Takeover Defenses, Firm-Specific Skills and Managerial Entrenchment

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Abstract

We examine the shareholder wealth effects of takeover defenses by developing a model in which takeovers facilitate target-firm restructuring and generate synergy gains. In an explicit contracting framework, we show that takeover defenses are deployed to insure employees' firm-specific skills and that defenses dominate severance payments as an insurance mechanism because the latter distort the incentives of employees to exert effort. However, takeover defenses also result in managerial entrenchment. Managers choose takeover defenses which maximize their benefits of control, rather than shareholder wealth. Golden parachutes and managerial share ownership serve to align managerial and shareholder preferences.

JEL Classification: G30, G34, J24

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1 Introduction

The literature on the market for corporate control has provided a number of arguments against the use of takeover defenses, showing that takeover defenses reduce firm value because they deter profitable takeovers and favour managerial entrenchment. However, it is puzzling to observe how widespread the adoption of takeover defenses is among US firms. In the last two decades, a large percentage of firms has introduced poison pills, staggered boards, anti-greenmail and fair price provisions in their corporate charter.

In this paper we develop a theoretical model to analyze takeovers which aim at generating synergy gains and imply target-firm restructuring and layoffs of personnel. An example of such acquisition has been recently offered by the takeover of Peoplesoft by Oracle.[1] Our results show that when takeovers lead to restructuring and layoffs, it is optimal for target-firms to adopt some takeover defenses. In a framework of explicit contracting, the adoption of takeover defenses provides insurance to target-firm employees against the unemployment that may follow restructuring. We find that takeover defenses dominate other forms of insurance, such as giving the employees a severance payment.

The model also shows that the adoption of takeover defenses has a major drawback. When managers have free hands over the use of takeover defenses, they are able to entrench and protect their private benefits of control. In order to prevent entrenchment as a side effect of takeover defenses, we find that shareholders align incentives by giving managers shares in the firm and golden parachutes in case of replacement.

In the first part of the paper, we develop a model of entrepreneurial firms in which productivity is higher when employees possess firm-specific skills. Although productivity is observable, the skills of the employees are not. There is moral hazard on the employee side. To stimulate high productivity, shareholders pay incentive-compatible wages with state-contingent compensations that reward employees with a bonus only when a high level of productivity is observed.

[1] In the first half of 2004, Oracle won a long battle to take over Peoplesoft, finally overcoming the obstacle of a poison pill. Oracle was interested in potentially lucrative software integration with Peoplesoft. In the aftermath of the takeover, Peoplesoft experienced sizeable layoffs amounting to over 3,000 employees. See Brown and Medoff (1988), Kaplan (1989), Lichtenberg and Siegel (1989) and Rosett (1990) for empirical evidence on labour cost cuts in takeovers.

With some probability a corporate raider takes over the firm and introduces a new production technology which translates into an acquisition premium for selling shareholders.[2] Following a technological change, the skills that employees developed for the old technology are no longer needed in the production process. Consequently, the existing employees are laid off.[3] Anticipating a takeover and subsequent mass layoffs, risk-averse employees require higher incentive wages to acquire firm-specific skills. As a result, labour costs increase and productivity decreases.[4]

Shareholders want to maximize the returns of the firm which originate from two sources: current production and future acquisition premia. The returns from these two sources are negatively correlated because current productivity is lower when the probability of a takeover is high. By varying the level of takeover defenses in the charter of their firm, shareholders trade current productivity and future acquisition premia off against each other. We find that at the optimum, takeover defenses raise acquisition cost just enough to provide insurance to the employees of the firm while still allowing for profitable takeovers.

An alternative way to provide insurance to employees is to give them a severance payment when they become unemployed. However, severance payments distort the incentive of employees to be productive. On the contrary, takeover defenses have a positive effect on productivity because they favour the implementation of incentive-compatible contracts.

In the second part of the paper, we examine the case of non entrepreneurial

[2]See Ahuja and Katila (2001), Bhide (1990), Harford (2005) and Mitchell and Mulherin (1996) for the role of restructuring in takeovers and Bhagat, Dong, and Hirshleifer (2005), Bradley, Desai, and Kim (1988), Jarrell, Brickley, and Netter (1988), Jensen (1988) and Moeller, Schlingemann, and Stultz (2004) for evidence of acquisition premia in US transactions.

[3]"People who produce things will stay. We look at people who report to people who report to people. We'll often cut fat at the corporate level." (Kravis (1989)) See also Bowers and Moore (1995), Gokhale, Groshen, and Neumark (1995) and Pontiff, Shleifer, and Weisbach (1990) for empirical evidence of the termination of defined-benefit pension plans after a takeover.

[4]In August 1996, U.S. Surgical Corporation, launched a hostile takeover bid for medical device maker Circon Corporation. The board of Circon commented: "We were terrified that we would lose our employees and that would destroy our ability to operate the company. That was a major, major issue, trying to hold our team together. Despite increased expenditure on incentives, turnover in the sales force began to increase sharply, no matter how much money we threw at it [incentives to salesmen], it was not enough to keep the sales force in place." (Hall, Rose, and Subramanian (2004))

firms in which managers act as intermediaries between shareholders and employees. We show that in insider dominated firms managers use takeover defenses to protect their private benefits of control rather than to maximize shareholder wealth.[5] We find that managerial entrenchment leads to an excessive amount of defenses.[6]

Managers must be given the incentives to choose the level of takeover defenses that maximizes firm value. We find that an optimal compensation scheme provides managers with a golden parachute which makes them indifferent towards takeovers. Only if golden parachutes fully insure managers against the loss of the private benefits of control, managers deploy the optimal amount of takeover defenses.

A final result is that golden parachutes cannot be used by shareholders as substitutes for takeover defenses. While takeover defenses address a problem related to the employees' human capital, golden parachutes are meant to reduce managerial moral hazard. These findings are supported by the empirical evidence of Borokhovich, Brunarski, and Parrino (1997).

The explanation of takeover defenses suggested here is similar in spirit to that of Chemla (2005), Garvey and Gaston (1997) and Shleifer and Summers (1988) and offers an alternative to explanations based on bargaining power (Bebchuk (1987), Berkovitch and Khanna (1990), Harris (1990)), managerial entrenchment (Casares-Field and Karpoff (2002), Shleifer and Vishny (1989)), managerial myopia (Stein (1989), Stein (1988)) or lobbying power (Bebchuk (2003), Coates (2001)).

The rest of the paper is organized as follows: Section 2 introduces the basic framework of the model. Section 3 examines the effect of takeovers on target-firm productivity and cost of labour. In this setting, takeovers are exogenous and there are no takeover defenses. In Section 4, we endogenize takeovers and allow for takeover defenses. We determine an equilibrium condition in which the probability of a takeover depends on takeover defenses and the productivity of target firms. Section 5 discusses the level of takeover defenses that maximizes firm value when takeovers are endogenous. Section 6 introduces managers and discusses how managerial entrenchment affects

[5]The market for corporate takeovers acts as an external control mechanism for poorly performing managers (Brickley and James (1987), Harford (2003), Kini, Kracaw, and Mian (1995), Kini, Kracaw, and Mian (2004), Martin and McConnell (1991), Scharfstein (1988)).

[6]For specific examples of entrenchment, see Kamma, Weintrop, and Wier (1988) on Unocal Corporation v. Mesa Partners and Graff (1996) on Del Webb Corporation.

the results of the previous sections. Finally, Section 7 concludes outlining the empirical implications of the model.

2 The Basic Framework

Shareholders own a firm which generates a cash flow using labour provided by homogeneous *employees.* Employees make an unobservable effort $e \in \{0,1\}$ to acquire firm specific skills $h \in \{0,h\}$ at a cost $\psi(e) \in \{0,\psi\}$. For the sake of simplicity, a firm's returns are generated only by employees' effort. More precisely, a positive level of effort produces a stochastic cash flow equal to h with probability p and zero otherwise. We shall generally refer to these two outcomes respectively as high and low cash flow. The probability of a high cash flow when effort is zero is $p_0 = p - \Delta p \leq p$.

Suppose now that with an certain probability an individual (henceforth known as the *corporate raider*) takes over the firm. Because we wish to study the effects of acquisitions in the purest case, we shall assume that the raider is a profit maximizer.[7] For the sake of generality, however, we shall not suppose that the raider and the firm's current shareholders necessarily have the same ability in running the firm. A corporate raider is endowed with an alternative production technology which has the following effect on cash flows: with probability π cash flows are unaffected by the takeover and continue to depend stochastically on the skills that the employees have acquired before the takeover. On the contrary, with probability $1-\pi$ existing skills become irrelevant from the point of view of cash flows. The corporate raider introduces a new technology which does not require any of the existing skills and which generates cash flows equal to k irrespectively of the level of skills acquired before the takeover. Takeovers, technology and expected cash flows are illustrated in Figure (1).

Shareholders have the ability to introduce *takeover defenses,* such as poi-

[7] By acquisition of a corporation, we mean a purchase of all its shares (or equivalently, of all its assets) or at least of sufficient shares to obtain a controlling interest. It is important to emphasize that we only discuss acquisition of targets that prior to the acquisition were not controlled by a single shareholder; acquisitions of targets that were previously controlled by a single shareholder pose a special set of problems and require a separate analysis. See for example Chang (1998).

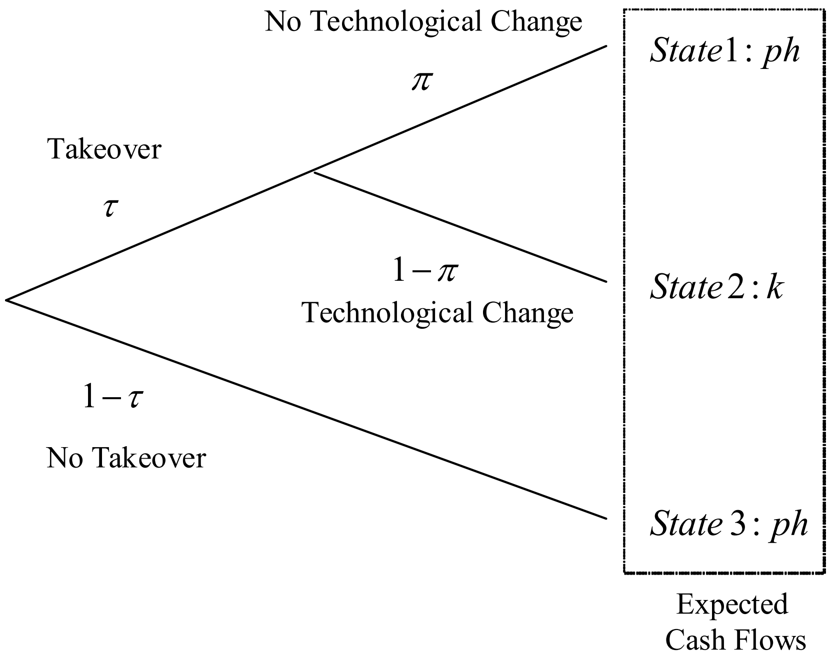

Figure 1: Takeovers and Technological Changes

son pills[8], staggered boards[9] and fair-price provisions[10], in the corporate charter of the firm that they own. The introduction of takeover defenses in the charter has the effect of increasing the costs of acquiring the firm for two main reasons: either because to exert control a raider must purchase more shares than necessary - e.g. poison pills and staggered boards - or because the average acquisition share price increases, as in the case of fair-price provisions.

We assume that higher acquisition costs represent a monetary loss which is directly born by the raider. Such loss, which we indicate with the term α, does not benefit existing shareholders in any way. We assume that there is a one to one mapping between α and the level of takeover defenses. Therefore, α can be used to indicate interchangeably the level of takeover defenses and the loss that they generate.

3 Incentive Compatible Wages

The first issue that we want to examine is whether takeovers have an effect on wages and on the incentives for employees to acquire firm-specific skills. For this purpose we momentarily leave aside both the question why firms introduce takeover defenses and what determines the probability that a firm will be subject to an acquisition. In this spirit, we assume that takeovers are exogenous and happen with a publicly known probability τ. Furthermore, we temporarily assume that the target firm is not protected by takeover defenses ($\alpha = 0$). In the next section, we will relax these two assumptions and allow for endogenous takeovers, discussing how shareholders choose α in some detail.

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[8] A standard poison pill is adopted when a board declares and pays a dividend consisting of rights to purchase stock from the company. The rights are governed by a "rights plan," and a rights agent is appointed to act for rights holders in respect of their rights, much as an indenture trustee would act for bondholders under an indenture. If specified events occur (such as a hostile acquisition of more than a specified amount of a company's stock), the pill is "triggered," and the rights allow holders (other than a hostile bidder) to purchase stock at a discounted price. (Coates (2001), note 25)

[9] Companies with staggered boards (also known as classified boards) elect a portion (usually one-third) of their directors each year, with directors serving multiyear (usually three-year) terms.

[10] Fair price provisions require a large shareholder to pay a price set by formula for all shares acquired in the back end of a two-tier acquisition. See Casares-Field and Karpoff (2002).

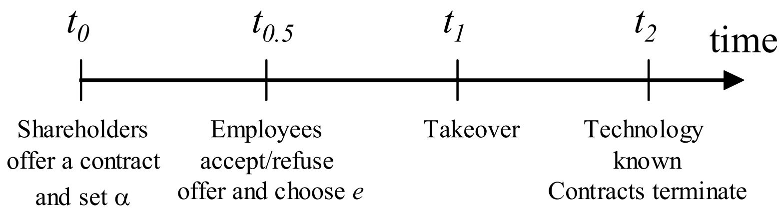

Figure 2: Timing of Contracting

In this setting, wages are the only choice variable for shareholders whose main aim is the maximization of firm value. Given that the value of the firm is higher when employees acquire firm-specific skills, we ask how wages can be set to give employees the incentives to exert effort.

Define a *labour contract* to be an agreement between shareholders and employees which defines a wage structure that depends on cash flows.[11] Shareholders make a take-it-or-leave-it offer to the employees which defines their state contingent compensations w_h when cash flow is high; w_l when cash flow is low; and w_{tc} when technology changes after a takeover. We assume that existing employees are laid off when technology changes. The term w_{tc} can then be interpreted as a severance compensation.

We assume that wages give employees a utility $u(w)$ which is twice continuously differentiable with first and second derivative such that $u'(\cdot) > 0$ and $u''(\cdot) < 0$. By assumption, employees are protected by limited liability and their reservation wage is $u(0) = u_0$. The inverse of the utility function is defined as $u^{-1}(\cdot)$.

The time-line of contracting is illustrated in Figure 2: at time t_0 shareholders offer a labour contract to the employees. At time $t_{0.5}$ employees accept or refuse the contract and choose the desired level of effort. At time t_1 a takeover happens with probability τ. At time t_2 the raider's technology becomes known and labour contracts are executed.

A labour contract offer is accepted by employees if the following partici-

[11] Although shareholders would prefer a contract in which employees' compensations depend on effort, such contract is not possible because effort is not observable.

pation constraint is satisfied,

$$[pu(w_h) + (1-p)\,u\,(w_l)]\,(1-\tau(1-\pi)) + \tau(1-\pi)u\,(w_{tc}) - \psi \geq u_0. \quad (PC_e)$$

Condition PC_e requires the expected utility that employees derive from a labour contract to be greater than the employees' reservation utility u_0. PC_e shows explicitly the dependence of an employee's expected utility on the likelihood of a takeover.

Due to the unobservability of effort there is a moral hazard problem in the relationship between employees and shareholders. In the absence of a labour contract, employees have no incentives to exert effort because it is costly for them to do so. To induce effort employees need to be rewarded when observed cash flows are high and 'punished' otherwise. We need to identify the condition which a labour contract must satisfy in order to induce employees' effort. By comparing expected utility with high and low effort, the following incentive constraint can be derived,

$$\begin{aligned} &[pu(w_h) + (1-p)\,u\,(w_l)]\,(1-\tau(1-\pi)) + \tau(1-\pi)u\,(w_{tc}) - \psi \geq \\ &[p_0 u(w_h) + (1-p_0)\,u\,(w_l)]\,(1-\tau(1-\pi)) + \tau(1-\pi)u\,(w_{tc})\,. \end{aligned} \quad (1)$$

Simplifying condition (1) yields the following incentive constraint,

$$(1-\tau(1-\pi))\,(u\,(w_h) - u\,(w_l)) \geq \frac{\psi}{\Delta p}. \quad (IC_e)$$

Condition IC_e states that in expectations the wedge between high and low wages must be large enough to compensate the employees for the cost of effort. Notice that the employees' incentive constraint does not depend on w_{tc}, the compensation when a change in technology takes place (State 2). This is because the incentive mechanism described here is based on the positive correlation between effort, observed cash flows and compensation. In State 2 there is no link between effort and cash flows. Paying employees in this State does not provide them with an incentive to exert effort. We will return to this issue in the commentary of the optimal incentive contract in Proposition 1.

To obtain the optimal incentive contract, we must first discuss how the value of a firm is affected by takeovers, while keeping wages fixed. Consider first the case when takeovers do not exist ($\tau = 0$). Firm value is simply given by the expected returns of the existent technology net of labour costs,

$$V_{nt} = p\,(h - w_h) - (1-p)w_l. \quad (2)$$

Consider now the valuation of a firm when takeovers happen with certainty $(\tau = 1)$. In this case, firm value is given by the following weighted average,

$$V_t = \pi V_{nt} + (1 - \pi)(k - w_{tc}). \tag{3}$$

By comparing these two extreme cases, we can clearly identify the effect of takeovers on the value of a target firm. Taking the difference between V_t and V_{nt} we obtain $(1 - \pi)\Delta V$ where

$$\Delta V = (k - w_{tc} - ph + pw_h + (1 - p)w_l).$$

The term ΔV indicates the net increase in value that is generated by a takeover. This increase can be decomposed in the following way: cash flows from the new technology k; expected savings in labour costs $pw_h + (1 - p)w_l$; loss in cash flows ph due to scrapping the old technology; a severance compensation w_{tc} to the employees when technology changes.

Current firm value $V(w_h, w_l, w_{tc})$ is given by the weighted average of V_t and V_{nt} as illustrated in the following equation

$$\begin{aligned} V(w_h, w_l, w_{tc}) &= \tau V_t(w_h, w_l, w_{tc}) + (1 - \tau)V_{nt}(w_h, w_l) && (4) \\ &= \underbrace{V_{nt}(w_h, w_l)}_{\text{Firm Value w/out Takeover}} + \underbrace{\tau(1 - \pi)\Delta V(w_h, w_l, w_{tc})}_{\text{Increase in Value due to a Takeover}}. && (5) \end{aligned}$$

From the point of view of shareholders, profit maximization requires choosing a wage structure which maximizes $V(w_h, w_l, w_{tc})$. As we suggested above, in the special case when effort is observable shareholders contract directly upon e. Shareholders set wages so that PC_e is just satisfied and First Best is obtained. A wage structure which satisfies these condition is the following: $w_h = w_l = w_{tc} = u^{-1}(\psi + u_0)$.

However, given that by assumption effort is unobservable, profit maximization requires wages to satisfy both condition PC_e and the employees' incentive constraint. Therefore, to maximize profits shareholders solve

$$\max_{\{w_h, w_l, w_{tc} \geq 0\}} V(w_h, w_l, w_{tc}) \tag{P_1}$$

subject to PC_e and IC_e.

The solution to P_1 is given in the following Proposition.

Proposition 1 ***(Incentive Compatible Wages)***

Under the assumption that effort to acquire firm-specific skills is not observable, an optimal compensation scheme provides no compensation for the employees both when cash flows are low ($w_l = 0$) and when technology changes ($w_{tc} = 0$). When cash flows are high, employees receive an incentive wage

$$w_h^{SB} = u^{-1}\left(\frac{\psi}{(1-\tau(1-\pi))\Delta p} + u_0\right).$$

Proof. See Appendix. ■

The Proposition contains two main results. The first is that providing a severance compensation to the employees in case of a technological change is not optimal ($w_{tc} = 0$); a result which follows directly from the fact that w_{tc} does not appear in the incentive constraint of the employees. The second result is that the optimum wage w_h^{SB} is an increasing and convex function of τ, which can be otherwise stated as[12]

$$\frac{\partial w_h^{SB}(\tau)}{\partial \tau} \geq 0, \frac{\partial^2 w_h^{SB}(\tau)}{\partial \tau^2} \geq 0. \tag{6}$$

The fact that wages increase more than proportionally for an increase in τ means that a rise in the probability of takeovers is costly for firms because labour costs rise. High labour costs have a negative impact on the willingness of firms to provide incentive contracts. For a firm it is worth setting an incentive contract only if

$$w_h^{SB}(\tau) \leq h. \tag{7}$$

Condition (7) is less likely to be satisfied when τ increases. From this observation follows that when τ is high, firms are less inclined to develop firm-specific skills.

Comparative statics helps identify the effects of an increase in the probability of takeovers on the valuation of target firms. On the one hand, a rise in τ implies higher expected takeover gains which translate into higher firm value.[13]. On the other hand, a rise in τ implies higher labour costs with a negative effect on firm value. To express this idea more formally, rewrite equation (4) as

$$V(\tau) = V_{nt}\left(w_h^{SB}(\tau)\right) + \tau(1-\pi)\Delta V\left(w_h^{SB}(\tau)\right)$$

[12] The derivatives in (6) are proven in the appendix.

[13] When $\tau = 1$ in equation (4) expected takeover gains are maximized.

so to explicitly express the dependence of firm value on τ. Differentiation with respect to τ shows that $V(\tau)$ is an increasing function of τ only when the following condition is satisfied

$$\underbrace{(1-\pi)\,\Delta V}_{\text{Increase in Takeover Gains}} \quad + \quad \underbrace{\tau p(1-\pi)w'(\tau)}_{\text{Increase in Expected Wage Cuts}} \quad \geq \quad \underbrace{pw'(\tau)}_{\text{Increase in Wages}} \tag{8}$$

Condition (8) states that an increase in the probability of takeovers raises the value of a target firm only if: the increase in expected takeover gains and wage cuts outweighs the increase in incentive wages.

4 Endogenous Takeovers

In the previous section, takeovers are exogenous and corporate raiders are limited to a passive role. In reality, however, raiders are key actors in the market for corporate control who actively choose acquisition targets on the basis of firm characteristics such as future cash flows, operating synergies, leverage and productivity. One characteristic that also matters is whether a firm deploys takeover defenses or not. In this section, we explore the latter point in detail and discuss how the probability of a takeover is affected by takeover defenses.

To model the behaviour of corporate raiders we introduce a sequential game in which raiders decide upon the acquisition of a firm after the level of wages and takeover defenses has been set. To determine the equilibrium of the sequential game, we proceed by backward induction. In this section we identify the reaction function of a raider for any given level of wages and takeover defenses. In the next section, we explore how target shareholders choose optimally wages and takeover defenses, once the reaction function of the raider is known.

With reference to Figure 2 the timing of the game is as follows: wages and takeover defenses are set at time t_0, while the acquisition is chosen at time t_1. Therefore, at time t_1 there is a subgame in which a raider choose in mixed strategies over the set of actions $\Omega = \{takeover,\ no\ takeover\}$. A mixed strategy is chosen when $0 < \tau < 1$. Pure strategies are given by $\tau = 0$ and $\tau = 1$.

The strategy that a raider chooses at time t_1 does not only depend on wages and takeover defenses, but also on the expectations of existing shareholders about the likelihood of a takeover. We assume that the expectations

τ^e of the probability of takeover τ are formed by shareholders at time t_0. We also assume that these expectations cannot be changed. In equilibrium expectations are rational and correctly anticipate a raider's strategy. Therefore, an equilibrium is where $\tau^e = \tau$.

Using the results of the previous sections we know that $w_l = w_{tc} = 0$. To simplify notation set $w_h = w$. The term $\Delta V\left(w_h, w_l, w_{tc}\right)$ simplifies to $\Delta V\left(w\right) = \left(k - ph + pw\right)$. We can write current firm value as explicitly dependent on τ^e,

$$V\left(\tau^e\right) = V_{nt} + \tau^e\left(1-\pi\right)\Delta V. \tag{9}$$

When $\tau^e = 0$ current firm value equals V_{nt} and when $\tau^e = 1$ firm value equals V_t. Given that shareholders' expectations are not updated, $V\left(\tau^e\right)$ identifies the price paid by a raider in an acquisition. It follows that a raider's profits from an acquisition are positive when

$$V_t - V\left(\tau^e\right) = \underbrace{\left(1-\tau^e\right)\left(1-\pi\right)\Delta V}_{\text{Acquisition Returns}} \geq \underbrace{\alpha}_{\text{Cost of Defenses}} \tag{PC_R}$$

Condition PC_R identifies a raider's participation constraint and states that only 'unexpected' acquisitions generate returns for a raider because 'expected' acquisitions are already 'priced' into current share values. We show below that in a rational expectations equilibrium all acquisitions are expected.

The assumption that shareholders do not update their expectations means that shareholders become aware of a change in control only *after* it has happened. On the contrary, if shareholders could update their expectations upon observing a bid offer, target firm share price would be V_{nt} when there is no offer and V_t when an offer is made. In the latter setting, takeovers never happen if α is strictly greater than zero because raiders make a sure loss equal to $-\alpha$ in an acquisition. Because of this somewhat unrealistic result, we prefer to assume that expectations are not updated.[14]

As there is no updating of expectations a raider chooses τ taking τ^e as given. Allowing for mixed strategies a raider's maximization problem is

$$\tau^* \in \arg\max_{0\leq\tau\leq 1} \tau\left[\left(1-\tau^e\right)\left(1-\pi\right)\Delta V - \alpha\right]. \tag{P_R}$$

Program P_R defines a raider's reaction function for any given τ^e. An

[14]See also Grossman and Hart (1980) on this issue.

equilibrium requires $\tau^* = \tau^e$. The following example illustrates this idea in more detail.

Example Consider the case when target-firm shareholders are certain that a corporate raider will mount a takeover bid and set accordingly $\tau^e = 1$. Current share price must then be equal to post-takeover price. A raider cannot expect to make any profit from the acquisition because prices already reflect entirely the expected takeover gains that an acquisition will generate. Anticipating this outcome, a raider refrains from bidding, thus contradicting the expectations that a takeover would happen with certainty. Therefore, there is no equilibrium in rational expectations when $\tau^e = 1$. ■

The following Proposition provides a solution to P_R and identifies the equilibrium probability of takeover.

Proposition 2 ***(Equilibrium probability of takeover)***
If $(1-\pi)\,\Delta V \geq \alpha$, a raider makes zero profits in equilibrium and takeovers happen with probability

$$\tau^* = 1 - \frac{\alpha}{(1-\pi)\,\Delta V}. \tag{10}$$

If $(1-\pi)\,\Delta V \leq \alpha$, condition PC_R is not satisfied and the equilibrium probability of takeover is zero.

Proof. See Appendix ■

Proposition 2 identifies the reaction function of a raider and contains three main results. The first is that with rational expectations takeovers are always anticipated by shareholders and corporate raiders make zero profits.[15] The second result is that firms with takeover defenses are less likely to be taken over.[16] The third result is that an increase in wages raises the probability of a takeover. More formally, the following relationship holds,

$$\frac{\partial \tau^*(w)}{\partial w} \geq 0. \tag{11}$$

[15] Grossman and Hart (1980) obtain the zero profit outcome in a setting where target-firm shareholders free-ride on each other.

[16] On the effect of takeover defenses on takeover bids see Borokhovich, Brunarski, and Parrino (1997), Casares-Field and Karpoff (2002), Comment and Schwert (1995) and Daines (2001).

The main implication of condition (11) is that firms with high labour costs are more likely to be taken over. This result reinforces the findings of the previous section that labour costs cuts are a motive for takeovers. We then conclude that in a rational expectations equilibrium, the probability of a technological takeover increases when wages are high.

5 Optimum Takeover Defenses

In this section we examine how shareholders set wages and takeover defenses, taking the reaction function of the raider as given. Inserting equation (10) into (4) yields the firm's current value after the adoption of takeover defenses,

$$V(\alpha, w) = V_{nt}(w) + (1 - \pi)\Delta V(w) - \alpha. \tag{12}$$

Equation (12) shows that in equilibrium the cost of takeover defenses is fully internalized by current shareholders. Shareholders solve the following maximization,

$$\max_{\{\alpha, w \geq 0\}} V(\alpha, w) \tag{P_2}$$

$$\text{subject to conditions } PC_e \text{ and } IC_e.$$

Figure (3) illustrates the maximization problem. The following proposition identifies the level of takeover defenses that maximizes firm value.

Proposition 3 ***(Optimum Takeover Defenses of an Entrepreneurial Firm)***

Indicate with $\widehat{w}$ the level of wages at the tangency point between IC_e and the highest shareholder isoprofit curve and set $w' = u^{-1}\left(\frac{\psi}{\pi \Delta p} + u_0\right)$. There are two possible cases:

- *If $\widehat{w} \geq w'$, the optimum level of takeover defenses is zero.*
- *If $\widehat{w} < w'$, the optimum level of takeover defenses is strictly greater than zero.*

Proof. See Appendix. ■

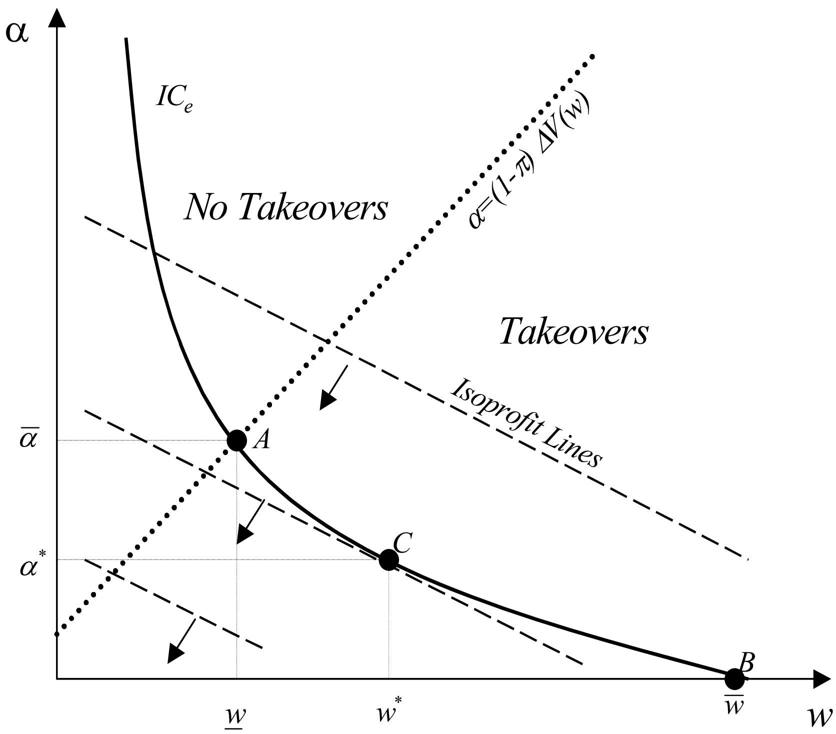

Figure 3: The figure illustrates how current shareholders choose α and w to maximize the value of the firm. Their choice must satisfy the employee incentive constraint IC_e. Isoprofit lines further down and left represent higher profit levels. The optimum is characterized by a tangency condition between the lowest isoprofit line and IC_e. When tangency takes place between A and B, it is optimal for a firm to adopt takeover defenses. In the special case, when tangency takes place to the left of A, the optimum level of defenses is $\overline{\alpha}$ which implies that $\tau = 0$. When tangency takes place to the right of B, it is optimal for a firm not to adopt takeover defenses. The upward-sloping line $\alpha = (1 - \pi)\Delta V\,(w)$ represents the participation constraint of a raider.

The main result of Proposition 3 is that for certain parameter spaces it is optimal for a firm to introduce takeover defenses in the corporate charter. Takeover defenses are adopted to insure employees from a technological shock. Insurance is required because employees are risk-averse. In the special case of risk-neutrality, the optimum level of takeover defenses is zero.[17]

Although the intuition behind the adoption of takeover defenses is relatively simple, it is less obvious why firms use takeover defenses rather than severance payments to provide insurance. Observe that severance payments and takeover defenses affect employee compensations differently. Return to Figure (1) and notice that State 2 implies a loss of information about effort: when technology changes, firm-specific skills acquired before the takeover produce a zero cash flow. Therefore, in State 2 cash flows do not provide information about effort. Providing a severance payment means that employees receive some money in State 2, i.e. in a state in which there is no information about their effort. We have shown above that such payments are sub-optimal because they do not provide an incentive for the employees to exert effort. On the contrary, takeover defenses are instrumental in providing incentives to the employees because they reduce the likelihood of State 2.

We conclude that takeover defenses are a better instrument than severance compensations for providing insurance to the employees. While severance compensations lead to information losses, takeover defenses help preserve information.

6 Managerial Entrenchment

The analysis of the previous sections is tailored for an entrepreneurial firm, where shareholders have direct control over the firm. We now move to more complex firms in which shareholders employ managers to run the firm on their behalf. We refer to this type of firms as *corporations*. In a corporation there are two agency relationships and two levels of moral hazard: one in the relationship between shareholders and managers and another in the relationship between managers and employees. In this section, we discuss how the optimal level of takeover defenses is affected by the introduction of managerial moral hazard.

We make the following assumptions:

[17]See the Appendix for a formal proof of this result.

1. Shareholders need managers because of their expertise in running the firm;
2. A change in technology requires a change of management;
3. Managers extract a private benefit $b < \Delta V$ from running the firm;
4. When managers are sacked, they lose their benefit;
5. Managers choose α and w.

Furthermore, in the spirit of Manne (1965) and Mayer, Milgrom, and Roberts (1992), we assume that a manager's interests are not perfectly aligned with those of shareholders. Managers can take unobservable actions which are disruptive for the well functioning of the firm. Such actions affect the probability of a technological change. More precisely, given a managerial action $d \in \{0, 1\}$, when $d = 0$ and $d = 1$ the probabilities of a technological shock are respectively given by π_0 and $\pi_1 = \pi_0 + \Delta\pi \geq \pi_0$.

A key issue for shareholders is how to design a contract that gives managers the incentives to act in the interest of the corporation. In the absence of such contract, a manager's expected utility depends on α, w and d as shown by the following expression

$$M(\alpha, w, d) = (1 - \tau_d(\alpha, w)(1 - \pi_d))\, b.$$

It is useful to examine the behaviour of a manager in the absence of an incentive compatible contract. The following lemma describes how managers choose α, w and d to maximize their utility.

Lemma 4 ***(Managerial Entrenchment)***
A manager maximizes utility $M(\alpha, w, d)$ by setting $\alpha = \overline{\alpha}$, $d = 1$ and $w = \underline{w}$.

Proof. See Appendix. ■

The Lemma contains two results both of which stress the implications of a misalignment of interests between shareholders and managers. First, in the absence of an incentive compatible contract, managers act against the interests of shareholders by taking actions that reduce the value of the firm for a potential acquirer ($d = 1$), thus discouraging an acquisition. Second, managers use takeover defenses to entrench in the firm and to protect their benefits of control. At the optimum, managers always choose the highest level of takeover defenses, which implies that even takeovers that would be profitable for shareholders are ruled out ($\tau = 0$).

To avoid managerial entrenchment, shareholders design contracts that give managers the incentives to maximize shareholder wealth. Consider the following contract[18]:

Managerial Contract Shareholders make a take-it-or-leave-it offer to a manager, according to which

1. if a manager chooses α and w so that firm value is maximized, she receives a share η of the firm; a compensation m_1 when there is a takeover and technology does not change (State 1); a compensation m_2 when there is a takeover and technology changes (State 2); a compensation m_3 when there is no takeover (State 3).

2. if a manager chooses α and w so that firm value is not maximized, she receives her reservation utility, here set equal to 0.

The equilibrium probability of takeover in the presence of a managerial contract is given by[19]

$$\tau^m = 1 - \frac{\alpha}{(1-\pi_d)(\Delta V - m_2) + m_3 - \pi_d m_1}. \tag{13}$$

Given the offer outlined above, a manager's utility can be rewritten as

$$\begin{aligned} M(\alpha, w, d; m_1, m_2, m_3, \eta) = (1-\tau^m)(b+m_3) + \tau^m \pi_d (b+m_1) \\ + \tau^m (1-\pi_d) m_2 + \eta V(\pi_d) \end{aligned}$$

A manager's utility now depends on the payments that she receives in the different states of the world, as well as on her private benefits of control. A manager has the incentives to choose the levels of α and w which maximize firm value (part one of the contract) when the following condition is satisfied

[18] We consider this simple managerial contract because deriving an optimal contract would be rather complex. An optimal contract requires state contingent compensations to depend on share prices which, in turn, depend on the state contingent compensations.

[19] Equation (13) is derived in the Appendix.

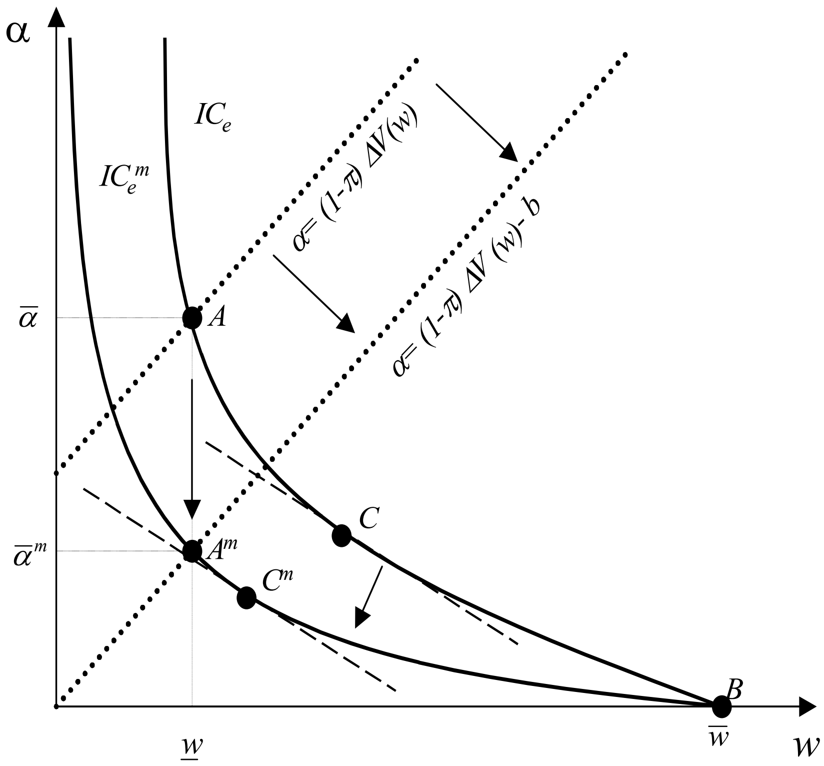

Figure 4: The diagram illustrates the shareholders' profit maximization of a corporation. The employees' incentive constraint in a corporation is slacker than that of an entrepreneurial firm. This is due to the fact that takeovers are less likely because the firm deploys a golden parachute in addition to takeover defenses.

$$M\left(\alpha, w, 0; m_1, m_2, m_3, \eta\right) \geq 0 \qquad (PC_m)$$

Condition PC_m represents a manager's participation constraint. The state contingent compensations provided in part one of the contract give a manager the incentives to choose $d = 0$ only when the following condition is satisfied,

$$M\left(\alpha, w, 0; m_1, m_2, m_3, \eta\right) \geq M\left(\alpha, w, 1; m_1, m_2, m_3, \eta\right). \qquad (14)$$

Condition (14) defines a manager's incentive constraint. The incentive constraint simplifies to

$$m_2 + \eta\left(\Delta V - m_2\right) \geq b + \left(1 - \eta\right) m_1. \qquad (IC_m)$$

Condition IC_m shows that a managerial incentive constraint requires the compensation in State 2 to be greater than that in State 1. In other words, IC_m states that a manager will not take actions to prevent a takeover only if she is promised a high compensation when a takeover happens.

6.1 Optimum Defenses and Managerial Contracts

In this section we determine the optimal level of takeover defenses of a corporation. When maximizing firm value, shareholders face both the moral hazard problem of managers and that of employees. Contracts need to be designed in such a way that both managers and employees have the incentives to act in the interests of shareholders. At the optimum, takeover defenses, employees' effort, wages and managerial compensations must be such that: employees choose $e = 1$; managers choose $d = 0$; and the level of α and w set by managers is as desired by shareholders.

To provide some comparative statics, we assume that there is an upper limit $\overline{m}$ to the compensation that shareholders are able to offer a manager. The value of a corporation is given by the following expression[20]

$$V\left(\alpha, m_1, m_2, w\right) = V_{nt}\left(w\right) + \left(1 - \pi_0\right)\left(\Delta V(w) - m_2\right) - \pi m_1 - \alpha. \qquad (15)$$

The shareholder maximization can be written as

$$\max_{\{0 \leq \eta \leq 1, \alpha, w \geq 0, 0 \leq m_1, m_2 \leq \overline{m}\}} \left(1 - \eta\right) V\left(\alpha, m_1, m_2, w\right) \qquad (P_3)$$

[20]Equation (15) is derived in the Appendix. In equilibrium, m_3 drops out because it represents a transfer from raiders to managers which does not affect shareholders.

subject to conditions PC_e, IC_e, PC_m and IC_m.

The maximization yields different results depending on the relative magnitudes of $\overline{m}$ and b. We consider two cases: $\overline{m} \geq b$ and $\overline{m} \leq b$. We first analyze the case when $\overline{m} \geq b$. The solution to the maximization is provided in the following Proposition.

Proposition 5 ***(Optimum Managerial Contract:*** $\overline{m} \geq b$***)***

1. *When* $\overline{m} \geq b$ *the optimum managerial contract requires:* $\eta = 0$, $m_1 = m_3 = 0$ *and* $m_2 = b$.

2. *Indicate with* $\widetilde{w}$ *the level of wages at the tangency between* IC_e *and the highest shareholder isoprofit curve. There are two possible cases*

    - *If* $\widetilde{w} \geq w'$, *the optimum level of takeover defenses is zero.*
    - *If* $\widetilde{w} < w'$, *the optimum level of takeover defenses is strictly greater than zero.*

Proof. See Appendix ∎

Proposition 5 is divided in two parts. The first part regards the optimum managerial contract. Interpret the term m_2 as a managerial *golden parachute* which is paid to managers in case of dismissal (State 2).[21] An optimum contract requires a manager's golden parachute to equal her private benefit of control ($m_2 = b$). By perfectly insuring managers against dismissal, shareholders ensure that managers have no incentives to stop profitable acquisitions.

The Proposition also shows that managers are not given shares in the firm at the optimum ($\eta = 0$). Giving shares to managers is a sub-optimal incentive mechanism when a sufficiently sizeable golden parachute is available

[21] Golden parachutes are severance agreements granting cash and other benefits if certain events follow a change in control. Among these are the firing, demotion or resignation of the CEO within a specified time following the change in control. The benefits provided by a golden parachute can be significant. Agrawal and Knoeber (1998) report examples of golden parachutes that provide for a lump sum payment of three times the CEO's total annual compensation, a three-year continuation of employee benefits, and an additional payment equal to three years of pension accruals if the CEO is terminated or elects to leave within five years following a change in control.

($\overline{m} \geq b$). The intuition of why golden parachutes are preferred to shares is that share value is a noisy proxy of managerial performance.

The second part of Proposition 5 extends the results of Proposition 3 to the case of a corporation. The results show that for some parameter spaces, the introduction of takeover defenses in the corporate charter of a firm maximizes firm value.

Consider now the case when $\overline{m} \leq b$. The optimum managerial contract changes as follows:

Corollary 6 ***(Optimum Managerial Contract when $\overline{m} \leq b$)***
When $\overline{m} \leq b$, the optimum managerial contract requires $m_1 = m_3 = 0$ and $m_2 = \overline{m}$ and

$$\widehat{\eta} = \frac{b - \overline{m}}{\Delta V(w) - \overline{m}}. \tag{16}$$

Proof. See Appendix. ■

The Corollary defines the optimum managerial contract when managers cannot be fully insured against dismissal. When the largest available golden parachutes is smaller than a manager's private benefits ($\overline{m} \leq b$), shareholders use shares to align their interests with those of managers. It follows that an optimum incentive contract requires both a golden parachute and managerial share ownership.

6.2 Golden Parachutes and Takeover Defenses

In this section we investigate the relationship between managerial golden parachutes and the optimum level of takeover defenses. We ask whether the optimum level of defenses is affected by the presence of a golden parachute. Our model shows that the presence of a golden parachute has an ambiguous effect on the optimum level of takeover defenses; a result which is in contrast with Knoeber (1986), according to which golden parachutes and takeover defenses are negatively correlated.

Indicate with $\widetilde{\alpha}(m_2)$ the optimum level of takeover defenses, explicitly expressing its dependence on m_2. Checking the sign of the first derivative we observe that [22]

[22] See the Appendix for a proof.

$$\frac{\partial \widetilde{\alpha}(m_2)}{\partial m_2} \lesseqgtr 0. \tag{17}$$

We conclude that golden parachutes and takeover defenses cannot be considered substitutes. Firms use defenses and parachutes for different reasons: while takeover defenses help reduce the moral hazard problem of employees, golden parachutes address the moral hazard of managers. The two moral hazard problems are not necessarily related.

6.3 Golden Parachutes and Takeovers

Golden parachutes also have an ambiguous effect on the likelihood of an acquisition. There are two effects at work here. Firstly, by increasing the expected costs for corporate raiders, golden parachutes reduce the probability of a takeover. More formally, we observe that the derivative of equation (13) with respect to m_2 is always negative,[23]

$$\frac{\partial \tau(m_2)}{\partial m_2} \leq 0. \tag{18}$$

From this result follows that fewer expected takeovers imply lower incentive wages for employees. The following example examines this idea in the case of a utility function that exhibits constant absolute risk aversion.

Example: CARA utility function Consider a utility function of the form $u(w) = -\exp(-\gamma w)$ with $\gamma > 1$. Then $u'(w) = \gamma \exp(-\gamma w)$ and $u''(w) = -\gamma^2 \exp(-\gamma w)$ and γ represents the index of absolute risk aversion. Differentiation of the optimum wages with respect to m_2 yields

$$\frac{\partial w\,(m_2)}{\partial m_2} = -\frac{1}{\exp(\gamma w) - 1}$$

which is negative and increasing in γ. Therefore, with a CARA utility function the level of wages decreases with the size of the golden parachute.■

[23] For example, in the attempted takeover of Northrop Grumman by Lockheed Martin in 1998 the golden parachute of the CEO of Northrop helped scuttle the hostile takeover attempt. It would have required the pursuer to give the ousted CEO a cash payment of $7.8 million, plus sock rights and options worth $16 million had the merger been approved. (Pearce and Robinson (2004)).

Secondly, providing a golden parachute makes the incumbent management less averse towards an incoming takeover. The provision of a golden parachute might increase the overall probability of a takeover, as long as the parachute is not too sizeable. More formally, comparing τ^m with τ_1, the probability of takeover is larger when managers receive a parachute if

$$m_2 \leq \frac{\Delta\pi\Delta V}{1-\pi_0}.$$

7 Conclusions

This paper examines the effects of takeover defenses on the valuation of firms. We find that firms introduce takeover defenses to insure their employees against the loss of human-capital that might follow an acquisition. In the presence of takeovers, which generate restructuring, target-firm employees have fewer incentives to acquire valuable firm-specific skills. Firms are required to pay higher wages if they want to have a skilled-labour force. Ultimately, we find that in an environment with many corporate acquisitions, the productivity of the labour force is lower and wages are higher. The typical target of an acquisition is characterized by few takeover defenses, high labour costs and low productivity.

If on the one hand, takeovers have a negative impact on productivity and wages, on the other, takeovers are the potential source of acquisition premia for selling shareholders. Such acquisition premia accrue to selling shareholders because any future increase in profits is priced in at the time of the acquisition. In the presence of takeovers, shareholders face a trade-off between current productivity and future acquisition premia. If there are too many takeovers, productivity is low. If there are too few takeovers, shareholders might miss out the chance of selling at a high price.

Takeover defenses represent an instrument for shareholders to strike a balance between these two effects. At the optimum, takeover defenses are just high enough to provide insurance to target-firm employees from the adverse effects of a takeover, thus keeping productivity high. At the same time, takeover defenses are low enough to allow for value increasing takeovers which generate a premium for selling shareholders.

If takeover defenses are meant to insure existing employees against the cost of layoff, we wonder if there exist alternative arrangements that achieve the same objective at a lower cost. We consider the case of severance compensations and conclude that severance compensations have negative effects on the employees' willingness to work. If employees are promised a compensation in case of layoff, they are not afraid of being laid off for not working hard. Consequently, they do not work hard.

In the second part of the paper, we examine how managers use takeover defenses to protect their own benefits against the interests of shareholders. Given that takeovers act as a mechanism to enforce discipline, managers use takeover defenses to fend off unwelcome acquisitions which might result in their own dismissal. As a result, managers often choose an excessively high level of protection which might repel potentially valuable takeovers. We interpret this phenomenon as managerial entrenchment.

Shareholders can prevent entrenchment by setting up contracts that align manager and shareholder interests. We find that an optimum incentive contract requires managerial share ownership and a golden parachute. When managers are promised a golden parachute, they have no interest in entrenching. Therefore, managers are less likely to oppose valuable takeovers. At the same time, however, golden parachutes raise the costs of an acquisition for a raider. Therefore, firms with a golden parachute are less likely to be taken over because managers must be compensated for their dismissal. The overall effect of golden parachutes on the likelihood of a takeover is, therefore, ambiguous.

Finally, it may appear that golden parachutes have a similar effect to takeover defenses, in that both instruments reduce the likelihood of a takeover. However, these two instruments are motivated by different reasons. Golden parachutes are meant to reduce the moral hazard of managers, while takeover defenses address the moral hazard of employees.

8 Appendix

Proof of Proposition 1 We first need to show that condition PC_e is implied by IC_e, so that PC_e can be ignored in the maximization. Limited liability requires that wages are such that $w_h, w_l, w_{tc} \geq 0$. Compare the right hand side of condition (1) with that of PC_e. The former is greater or equal to the latter. They are equal only when $w_h = w_l = w_{tc} = 0$. This observation implies that IC_e is at least as stringent as PC_e. Consequently, PC_e can be ignored. Cost minimization implies that IC_e binds at the optimum and that $w_l = w_{tc} = 0$. It follows that incentive compatible wages are given by the following equation

$$w_h^{SB} = u^{-1}\left(\frac{\psi}{(1-\tau(1-\pi))\Delta p} + u_0\right).$$

Derivation of the Derivatives of w_h^{SB} with Respect to τ We want to show that w_h^{SB} is an increasing and convex function of τ. It is useful to define the following function

$$g(\tau) = \frac{\psi}{(1-\tau(1-\pi))\,\Delta p} + u_0.$$

Observe that $u'(g(\tau)) \geq 0$, $u''(g(\tau)) \leq 0$, $g'(\tau) \geq 0$ and $g''(\tau) \geq 0$. We can then write $w_h^{SB}(\tau) = u^{-1}(g(\tau))$. Using the formula for the derivative of the inverse, we get

$$\frac{\partial w_h^{SB}(\tau)}{\partial \tau} = \frac{g'(\tau)}{u'(g(\tau))} \geq 0.$$

Further differentiation yields

$$\frac{\partial^2 w_h^{SB}(\tau)}{\partial \tau^2} = -\frac{u''(g(\tau))g'(\tau)}{u'(g(\tau))^2} + \frac{g''(\tau)}{u'(g)} \geq 0.$$

Proof of Proposition 2 There are two cases to consider:

1. $(1-\pi)\,\Delta V > \alpha$: if expectations are $\tau^e = 0$, the best strategy for a raider is $\tau = 1$. An equilibrium would require $\tau^e = 1$. However, when shareholders set $\tau^e = 1$ the best action for a raider changes to $\tau = 0$. As a result $\tau^e = 0$ does not give rise to an equilibrium. Alternatively consider the case when expectations are such that $\tau^e = 0.5$. If $0.5\,(1-\pi)\,\Delta V > \alpha$, the best action for a raider is $\tau = 1$. In equilibrium, we should then have $\tau^e = 1$. However, when $\tau^e = 1$ the best action for a raider is $\tau = 0$. Again, an equilibrium does not arise. If $0.5\,(1-\pi)\,\Delta V < \alpha$, the best action for a raider is $\tau = 0$. In equilibrium, we should then have $\tau^e = 0$. However, when $\tau^e = 0$ the best action for a raider is $\tau = 1$. Again, an equilibrium does not arise. The only case when an equilibrium exists is when $(1-\tau^e)\,(1-\pi)\,\Delta V = \alpha$ for which value the objective function of a raider is zero. The equilibrium condition can then be written as

$$\tau^e = \tau = 1 - \frac{\alpha}{(1-\pi)\,\Delta V}.$$

2. $(1-\pi)\,\Delta V < \alpha$: the objective function of the raider is always non positive. Therefore, no takeover occurs and an equilibrium exists in $\tau^e = \tau = 0$.

Proof of Proposition 3 Following the same steps as in the proof of Proposition 1, it can be shown that the participation constraint of the employees is always slacker than the incentive constraint. We now prove that the incentive constraint binds at the optimum. Substitute equation (10) into IC_e to get

$$\alpha \geq \frac{\Delta V\,(w)}{u(w)-u_0}\frac{\psi}{\Delta p} - \pi\Delta V\,(w) \tag{19}$$

which has the advantage of being an explicit condition on α. Set up the following Lagrangian in which λ represents the multiplier of constraint (19),

$$L\,(\alpha, w; \lambda) = V\,(\alpha, w) - \lambda\left(\frac{\Delta V\,(w)}{u(w)-u_0}\frac{\psi}{\Delta p} - \pi\Delta V\,(w) - \alpha\right).$$

Differentiate $L\,(\alpha, w; \lambda)$ with respect to α and set the derivative equal to zero to get the First-Order conditions. Solving the system of equations that follows from the First-Order conditions we obtain $\lambda = 1$. Complementary slackness implies that IC_e binds at the optimum due to the positive λ. Therefore, constraint (19) holds with an equal sign. Insert (19) into P_2 and simplify to get the following unconstrained maximization which is solely in terms of w,

$$\max_{w}\; V_{nt}\,(w) + \Delta V(w)\left(1 - \frac{\psi}{\Delta p\,(u(w)-u_0)}\right). \tag{20}$$

Differentiation yields the following First-Order condition

$$p\,(u(\widehat{w}) - u_0) = \Delta V\,(\widehat{w})\, u'(\widehat{w}). \tag{21}$$

The second derivative of the objective function equals

$$\frac{2pu'(w)}{(u(w)-u_0)^2} + \frac{\Delta V\,(w)\, u''(w)}{(u(w)-u_0)^2} - \frac{2\Delta V\,(w)\, u'(w)^2}{(u(w)-u_0)^3} \tag{22}$$

Insert condition (21) into (22) and simplify to obtain

$$\frac{\Delta V\,(w)\, u''(w)}{(u(w)-u_0)^3} \leq 0.$$

Given that at the optimum the sign of the second derivative is negative, we conclude that condition (21) identifies a maximum. Insert equation (21) into (19) to obtain

$$\widehat{\alpha} = \frac{\psi p}{\Delta p u'(\widehat{w})} - \pi \Delta V(\widehat{w})$$

The value $\widehat{\alpha}$ is greater than zero when $\frac{\psi}{\Delta p} \geq \pi \left(u(\widehat{w}) - u_0\right)$. To find the optimum, we must now check that $\widehat{\alpha}$ is non-negative and that it is not greater $\overline{\alpha}$ which is defined as the level of defenses at which $\tau^* = 0$. There are three possible cases: if $\widehat{\alpha} \leq 0$, the optimum level of defenses is $\alpha^* = 0$ because defenses cannot be negative. If $0 \leq \widehat{\alpha} \leq \overline{\alpha}$, the optimum level of defenses is $\alpha^* = \widehat{\alpha}$. If $\widehat{\alpha} \geq \overline{\alpha}$, the optimum is $\alpha^* = \overline{\alpha}$.

Proof that $\alpha = 0$ with Risk-Neutral Employees When employees are risk neutral, $u(w) = w$ and $u_0 = 0$. The incentive constraint simplifies to

$$w \geq \frac{\psi}{\pi \Delta p}. \tag{23}$$

Shareholders can lower α, at no cost in terms of higher risk premiums. Given that α represents a cost, shareholders set $\alpha = 0$. This choice of α implies that $\tau = 1$ and expected wages equal πw. To satisfy condition (23) it must be $w = \underline{w}$. Therefore, the optimum is at $(0, \underline{w})$.

Proof of Lemma 4 A manager's utility increases in b, a private benefit which is received with certainty when there is no takeover and with probability π_d when there is a takeover. Therefore, a manager must minimize the probability of a takeover, in order to maximize the probability of receiving b. First, from equation (10) we observe that $\pi_1 \geq \pi_0$ implies $\tau_1 \leq \tau_0$. Therefore, a manager chooses $d = 1$, because the probabilities of a takeover are lower when $d = 1$ than when $d = 0$. Second, a manager chooses a level of takeover defenses equal to $\overline{\alpha}$ which ensures that all takeovers are deterred. Third, from (11), a manager prefers to set lower rather than higher employees' wages. Defenses being set equal to $\overline{\alpha}$, wages must then equal $\underline{w}$.

Derivation of Equation (13) Accounting for state contingent managerial compensations, equation (9) becomes

$$V(\tau^e, m_1, m_2, m_3) = V_{nt} + \tau^e (1 - \pi_d) \Delta V - (1 - \tau^e) m_3 - \tau^e \pi_d m_1 - \tau^e (1 - \pi_d) m_2. \tag{24}$$

Takeover gains are now given by

$$\pi_d (V_{nt} - m_1) + (1 - \pi_d) (k - m_2) - V(\tau^e, m_1, m_2, m_3) =$$
$$(1 - \tau^e) [(1 - \pi_d) (\Delta V - m_2) + m_3 - \pi_d m_1]$$

Setting takeover gains equal to zero yields (13).

Derivation of Equation (15) Firm value is obtained by inserting equation (13) into (24).

Proof of Proposition 5 We first show that a contract that satisfies a manager's incentive constraint, also satisfies a manager's participation constraint. The right hand side of condition IC_m is always greater or equal to zero. Therefore, condition PC_m is implied by IC_m. In what follows we can then ignore PC_m. Cost minimization implies $m_1 = m_3 = 0$.

Following the same steps as in the proof of Proposition (3), we find that IC_e binds at the optimum. Rewrite IC_e as

$$\alpha (m_2, w) = \frac{(\Delta V(w) - m_2)}{u(w) - u_0} \frac{\psi}{\Delta p} - \pi_0 (\Delta V(w) - m_2). \tag{25}$$

Insert equation (25) into the objective function of P_3 and simplify to get a maximization which is solely in terms of w, η and m_2. Indicate with μ the multiplier of IC_m and set up the following Lagrangian

$$L (w, \eta, m_2; \mu) = (1 - \eta) (V_{nt} (w) + (1 - \pi_0) (\Delta V(w) - m_2) - \alpha (m_2, w))$$
$$+ \mu [(1 - \eta) m_2 - b + \eta \Delta V(w)].$$

Differentiating with respect to m_2 and simplifying yields the following first order condition

$$\mu = 1 - \frac{\psi}{\Delta p (u(w) - u_0)}.$$

Noticing that $u(w) - u_0 \geq \frac{\psi}{\Delta p}$ when IC_e is satisfied, we conclude that IC_m binds at the optimum. Rewrite IC_m as

$$m_2 (\eta, w) = \frac{b - \eta \Delta V (w)}{1 - \eta}. \tag{26}$$

Insert (26) into (25) and simplify to get

$$\alpha\left(\eta, w\right)=\frac{\Delta V\left(w\right)-b}{1-\eta}\left(\frac{\psi}{\left(u(w)-u_0\right)\Delta p}-\pi_0\right) \tag{27}$$

Inserting (26) and (27), into the objective function yields the following unconstrained maximization,

$$\max_{\{\eta,w\}} \left(1-\eta\right)\left\{V_{nt}\left(w\right)+\left(1-\pi_0\right)\left(\Delta V(w)-m_2\left(\eta,w\right)\right)-\alpha\left(\eta,w\right)\right\}. \tag{P_3'}$$

The objective function is linear in η. Differentiating with respect to η and simplifying yields $-V_{nt}\left(w\right)\leq 0$. We conclude that it is optimal to set $\widetilde{\eta}=0$. To satisfy the managerial incentive constraint, shareholders set $\widetilde{m}_2=b$ and $\widetilde{\eta}=0$. Differentiate the objective function with respect to w. Rearranging and simplifying returns the following first order condition

$$u(\widetilde{w})-u_0=\frac{1}{p}\left(\Delta V(\widetilde{w})-\widetilde{m}_2\right)u'(\widetilde{w}). \tag{28}$$

Finally, inserting equation (28) into (27) and simplifying gives

$$\widetilde{\alpha}=\frac{\psi p}{\Delta p u'(\widetilde{w})}-\pi_0\left(\Delta V(w)-\widetilde{m}_2\right). \tag{29}$$

To check that the vector $(\widetilde{\alpha},\widetilde{\eta},\widetilde{w},m_1=0,\widetilde{m}_2,m_3=0)$ defines a local maximum we check the sign of the second derivative and observe that it is negative at the optimum when $\Delta V(w)\geq 0$, indicating that equation (28) defines a maximum. Equation (29) identifies a positive level of defenses when $\frac{\psi}{\Delta p}\geq\pi\left(u(\widetilde{w})-u_0\right)$.There are three possible cases: if $\widetilde{\alpha}\leq 0$, the optimum level of defenses is $\alpha^m=0$. If $0\leq\widetilde{\alpha}\leq\overline{\alpha}^m$, the optimum is in $\alpha^m=\widehat{\alpha}$. If $\widetilde{\alpha}\geq\overline{\alpha}^m$, the optimum is in $\alpha^m=\overline{\alpha}^m$.

Proof of Corollary 6 When $\overline{m}\leq b$, the proof is identical to that of Proposition 5 up to P_3'. The solution $m=b$, $\eta=0$ is not available to shareholders because of the upper limit of m. In this case shareholders set $m=\overline{m}$ and choose the minimum η that satisfies the managerial incentive constraint. The optimum level of η is then given by imposing $m=\overline{m}$ into equation (26) and rearranging to get

$$\widehat{\eta}=\frac{b-\overline{m}}{\Delta V\left(w\right)-\overline{m}}. \tag{30}$$

Proof of Derivative (17) Implicit differentiation of equation (28) gives

$$\frac{\partial \widetilde{w}\,(m_2)}{\partial m_2} = \frac{u'(w)^2}{u''(w)\,(u(w) - u_0)} \leq 0. \tag{31}$$

Rewrite equation (29) as

$$\widetilde{\alpha}(m_2) = \frac{\psi p}{\Delta p u'(\widetilde{w}(m_2))} - \pi \left(\Delta V(\widetilde{w}(m_2)) - m_2\right). \tag{32}$$

Differentiate equation (32) to obtain

$$\frac{\partial \widetilde{\alpha}(m_2)}{\partial m_2} = -\frac{\psi p u''(w)}{\Delta p u'(\widetilde{w}(m_2))} \frac{\partial \widetilde{w}\,(m_2)}{\partial m_2} - \pi p \frac{\partial \widetilde{w}\,(m_2)}{\partial m_2} + \pi. \tag{33}$$

Equation (33) can take either sign depending on the values of the parameters.

References

Agrawal, A., and C. R. Knoeber (1998): "Managerial Compensation and the Threat of Takeover," *Journal of Financial Economics*, 47, 219–239.

Ahuja, G., and R. Katila (2001): "Technological Acquisitions and the Innovation Performance of Acquiring Firms: A Longitudinal Study," *Strategic Management Journal*, pp. 197–220.

Bebchuk, L. A. (1987): "The Pressure to Tender: An Analysis and a Proposed Remedy," *Delaware Journal of Corporate Law*, 12(911), 917–931.

Bebchuk, L. A. (2003): "Why Firms Adopt Antitakeover Arrangements," *University of Pennsylvania Law Review*, 152, 713–753.

Berkovitch, E., and N. Khanna (1990): "How Target Shareholders Benefit from Value-Reducing Defensive Strategies in Takeovers," *Journal of Finance*, 45(137).

Bhagat, S., M. Dong, and D. Hirshleifer (2005): "Do Tender Offers Create Value? New Methods and Evidence," *Journal of Financial Economics*, 71(1), 3–60.

Bhide, A. (1990): "Reversing Corporate Diversification," *Journal of Applied Corporate Finance*, 3(2), 70–81.

Borokhovich, K. A., K. R. Brunarski, and R. Parrino (1997): "CEO Contracting and Antitakeover Amendments," *Journal of Finance*, LII(4), 1495–1517.

Bowers, H. M., and N. H. Moore (1995): "Market Valuation of Excess Pension Assets: Evidence from the Market for Corporate Control," *Journal of Risk and Insurance*, 62(2), 214–229.

Bradley, M., A. Desai, and E. H. Kim (1988): "Synergistic Gains from Corporate Acquisitions and their Division Between the Stockholders of Target and Acquiring Firms," *Journal of Financial Economics*, 21, 3–40.

Brickley, J., and C. James (1987): "The Takeover Market, Corporate Board Composition and Ownership Structure: The Case of Banking," *Journal of Financial Economics*, 30, 161–180.

Brown, C., and J. Medoff (1988): "The Impact of Firm Acquisitions on Labor," *In A. Auerbach, ed. Corporate Takeovers: Causes and Consequences*, University of Chicago Press.

Casares-Field, L., and J. Karpoff (2002): "Takeover Defenses of IPO Firms," *Journal of Finance*, LVII(5), 1857–1889.

Chang, S. (1998): "Takeovers of Privately Held Targets, Methods of Payment, and Bidder Returns," *Journal of Finance*, LIII(2), 773–784.

Chemla, G. (2005): "Hold-Up, Stakeholders and Takeover Threats," *Journal of Financial Intermediation*, 14, 376 – 397.

Coates, J. C. (2001): "Explaining Variation in Takeover Defenses: Blame the Lawyers," *California Law Review*, 89(1301).

Comment, R., and G. W. Schwert (1995): "Poison or Placebo? Evidence on the Deterrence and Wealth Effects of Modern Antitakeover Measures," *Journal of Financial Economics*, (39), 3–43.

Daines, R. (2001): "Does Delaware Law Improve Firm Value?," *Journal of Financial Economics*, 62, 525–558.

Garvey, G. T., and N. Gaston (1997): "A Theory of the Optimal Cost Barrier to Corporate Takeovers," *International Economic Review*, 38(3), 657–675.

Gokhale, G., E. L. Groshen, and D. Neumark (1995): "Do Hostile Takeovers Reduce Extramarginal Wage Payments?," *Review of Economics and Statistics*, 77(3), 470–485.

Graff, S. K. (1996): "The Del Webb Corporation (C)," *Harvard Business School Case Study*, (9-497-019).

Grossman, S. J., and O. D. Hart (1980): "Takeover Bids, the Free-Rider Problem and the Theory of the Corporation," *Bell Journal of Economics*, 11, 42–64.

Hall, B. J., C. Rose, and G. Subramanian (2004): "Circon (A) (Abridged)," *Harvard Business School Case Study*, (9-904-023).

Harford, J. (2003): "Takeover Bids and Target Directors' Incentives: The Impact of a Bid on Directors' Wealth and Board Seats," *Journal of Financial Economics*, 69, 51–83.

——— (2005): "What Drives Merger Waves?," *Journal of Financial Economics*, 77, 529–560.

Harris, E. G. (1990): "Antitakeover Measures, Golden Parachutes, and Target Firm Shareholder Welfare," *RAND Journal of Economics*, 21(4), 614–625.

Jarrell, G. A., J. A. Brickley, and J. M. Netter (1988): "The Market for Corporate Control: The Empirical Evidence Since 1980," *Journal of Economic Perspectives*, 2(1), 49–68.

Jensen, M. C. (1988): "Takeovers: Their Causes and Consequences," *Journal of Economic Perspectives*, 2(1), 21–48.

Kamma, S., J. Weintrop, and P. Wier (1988): "Investors' Perceptions of the Delaware Supreme Court Decision in Unocal V. Mesa," *Journal of Financial Economics*, 20, 419–430.

Kaplan, S. (1989): "The Effects of Management Buyouts on Operating Performance and Value," *Journal of Financial Economics*, 24, 217–254.

Kini, O., W. Kracaw, and S. Mian (1995): "Corporate Takeovers, Firm Performance and Board Composition," *Journal of Corporate Finance*, 1, 383–412.

——— (2004): "The Nature of Discipline by Corporate Takeovers," *Journal of Finance*, LIX(4), 1511–1552.

Knoeber, C. R. (1986): "Golden Parachutes, Shark Repellents, and Hostile Tender Offers," *American Economic Review*, 76(1), 155–167.

Kravis, H. (1989): "Greed Really Turns Me Off," *Fortune*, pp. 69–71.

Lichtenberg, F., and D. Siegel (1989): "The Effect of Takeovers on the Employment and Wages of Central-Office and Other Personel," *NBER Working Paper*, (2895).

Manne, H. (1965): "Mergers and the Market for Corporate Control," *Journal od Political Economy*, 73, 110–120.

Martin, K. J., and J. J. McConnell (1991): "Corporate Performance, Corporate Takeovers and Management Turnover," *Journal of Finance*, 46, 671–687.

Mayer, M., P. Milgrom, and J. Roberts (1992): "Organizational Prospects, Influence Costs and Ownership Changes," *Journal of Economics and Management Strategy*, 1(1), 9.

Mitchell, M. L., and J. H. Mulherin (1996): "The Impact of Industry Shocks on Takeover and Restructuring Activity," *Journal of Financial Economics*, 41, 193–229.

Moeller, S. B., F. P. Schlingemann, and R. M. Stultz (2004): "Firm Size and the Gains from Acquisitions," *Journal of Financial Economics*, 73, 201–228.

Pearce, J. A., and R. B. Robinson (2004): "Hostile Takeover Defenses That Maximize Shareholder Wealth," *Indiana University Kelley School of Business Case Study*, (BH 107).

Pontiff, J., A. Shleifer, and M. S. Weisbach (1990): "Reversions of Excess Pension Assets After Takeovers," *RAND Journal of Economics*, 21(4), 600–613.

Rosett, J. (1990): "Do Union Wealth Concessions Explain Takeover Premiums?," *Journal of Financial Economics*, 27, 263–282.

Scharfstein, D. (1988): "The Disciplinary Role of Takeovers," *Review of Economic Studies*, 55, 185–199.

Shleifer, A., and L. H. Summers (1988): "Breach of Trust in Hostile Takeovers," *in Alan J. Auerbach ed., Corporate Takeovers: Causes and Consequences*, Chicago: University of Chicago Press / NBER.

Shleifer, A., and R. W. Vishny (1989): "Management Entrenchment," *Journal of Financial Economics*, 25, 123–139.

Stein, J. C. (1988): "Takeover Threats and Managerial Myopia," *Journal of Political Economy*, 96(1), 41–80.

——— (1989): "Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behaviour," *Quarterly Journal of Economics*, 104, 655–669.