Pi(e_2; \rho, v)\right] e_2$ denote the effort elasticity of the probability of takeover. Note that $-\infty < \varepsilon_\pi < 0$ since $\Pi'(e_2; \rho, v) < 0$. Let $\varepsilon_q = [q_2'(e_2)/q_2(e_2)] e_2$ denote the effort elasticity of long term returns with $0 < \varepsilon_q < \infty$. Then

$$bq_2'(e_2^*)[1 - \Pi(e_2^*; \rho, v)] - bq_2(e_2^*)\Pi'(e_2^*; \rho, v) \lessgtr bq_2'(e_2^*)$$

if

$$-\varepsilon_\pi \lessgtr \varepsilon_q.$$

Therefore whether $\bar{e}_2$ is greater or smaller that e_2^* depends on the relative effort elasticities of probability of takeover and return from long term investment. If the probability of effort is relatively more elastic than the long term returns, i.e.:$-\varepsilon_\pi > \varepsilon_q$ then $\bar{e}_2 > e_2^*$. If, on the other hand, the he long term returns are relatively more elastic with respect to effort than the probability of effort i.e.$-\varepsilon_\pi < \varepsilon_q$ then $\bar{e}_2 < e_2^*$.

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Intuitively, if $\Pi(\cdot)$, the probability of takeover is very sensitive to changes in e_2, this could be the case because of a low improvement value, or alternatively if the return function is relatively less sensitive to changes in e_2 then $\bar{e}_2 > e_2^*$. In this case the manager's investment decision will be biased towards long term projects. Because the benefit he gets by reducing the probability of takeover outweighs the forgone earnings from short term investments hence he overinvests in long term projects. On the other hand, if $\Pi(\cdot)$, the probability of takeover is not very sensitive to changes in e_2, this could be the case because of a high improvement value, or alternatively if the return function is relatively more sensitive to e_2 then $\bar{e}_2 < e_2^*$, that is the manager's decision will be biased towards short term projects. This is because the probability of takeover declines but not very much as a response to increase in long term investment while the foregone earnings from short term investments will be much higher, hence the manager prefers to invest more on short term investments which generates sure income.

Proposition below summarizes the results when the probability of takeover is endogenous.

Proposition 3: If $\min\{\rho, v - q_2(e_2)\} = \rho$ then $\bar{e}_1 = \widehat{e}_1 > e_1^*$ and $\bar{e}_2 = \widehat{e}_2 < e_2^*$. If $\min\{\rho, v - q_2(e_2)\} = v - q_2(e_2)$ then

1. if $-\varepsilon_\pi > \varepsilon_q$ then $\bar{e}_2 > e_2^*$, and

2. if $-\varepsilon_\pi < \varepsilon_q$ then $\bar{e}_2 < e_2^*$.

In general, it is ambiguous how the long term investment will change when the probability of takeover can be affected by the manager's initial allocation of his constant time between short and long term projects. There is a room for overinvestment in long term projects even when there is a threat of takeover.

In analysis above we have assumed that $a = b$, that is the share of manager from short and long term earnings are equal. So in terms of their contribution to his income he does not differentiate between them. The result will continue to be the same in terms of direction but will be stronger if $a < b$. What if $a > b$? By setting $a > b$ in the initial contract we are giving an additional incentive to the manager to choose higher levels of e_1. One could argue that if initial shareholders want to encourage the possible takeovers in future, they might prefer $a > b$ in the initial compensation contract to prevent the distortion in the manager's incentive to invest to reduce a possibility of a takeover in the future.

3 Conclusion

This paper attempts to show that a threat of takeover does not necessarily lead to managerial myopia. The result heavily depend on the way the probability of takeover is modelled. We have assumed that the probability of takeover depends on investment in long term projects negatively. This contrasts with models that stress managerial myopia as Stein [10] which relies on the assumption that the stock market undervalues the long term projects hence reduces the current price of the firm making them more vulnerable to possible takeovers. However, in a well functioning stock markets current prices reflect the relevant information to uninformed traders about the future profitability of the firm.(see Holmstrom and Tirole [3] and Kyle [4]).[4] Hence in a such a world, the probability of takeover will be a function of future earnings as long as current prices do reflect them. A manager will have an incentive to shift his resources to the long term projects simply because the equilibrium price is determined by future earnings and he can affect the probability of takeover by increasing the equilibrium price through the long run investments.

An extension of the model is to introduce a rather general framework (a la Holmstrom and Tirole [3]) with different type of investors (owners, liquidity traders, speculative traders) and endogenize the current stock price as a function of future earnings, hence, the manager's investment decision.

References

[1] Grossman, S. and O. Hart, (1980) "Takeover Bids, the Free Rider Problem, and the Theory of Corporation," *The Bell Journal of Economics*, Vol. 11, No. 1, 42-64.

[2] Grossman, S. and O. Hart, (1981) "The Allocational Role of Takeover Bids in Situations of Asymmetric Information," *The Journal of Finance*, Vol. 36. No. 2, 253-270.

[3] Holmstrom, B. and J. Tirole, (1993) "Market Liquidity and Performance Monitoring," *The Journal of Political Economy*, Vol.101, No.4, 678-709

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[4]This is the extention we are currently working on.

[4] Kyle, A. (1985) "Continuos Auctions and Insider Trading," Econometrica, Vol. 53, No. 6, 1315-1335.

[5] Manne, H. G. (1965) "Mergers and Market for Corporate Control," *The Journal of Political Economy*, Vol. 73, 110-120.

[6] Scharfstein, D. (1988) "The Disciplinary Role of Takeovers," *The Review of Economic Studies*, Vol. 55, 185-199.

[7] Schnitzer, M. (1995) "The "Breach of Trust" in Takeovers and the Optimal Corporate Charter," *The Journal of Industrial Economics*, Vol. 43, No. 3, 229-259.

[8] Shleifer, A. and L. H. Summers, (1988) "The Breach of Trust in Hostile Takeovers," in A. Auerbach, Ed. *Corporate Takeovers, Causes and Consequences*, University of Chicago Press, Chicago, IL.

[9] Shleifer A. and R. Vishny, (1986) "Large Shareholder and Corporate Control," *Journal of Political Economy*, Vol.94, No.3, 461-488.

[10] Stein, J.C., (1988) "Takeover Threats and Managerial Myopia," *The Journal of Political Economy*, Vol. 96. No.1, 61-80.