A Theory of Merger-Driven Alliances *

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March 8, 2013

Abstract

I model the decision of two firms to form an equity alliance when they consider future corporate control. An established partner receives a signal about the match quality that he has with an entrepreneurial firm. The entrepreneurial firm (Target) has superior information about the quality of the prospective match than the Bidder. This uncertainty will be revealed to the established firm (Bidder) either after the merger or within an equity alliance. I show that it is optimal for the established firm to propose a merger if the signal is above an endogenous *signal threshold*. If the signal is below the threshold, the optimal choice is to form an equity alliance and have the match quality revealed through contracting. After the revelation of the true match quality, and if the match quality is sufficiently high to generate a positive payoff for the established firm, the two firms can proceed to a merger. If the match quality is below the endogenous *quality threshold*, then the Target is permanently rejected. Surprisingly, I find that even though the signal is positively correlated with the true match quality, it has a negative impact on the Bidder's payoff resulting from the Alliance.

Keywords: Equity alliances; Corporate control; Equity stakes; Agency Models

JEL Classifications: D86; G34

*I would like to thank Andriana Bellou, Peter B. Morgan, Jose M. Plehn-Dujowich and Konstantinos Serfes for comments and suggestions. All errors are mine only.

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1 Introduction

During the last two decades strategic alliances as a corporate practice have become almost as popular as mergers and acquisitions. For instance, between 1985 and 1999 the total number of alliance transactions increased from 610 to 8,759. The respective merger counts during the same period increased from 3,001 to 9,628 (Robinson, 2008). These numbers suggest a dramatic explosion in strategic alliance activity and a much more modest increase in corporate mergers. Despite this remarkable surge in strategic alliances, the choice of forming an alliance as opposed to a merger is not well understood. What are the determinants of the decision to enter an alliance as opposed to a merger? What affects the dissolution of an alliance and a possible transition into a merger? Are alliances an alternative to mergers? In this paper, I address these questions by proposing a theory of merger-driven alliances.

Strategic alliance is a contract between two independent corporate entities that agree to work on a common venture. Upon a merger, on the other hand, at least one of the two parties ceases to exist as a separate entity. From the firm's point of view, the choice between alliance formation and merger is not an obvious one. Both are strategic practices that seek growth through synergies and both can be motivated by seemingly related considerations such as, technology acquisition (McConnell and Nantell, 1985). Nevertheless, while mergers may result in a more efficient use of resources than alliances due to for instance the avoidance of hold-up problems (Hart and Moore, 1990; Hart, 1995), they are a binding corporate decision and costly to be reversed. Strategic alliances, however, do not involve any commitment and provide both parties with the flexibility of opting out of the mutual agreement at a lower cost (efficiency/commitment tradeoff). In addition, recent academic research has challenged the effectiveness of mergers as a successful growth strategy by documenting a puzzling long-run underperformance of the acquiring firm. For instance Agrawal et al (1992) found that Bidder's shareholders experience significant negative abnormal return over a five-year period after the merger. These findings have also been corroborated by Rau and Vermaelen (1998) and Loughran and Vijh (1997). Hence, the uncertainty about the Target's type and the potential inability to reliably assess the quality of future synergies from a merger may further complicate the choice between an alliance and a merger.

In this paper, I develop a theory that motivates the formation of equity alliances based on the anticipation of future corporate control. This theory treats the equity alliance as a "weaker" form of merger since it requires the transfer of equity from one partner to the other or both. I argue that it is optimal for the two firms to form an equity alliance first, when they have merger plans in mind, and the immediate assessment of merger synergies is difficult. This weak form of acquisition gives the opportunity to the established partner/Bidder to learn about the match quality he has with an entrepreneur/Target. Alternatively, the alliance helps the bidder to learn the "type" of synergies and decide whether to proceed with full acquisition of the target, when the uncertainty is resolved. Moreover, it allows the two parties to direct effort into becoming more compatible or more valuable to each other thereby increasing future cash flows. During the alliance period, firms learn about their partner's type and then decide whether to transit into a more "permanent" relationship, such as a merger, or become a stand alone firm again.

To illustrate this idea, consider the following example. In August 1997, DuPont a large chemical company, acquired a 20% stake in Pioneer, an American seed corn company. Immediately, the two companies announced the formation of an equity alliance and they started a new joint project called Optimum Quality Grains, L.L.C. In this joint venture, DuPont and Pioneer participated equally with 50% contribution each in the development of a market for new quality grain traits. In March 13th 1999, when merger rumors about DuPont and Pioneer started to spread, Tom Burnett, research director of Merger Insight, which tracks mergers and acquisitions, said: "The next announcement will probably be either that the companies agree to merge or the companies break up talks altogether," (Los Angeles Times, March 13, 1999). Two days later, in March 15th 1999, DuPont announced that the two companies signed an agreement for the acquisition of the remaining 80% of Pioneer by DuPont.

The above example suggests that there is a lot of uncertainty involved in a potential merger. Even though, two firms initially identify each other as a potentially good match, there are still many factors that can affect the success of a merger that are not apparent before the two partners start doing business together. Therefore, when the level of uncertainty is sufficiently high then the flexibility of a strategic alliance may seem an attractive option compared to the commitment that a merger requires. Even if a merger has not yet been consummated, after signing a merger contract the Bidder cannot renege. For example, on July 2007 Hexion and Huntsman signed a merger agreement. Even though, Hexion was initially optimistic about the deal with Huntsman, this situation changed upon the disappointing numbers reported by Huntsman after the first quarter of 2008. Hexion attempted to terminate the deal and walk away but these efforts were proven unsuccessful.

The scenario where an established firm enters an equity alliance with a young entrepreneurial firm, which later on might lead to a merger, is typical (Mathews, 2006; 2007).[1] This scenario is illustrated in the example above (DuPont-Pioneer) and motivates my theoretical model.[2] The theoretical framework builds on a two-stage game (Figure 1), which incorporates an agency model with double moral hazard and adverse selection . The agency problems arise because both involved parties (Bidder and Target) exert costly unobservable effort in order to increase the value of the alliance (if an alliance is eventually formed) and because there is initially asymmetric information with respect to the productivity potential of the Target in the prospective match, which is better known by the Target but not directly observed by the established partner. In other words, I assume that the Target possesses superior information about the quality of the synergies from joint production with the Bidder. This could be true if, for instance, the Target is the engineer of a new technology, developed potentially by his own start-up company, and therefore is aware of the entrepreneurial environment (offered by a larger and better-established firm) where his technology can be put in its best use. In my model, the big established firm (Bidder) decides on the first stage whether to propose a direct merger or a strategic alliance to the young entrepreneur (Target) upon receipt of a signal about the Target's productive potential. If the Bidder finds optimal the formation of the alliance, then, I take as given that there will be a transfer of ownership from the entrepreneur to the Bidder (equity alliance).[3] The main focus in this study is to identify the circumstances under which it is mutually beneficial to form an alliance when future corporate control is anticipated.

The model predicts that the Bidder will decide to merge in the first stage only if he receives a signal of the true match quality, which is above an endogenous threshold. The choice between the formation of an alliance as opposed to a merger is influenced by the productivity and cost components of the effort exerted by the parties involved in an alliance. An alliance is more likely to occur if either (i) both partners have low costs of effort within the alliance or (ii) their efforts are more productive within the alliance or (iii) if the Target

[1] Krishnaswami et al. (2003) found that it is very likely to observe the selling of an equity block within strategic alliances when one of the partners is a small, high-growth firm but capital constrained

[2] Even though both firms in the example were well established in their markets, DuPont were a lot bigger than Pioneer.

[3] I do not study why there is an equity selling during the formation of the alliance. Mathews (2006; 2007) studies in detail the reasons why firms might want to have a transfer of ownership during an alliance formation.

does not have a better outside option. If the Bidder optimally chooses the option of an equity alliance first, then the model delivers a straightforward decision rule for a merger at the second step: proceed to a merger only if the match quality revealed upon joint production during the alliance exceeds an endogenous threshold. The comparative statics analysis reveals that the Bidder would like to acquire the Target at the second step if the latter has lower outside option, lower cost of effort and weaker first-step signal.

Finally, the model delivers numerous predictions about the impact of the signal of match quality on various aspects of the game. A surprising and interesting result is that the signal is negatively related to the expected payoff of the Bidder from the alliance. The intuition for this result is the following. One of the main reasons for which the Bidder chooses an alliance first is because of the uncertainty about match quality. The stronger the signal, the lower the uncertainty surrounding a prospective direct merger with the Target and hence, the lower the payoff from the formation of the alliance. This intuition also applies to the result that the optimal equity transfer is positively related to the signal. A strong signal implies less uncertainty and increases the desire of the Bidder to buy a greater equity stake of the Target since the probability to move into a full merger is higher. Nevertheless, the relationship between the signal and the price that the Bidder pays for the equity transfer is ambiguous. The optimal stake price is negatively related to the signal only if the contribution (defined as productivity/cost ratio of effort) of the Bidder in the alliance exceeds the contribution of the Target.

This paper contributes to the literature that examines the motives behind strategic alliances. While there is a long standing literature in finance analyzing the potential motives for mergers, there is surprisingly very little work focusing on the determinants of strategic alliances.[4] One plausible explanation could be "a significant overlap in the apparent (or at least stated) motives for corporate mergers and joint ventures" (McConnell and Nantell, 1985). To the best of my knowledge, this is the first study that proposes a motive for the formation of strategic alliances which is completely disjoint from any motivation of forming a merger: in cases when the established Bidder intends to merge with a younger Target but the assessment of the resulting synergies from joint production is initially noisy, the strategic alliance works as an intermediate step to resolve the surrounding uncertainty.

[4]Proposed motives for mergers include, the hubris hypothesis (Roll, 1983), bankruptcy avoidance (Shrives and Stevens, 1979), replacement of inefficient management (Martin and McConnell, 1991), efficient response to industry shocks (Mitchell and Mulherin, 1996), and managerial empire building (Mueller, 1969)

Even though I focus on equity alliances, my analysis is more general and can be applied to non-equity alliances as well. The main idea of the paper, which is the fact that strategic alliances help the resolution of uncertainties regarding the synergies and reveal the degree of compatibility of the two partners, is not affected by any potential transfer of ownership. The reason I focus on equity alliances is twofold. First, anecdotal evidence suggests that in the recent years the percentage of equity alliances relative to non-equity alliances has increased (Margulis and Pekar, 2003). Second, when future merger plans exist, an equity alliance provides stronger foundations that can facilitate a future merger. Mathews (2007) shows that the exchange of equity during the formation of a strategic alliance is an optimal selling mechanism that can help the first bidder and the target to extract surplus from subsequent bidders in a later auction type of merger. While my analysis does not question the type of alliance but instead takes as given the formation of an equity type of alliance, the model yields additional predictions about the optimal equity transfer and stake price.[5]

This paper is organized as follows. In section 2, I review the relevant literature. Section 3 describes the model. Section 4 presents the main results and section 5 analyzes the impact of the observable signal on the optimal stake size transferred to the Bidder and the price he has to pay for this stake. Finally, Section 6 discusses the empirical implications of the model and section 7 concludes.

2 Literature Review

Mergers and alliances are two representative examples of the many ways that firms can combine their resources in order to achieve a joint objective. Although alliances are increasingly common arrangement in U.S. and all over the world, our understanding of what motivates their formation and their valuation effects is limited. Moreover, given the similarities between mergers and alliances, it is not clear under what circumstances two firms would prefer a merger versus an alliance and vice versa.

Mergers became popular very early and was the basic growth strategy for firms in the 60s, 70s and 80s. Almost every decade the US economy experienced a big merger wave and the interesting fact is that every wave was motivated by a different driving force and

[5]Mathews (2006) and (2007) offers two theories that explain the choice of equity alliance vs other types of alliances. My model yields predictions about the optimal equity transfer and transfer price adding up to Mathew's (2007) work.

had different effects. The popularity of mergers as a corporate practice stimulated extensive academic research seeking to understand the motives behind mergers and the wealth effects that resulting from this practice, which were different for every merger wave. Early evidence revealed that mergers create value for the shareholders of the target and the bidder (Dodd and Ruback, 1977; Bradley, 1980; Bradley, Desai and Kim, 1983). But, very soon, it became a stylized fact that only target's shareholders have positive gains in takeovers while bidder's shareholders earn negative abnormal returns or nothing (Jensen and Ruback, 1983; Malatesta, 1983; Andrade, Mitchell and Stafford, 2001). Later studies that focused on the long run performance of mergers start casting doubts on the success of this practice and document a poor post acquisition performance (Loughran and Vijh, 1997; Rau and Vermaelen, 1998). Given that the post-merger performance was not the expected, top executives became sceptical about the effectiveness of mergers and as a result started to consider seriously alliances as an alternative. In contrast to mergers, alliances use the resources of both firms to accomplish a common objective, but the two parent firms retain their distinct identity. In this regard, alliances try to take advantage of the existence of any potential synergies coming from the pooling of resources and the joint production, and at the same time the alliance partners have flexibility by remaining distinct entities. Hence, alliances started to become increasingly popular after the 90s.

One of the first studies about the wealth effects of joint ventures conducted by McConnell and Nantell (1985) who focused on the stock performance of joint ventures using a sample of 136 U.S joint ventures from 1972 -1979. They found positive stock returns around the announcement day and they concluded that joint ventures are wealth-creating transactions for the shareholders of the participating firms. The authors interpreted their findings as synergistic gains coming from the joint production. Chan et al. (1997) studied whether strategic alliances create value for the shareholders of the participating firms. They examined 345 non-equity strategic alliances between 1983 and 1992 which where not organized as joint ventures and they found positive wealth effects for the shareholders of the partnering firms and no evidence of wealth transfer between the firms. Johnson and Houston (2000), focused on joint ventures but they distinguished between between horizontal and vertical joint ventures. Their results revealed different valuation effects for those two distinct types of ventures. For the case horizontal joint ventures they found wealth gains during the announcement period corroborating the synergistic effect findings of McConnell and Nantell

(1985). In the case of vertical joint ventures they found positive wealth gains only for the supplier and not for the buyer. Finally, Allen and Phillips (2000) conducted an empirical analysis on 402 firms with a corporate block owner between 1980 and 1991. They found that there is, on average, a significant increase on target's stock price at the announcement of a purchase of its equity from another corporation. interesting enough this excess stock return for the target firm is larger when the block purchase is accompanied by an alliance between the two firms.

This paper is closely related with the following three theoretical studies about strategic alliances. Mathews (2006) studied the strategic implications of strategic alliances. One of the generally accepted motives behind the formation of strategic alliances is the mutual gain from synergies that an efficient joint production will generate. The synergistic gains though in most cases can be realized only if the alliance partners share technological knowledge or know-how. This transfer of knowledge gives the incentive to the partners to enter and compete in with each others product market. This incentive becomes very strong in the case where a big establish firm forms an alliance with an entrepreneurial firm. Mathews shows that an equity transfer from the entrepreneur to the established partner eliminates the incentive of the established firm to enter and compete in the product market of the entrepreneur.

How the anticipation of a future merger can motivate the sale of an equity block studied by Mathews (2007). In the model, a Target can sell an equity stake to a potential bidder, who can naturally be an alliance partner, before the revelation of the value of the potential merger. This action creates an "optimal" toehold on the behalf of the Bidder who commits to behave more aggressively in a future merger contest. Hence, the Target and the block purchaser can extract surplus from the other contest participants and share it.

Robinson (2008) studied a case on the opposite direction of mine. He proposed and tested a model where a firm can either internally organize a project or pursue it under the umbrella of a strategic alliance. The model/analysis points out the ability of alliances to resolve problems that arise from the fact that certain actions are not contractible, and hence, not enforceable if undertaken within the boundaries of the firm. The headquarters cannot contract with the individual projects/divisions within the firm on the allocation of resources/capital but contracting is a choice when the project is undertaken by two alliance partners. Robinson tested empirically the predictions of his model and he found that alliances are more likely to happen when firms try to expand their portfolio of business for diversification purposes. In other words, rarely a firm would start an alliance on a project in its main line of business. Moreover, strategic alliances are preferred over internally organized projects when the project is on average riskier.

Concluding, this study contributes to the academic debate about the motives behind alliances and the value creation resulting from these transactions. In the section of the empirical applications of my analysis, I discuss the empirically testable predictions of the model and how mergers resulted from strategic alliances are expected to generate synergistic gains.

3 The Model

Consider an established firm and an entrepreneurial firm. The two firms are both *risk neutral*. The established firm is considering acquiring the young firm. The acquisition can be done either in one step, which is to directly make an offer and buy the target, or in two steps. The two-step process is as follows: the established partner can buy a small fraction of the entrepreneur's equity first and form an equity alliance, and then, later can decide whether to fully acquire the entrepreneur or not. The two-step acquisition might end up being more expensive in monetary terms but it comes with some significant benefits[6]. First, within the alliance period, the established partner can learn or discover the match quality between the two firms. A higher match quality will lead to higher payoffs in a subsequent merger. The circulation of information is easier and is more private within the environment that the strategic alliance is offering. This is some times necessary for the success of the alliance (Robinson, 2008; Mathews, 2006). But most importantly an alliance agreement gives the opportunity to the established partner to *incentivize* the entrepreneur to reveal private information that outside a contracting setting would be difficult or impossible to discover. Second, the established partner has the opportunity to exert effort and make the young entrepreneurial firm more compatible. In other words, the established partner can *shape* the young entrepreneurial firm in ways that guarantee higher future synergies. For example, the established firm can push the young firm to focus on R&D programs that complement their technology, can suggest changes in the organization structure and finally can suggest

[6]One can think about it as a real option where you pay a premium to have the option to make your decision later.

cultural changes that bring the two firms closer[7].

The structure and timing of the game are as follows. In the *first stage* of the game the established partner meets the entrepreneurial firm. The partners' true match quality $\theta \in [\underline{\theta}, \overline{\theta}]$ is not immediately observable to the established partner, instead, the established firm receives a signal about the true match quality. The signal $s \in [\underline{\theta}, \overline{\theta}]$ is distributed according to the distribution $F(s)$. Moreover, the established partner forms beliefs $F(\theta|s)$ about the true match quality , which depend on the signal s. Given s, the distribution $F(\theta|s)$ represents the pool of all potential "types" of match quality between the two partners. Moreover, let $\mu(\theta|s) \equiv [1 - F(\theta|s)]/f(\theta|s)$ denote the inverse of the hazard rate of $F(\theta|s)$[8]. Given that the true match quality is unknown to the established partner at stage 1 of the game, his decision between merger versus alliance is based on his beliefs and more precisely the way that the signal affects the distribution of match quality.

Assumption 1 $\partial\mu(\theta|s)/\partial s > 0$ for all θ and s $\in [\underline{\theta}, \overline{\theta}]$

The relationship between the true match quality level θ and the signal of match quality s is critical for my results. Assumption 1 implies that an increase in the match quality signal leads the distribution of unobservable match quality to shift to the right. A simplified way to think about assumption 1 is that the unobservable match quality and the signal are positively related. An example that illustrates my assumption is the following. Before a potential merger, the R&D department or a scientific team from the established firm conduct an assessment of the potential that the proposed merger will have. They analyze how compatible is their own technology with the technology of the entrepreneur, and how the technological input of the entrepreneur can help the established firm achieve its strategic goals. The results of the due diligence are presented to the top management in the form of a report. The more favorable is this report about the potential synergies from the proposed merger, the higher the unobservable match quality should be.

As I mentioned above the distribution $F(\theta|s)$ represents the *beliefs* of the established partner about the distribution of unobservable match quality. It is important to understand the belief structure and how the observed signal affects the established partner's perception of the unobservable match quality. More rigorously, the beliefs have the following structure. If $s_1 < s_2$ are two signals in $[\underline{\theta}, \overline{\theta}]$ then $F(\theta|s_2) < F(\theta|s_1)$ for every $\theta \in [\underline{\theta}, \overline{\theta}]$. This implies

[7]The literature of strategic management has long ago identify cultural differences as one of the most important reasons of merger failures.

[8]In statistics the hazard rate denotes the probability for an event to occur given that this event has occured yet.

that the distribution $F(\theta|s_2)$ first-order stochastically dominates the distribution $F(\theta|s_1)$. Moreover, if $s_1 < s_2$ then $\mu(s_2) \geq \mu(s_1)$ which implies that the distribution under s_2 dominates the distribution under s_1 in terms of the hazard rate. Krishna (2002) shows that dominance in terms of hazard rate implies first-order stochastic dominance. This is how assumption 1 and belief structure are connected.

Assumption 2 $\partial\mu(\theta|s)/\partial\theta \leq 0$ for all θ and s $\in [\underline{\theta}, \overline{\theta}]$

I also assume that the inverse of hazard rate is decreasing in the unobservable match quality. This assumption ensures a separating equilibrium and is standard in mechanism design (Salanie, 2005; Bolton and Dewatripont, 2005). In a separating equilibrium the higher the match quality is, then, the less the Target will give as a transfer to the Bidder from his own equity. This assumption is not very restrictive. If a density function f is log-concave then assumption 2 is satisfied and this distribution has a decreasing inverse hazard rate (Bagnoli and Bergstrom,2005). The majority of the popular density functions are log-concave and hence satisfy assumption 2. Examples of distributions with log-concave density functions include: the normal, the exponential, the logistic, the Beta and the Gamma.

After receiving the signal s in the first stage, the established firm has to decide whether to acquire the entrepreneurial firm or not. In the case where the established Bidder acquires the young Target, he will receive the following payoff

$$U_m^B(\theta|s) = E[\theta|s] \tag{1}$$

where $\frac{\partial E[\theta|s]}{\partial s} > 0$. Given Assumption 1, that the signal is positively correlated with the true match quality, when the two firms merge in the first stage the utility of the Bidder is increasing in the observed signal. Of course, Bidder's utility in the case of merger in the first stage is increasing in the unobservable match quality, i.e $\partial E[\theta|s]/\partial\theta > 0$. Therefore, the Bidder's payoff if he acquires immediately the Target is a function which is increasing in both arguments, the signal and the true match quality.

If the established partner chooses to form a strategic alliance first, then the game proceeds to the *second stage*. The alliance is formed by both partners signing a contract. After the agreement the joint production starts. Let y denote the market value of the young entrepreneurial firm after the formation of the alliance

$$y(e_B, e_T, \theta) = \lambda\theta + \delta_T e_T + \delta_B e_B + \epsilon \tag{2}$$

where e_T is the unobservable effort the Target exerts to increase its market value, and e_B is the unobservable effort that the Bidder exerts to make the Target more valuable as a merger partner. Given that y is the value of Target inside the alliance, the more effort the Bidder exerts and the more compatible the Target becomes, the more valuable the Target becomes as a merger partner and consequently that increases Target's value. Moreover, $\delta_T \geq 0$ and $\delta_B \geq 0$ are the sensitivities of Target's market value to the effort of the Target and the effort of the Bidder, respectively. $\lambda \geq 0$ is the sensitivity of Target's market value to the match quality θ. The match quality affects the value of the Target because after the formation of the alliance there is active collaboration and joint production between the two alliance partners. Finally, ϵ is a stochastic disturbance of the Target's value which is distributed normally with mean zero and variance σ^2.

In general equation (2) can be thought as the outcome of some joint production between the two alliance partners. The inputs in this "production function" are additively separable which implies perfect substitutability among the inputs. This is a standard assumption in the agency literature (Laffont and Tirole, 1993; Bernardo, Cai and Luo, 2001; Dutta, 2008).In my setting, the assumption of perfect substitutability among the inputs could be interpreted the following way; if the match quality θ between the firms is low then the two partners can make up for it by exerting more effort, either one of the two or both of them simultaneously.

The contract has the form of a "take-it-or-leave-it" offer and is given by the established partner to the entrepreneur. After the uncertainty is resolved and players choose their efforts, then the contract is signed. The decision is made based on the true match quality.

The contract signed in order to form the alliance is specified by the following expression: $\mathcal{W} = (q(\theta|s), t(\theta|s), e_T(\theta|s), e_B(\theta|s), \hat{\theta}(s))$. Let $e_T(\theta|s)$ and $e_B(\theta|s)$ denote the Target's effort and Bidder's effort respectively, as functions of the the match quality and the signal. Let $\hat{\theta}$ denote the endogenous threshold level of match quality above which the Target is accepted for merger. The mechanism $q(\theta|s)$ represents the equity percentage that the Target keeps in the equity alliance and $1 - q(\theta|s)$ represents the equity transfer from the Target to the Bidder. In exchange for the equity transfer, the Bidder gives the Target a monetary transfer $t(\theta|s)$. In other words, $1 - q(\theta|s)$ and $t(\theta|s)$ represent the stake size and the stake's price respectively in the case of an equity alliance. The contact is contingent on the signal s because the Bidder first observes the signal and then decides whether to enter the alliance or not. The Bidder's beliefs and inferences are based on the observed signal.

The contract is designed in such a way that compels the Target to exert the desired effort (Incentive Compatibility), to truthfully reveal his private information about the unobservable match quality (Truth Telling) and voluntarily to sign the contract (Individual Rationality).By virtue of the revelation principle (Myerson 1979), the Bidder can restrict his attention to truthful mechanisms in which the message space is restricted to be the private information possessed by the Target.

The Target's reservation utility is assumed to be r. This is the outside option of the Target or the value of the next best offer that forgoes in order to proceed with the alliance. It may be interpreted as the value of the Target as a stand alone firm or the value of the Target in a merger with the next highest value Bidder.

The assumption that the big establish company has all the bargaining power is reasonable. In reality in many instances the young entrepreneurial firms are acquired in early stages of their lives with almost zero bargaining power they usually receive a take-it-or-leave-it offer from an established firm in their industry. The assumption that the young entrepreneur has superior and private information about the match quality is also reasonable. It is very typical that entrepreneurs who develop new technologies used to work for a big established company before establishing a start-up company. It is also true that many of those entrepreneurs came up with their project idea when they were working in the R&D department of a big established company and decided to pursue this project on their own instead of pursuing it within the boundaries of their previous employer. Gromb and Scharfstein (2002), and, Ambec and Poitevin (2001) model this scenario where a new R&D project can be developed within an established firm or within a start-up.

3.1 The Payoff Functions

The established partner/Bidder has the following payoff function inside the Alliance

$$U^B(\theta|s) = (1 - q(\theta|s))y(e_T(\theta|s), e_B(\theta|s), \theta) - t(\theta|s) - c_B e_B(\theta|s)^2/2 \tag{3}$$

The cost of effort that the Bidder exerts to "shape" the Target is measured according the cost function $C(e_B) = c_B e_B^2/2$.

The entrepreneur/Target has the following payoff function inside the Alliance

$$U^T(\theta|s) = q(\theta|s)y(e_T(\theta|s), e_B(\theta|s), \theta) + t(\theta|s) - c_T e_T(\theta|s)^2/2 \tag{4}$$

The Target's effort cost function is $C(e_T) = c_T e_T^2/2$. The choice of the effort cost function is in accordance the literature. This convex in effort cost function is standard in the agency literature (Bernardo, Cai and Luo, 2001; Raith 2003; Dutta, 2008).

Assumption 3 $\frac{\delta_T^2}{c_T} - \mu(\theta|s)\lambda \geq 0$ for all θ and s $\in [\underline{\theta}, \overline{\theta}]$

Assumption 3 ensures that the optimal equity share for the Target is non-negative.

4 Equity alliances and Corporate Control

I solve for the subgame perfect Nash equilibrium (SPNE) of the game. I start by solving stage 2 of the game and continue with backwards.

4.1 Stage 2: The decision of the Bidder to Acquire the Target

In stage 2, the Bidder proposes an equity alliance to the Target. The structure of the game in the second stage is as follows. The formation of the equity alliance starts with a contract between the Bidder and the Target that dictates what percentage of the market value of the Target will be transferred to the Bidder q, the monetary value of this transfer t, the effort that the Bidder should exert e_B, the effort that the Target should exert e_T. Once truthful revelation of the match quality has occurred the Bidder has also to decide whether to accept or reject the Target according to the threshold match quality level $\hat{\theta}$ which has also been devised by the Bidder. In the model I assume that there are not negotiations between the two counter parties but instead,the Bidder makes a "take-it-or-leave-it" offer to the Target. That approach allocates all the bargaining power to the Bidder and might seem a little extreme, but in fact, it is a very common assumption. In the Principal-Agent literature usually studies allocate all the bargaining power to the Principal (Dutta, 2008) or in some cases to the Agent (Gibbons and Murphy, 1992). Moreover, in my setting this assumption is reasonable since the Bidder is assumed to be a big established firm and the Target is assumed to be a young entrepreneurial firm.

The Bidder designs a menu of contracts which is tailored towards every possible match quality level that the target might have with the bidder. The menu of contracts is designed in such a way that the Target will find more attractive for him this contract that corresponds to truthful revelation of the match quality. Therefore, by self selecting into a specific contract from the menu, the Target reveals to the Bidder the true match quality level. On the one hand, the contract is designed to reveal the truth to the Bidder about Target's private information. On the other hand, it specifies the optimal levels of equity and monetary transfers as well as the the optimal effort levels and cutoff match quality level.

After the Target has revealed the true match quality to the Bidder, the Bidder decides whether to proceed with a merger or not. Given that he is endowed with all the power, he can simply reject the Target if the match quality is not high enough to ensure enough profits in a potential merger. The decision making as far as the merger is concerned is based on the following procedure. Without loss of generality, Bidder's reservation utility is zero and there is a threshold match quality level that leaves him with zero profit, which is how the Bidder implicitly derives this threshold rule. After both, Bidder and Target, have exerted the optimal levels of effort to increase the market value of the Target y, and the Target has truthfully reveal the match quality level, the Bidder will consider a merger only if the match quality level results in positive profit for him.

The threshold level represents the absolutely minimum match quality that is necessary for the Bidder in order to proceed with a merger. Higher match quality level results in higher synergies in the case of a potential merger. The positive relationship between match quality and merger synergies makes the Target desirable at an increasing rate as the match quality level rises. This is also the reason why the Target is able to extract more informational rent as his match quality level rises. Summarizing, at the end of the period and having the uncertainty resolved the Bidder decides whether to propose a merger or not based on the true match quality level.

4.2 The Bidder's Mechanism Design Problem

The Bidder's objective is to maximize his own expected profit from contracting with the potential Target. Given that match quality affects Bidder's utility and it is unobservable to him, at his program, the Bidder averages across the distribution of match quality $F(\theta|s)$. If the Target has match quality below the endogenous threshold $\hat{\theta}(s)$, he will be rejected by the Bidder and the intended acquisition will not take place. The immediate implication of this is that the Bidder will average across the acceptable levels of match quality.

$$\max_{\{q(\theta|s),t(\theta|s),e_T(\theta|s),e_B(\theta|s),\hat{\theta}(s)\}} \int_{\hat{\theta}(s)}^{\bar{\theta}} E[(1-q(\theta|s))y(e_T(\theta|s),e_B(\theta|s),\theta)-t(\theta|s)-\frac{c_B e_B(\theta|s)^2}{2}]dF(\theta|s) \tag{5}$$

Target's Individual Rationality Constraint (IR)

$$q(\theta|s)y(e_T(\theta|s),e_B(\theta|s),\theta|s)+t(\theta|s)-\frac{c_T e_T(\theta|s)^2}{2} \geq r \ \ for \ \ all \ \ \theta \in [\hat{\theta}(s),\bar{\theta}] \tag{6}$$

Target's Incentive Compatibility Constraint (IC_T)

$$e_T = \underset{\tilde{e_T}}{argmax} \ \ q(\theta|s)y(e_T(\theta|s),e_B(\theta|s),\theta)+t(\theta|s)-\frac{c_T e_T(\theta|s)^2}{2} \ \ for \ \ all \ \ \theta \in [\hat{\theta}(s),\bar{\theta}] \tag{7}$$

Bidder's Incentive Compatibility Constraint (IC_B)

$$e_B = \underset{\tilde{e_B}}{argmax} \ \ (1-q(\theta|s))y(e_T(\theta|s),e_B(\theta|s),\theta)-t(\theta|s)-\frac{c_B e_B(\theta|s)^2}{2} \ \ for \ \ all \ \ \theta \in [\hat{\theta}(s),\bar{\theta}] \tag{8}$$

Target's Truth Telling Constraint (TT)

$$q(\theta|s)y(e_T(\theta|s),e_B(\theta|s),\theta)+t(\theta|s)-\frac{c_T e_T(\theta|s)^2}{2} \geq$$

$$q(\tilde{\theta}|s)y(e_T(\tilde{\theta}|s),e_B(\tilde{\theta}|s),\theta|s)+t(\tilde{\theta}|s)-\frac{c_T e_T(\tilde{\theta}|s)^2}{2} \ \ for \ \ all \ \ \theta,\tilde{\theta} \in [\hat{\theta}(s),\bar{\theta}] \tag{9}$$

The Bidder's program averages across the acceptable levels of match quality θ. Even though the distribution of match quality start with lowest possible level of match quality be $\underline{\theta}$, if the Target has any level of match quality between $\underline{\theta}$ and $\hat{\theta}(s)$ will be rejected. Therefore the only levels of match quality considered by the Bidder for a potential merger are all the levels beyond the threshold level $\hat{\theta}(s)$.

4.3 The Optimal Alliance Contract

The solution of the mechanism design problem is described in the following lemma

Lemma 1 *(Solution to the Mechanism Design Problem)*

The optimal effort exerted by the Bidder is

$$e_B(\theta|s) = \frac{\delta_B^2 + c_B\lambda\mu(\theta|s)}{\delta_B^2 + \frac{c_B}{c_T}\delta_T^2}\frac{\delta_B}{c_B} \tag{10}$$

The optimal effort exerted by the Target is

$$e_T(\theta|s) = \frac{\delta_T^2 - c_T\lambda\mu(\theta|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2}\frac{\delta_T}{c_T} \tag{11}$$

The optimal equity share for the Target is

$$q(\theta|s) = \frac{\delta_T^2 - c_T\lambda\mu(\theta|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2} \tag{12}$$

The optimal equity transfer to the Bidder is

$$1 - q(\theta|s) = \frac{\delta_B^2 + c_B\lambda\mu(\theta|s)}{\delta_B^2 + \frac{c_B}{c_T}\delta_T^2} \tag{13}$$

The optimal monetary transfer is

$$t(\theta|s) = \lambda\int_{\hat{\theta}(s)}^{\theta}\frac{\delta_T^2 - c_T\lambda\mu(z|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2}dz + r + (\frac{\delta_B^2}{c_B} - \frac{\delta_T^2}{2c_T})(\frac{\delta_T^2 - c_T\lambda\mu(\theta|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2})^2 - (\lambda\theta + \frac{\delta_B^2}{c_B})\frac{\delta_T^2 - c_T\lambda\mu(\theta|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2} \tag{14}$$

The expected value of the Target is

$$E[y(\theta|s)] = \lambda\theta + \frac{\delta_B^2}{c_B} + (\frac{\delta_T^2}{c_T} - \frac{\delta_B^2}{c_B})\frac{\delta_T^2 - c_T\lambda\mu(\theta|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2} \tag{15}$$

The expected payoff or profit for the Bidder is

$$U^B(\theta|s) = \frac{(\delta_T^2 - c_T\lambda\mu(\theta|s))^2}{2c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)} + \lambda\theta + \frac{\delta_B^2}{2c_B} - r \tag{16}$$

The unique screening threshold of unobservable match quality $\hat{\theta}(s)$ is defined implicitly by the following equation

$$\frac{(\delta_T^2 - c_T \lambda \mu(\hat{\theta}(s)|s))^2}{2c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)} + \lambda\hat{\theta}(s) + \frac{\delta_B^2}{2c_B} - r \equiv 0 \tag{17}$$

Proof: Please see Appendix

Lemma 1 shows that the model exhibits some basic properties of agency theory. Firstly, the "sorting mechanism", which in my case is the equity share that the Target keeps inside the equity alliance $q(\theta|s)$, is increasing in the unobservable match quality θ. This result is ensured by assumption 2 and equation (31) shows that it is required to ensure that the Target truthfully reveals the unobservable match quality to the Bidder. Secondly, the Bidder is strictly better off by having superior match quality with his alliance partner. Bidder's payoff inside the alliance, $U^B(\theta|s)$, in increasing in the unobservable match quality θ, a result which is also holds due to assumption 2.

The purpose of forming an alliance is to give the opportunity to the Bidder to learn the unobservable match quality before a potential merger proposal. Knowing the true match quality and based on his interaction with the Target, the Bidder can accurately estimate the synergies that will result from a potential merger. The payoff of the Bidder outside this relationship is zero. Hence, the threshold level of unobservable match quality is obtained by setting the Bidder's payoff inside the alliance (virtual surplus) $U^B(\theta|s)$ equal to zero. If the match quality level is not high enough in order to imply a positive payoff, the Bidder is endowed with the power to reject the Target. As I showed above the Bidder is always better off when the Target has superior level of match quality. This result generates a straight forward decision rule for the Bidder as far as the final merger decision is concerned: the Bidder will propose a merger to the Target only if the revealed match quality level is above the endogenous threshold level that makes the Bidder's payoff zero. In the case where the Target has low level of match quality and lies below the endogenous threshold level no merger proposal will occur.[9] The properties of the endogenous threshold level $\hat{\theta}(s)$ are presented in the following proposition.

Proposition 1 *The unique threshold of level of unobservable match quality $\hat{\theta}(s)$ is*

- *increasing in the signal s, the Target's outside option r, the Target's cost of effort c_T, the Bidder's cost of effort c_B and the inverse of hazard rate $\mu(\theta|s)$.*

[9] In the extreme case where the threshold level $\hat{\theta}(s)$ is so high that exceed the maximum possible match quality level $\overline{\theta}$, then the Bidder proposes no merger.

- *decreasing in the sensitivity of Target's market value to Target's effort δ_T and the sensitivity of Target's market value to Bidder's effort δ_B.*

Proof: Please see Appendix

If it is costly for the Target to increase its value during the period of the alliance then the Bidder will require a higher match quality to offset this difficulty. As the cost of Target's effort increases the more "selective" the Bidder becomes when it comes to the decision whether to propose a merger. Therefore, the higher is the cost of effort for the Target the higher the synergies required by the Bidder for a merger. The same intuition applies in the case of Bidder's effort. The Bidder supplies the alliance with productive effort that aims to shape the Target and make him more compatible with his technologies and culture. If this procedure is costly then in order to proceed to merger, the Bidder will require higher levels of match quality to ensure a positive payoff from the merger.

The opposite happens with the sensitivity of Target's market value to the Target's effort. If every unit of effort is more productive, then lower match quality is required in order to be accepted for a merger. Again, the same intuition applies for the negative relationship between the match quality threshold and the sensitivity of Target's market value to the Bidder's effort. The results in proposition 2 rely on the assumption that match quality and effort are perfectly substitutable. This implies that higher effort can make up for lower levels of match quality. These results are very intuitive. The effort that the Target supplies the alliance increase its market value and therefore, make him more attractive to the Bidder. Taking one step further this can be a proxy for the productive effort that the Target can supply after a merger. If the Target's market value is very sensitive to Target's effort then lower match quality might be enough to generate a desirable level of market value. The interpretation of effort is important here. During the alliance period the effort increases the value of the Target itself. After a merger the effort will increase Target's output within the merger whatever this output is.

The inverse of hazard rate captures the degree by which the virtual surplus differs from the social surplus. The virtual surplus is represented by the Bidder's objective and therefore, the inverse of hazard rate measures the degree of information problems. The more severe the adverse selection problem, the higher is the acceptable level of match quality for a merger. Because the Bidder's payoff from the alliance is increasing in the match quality level (i.e $\partial U^B(\theta|s)/\partial\theta > 0$), when the adverse selection problem becomes more severe, as it is measured by the inverse of hazard rate, a superior match quality is needed in order the Bidder to achieve the same payoff.

4.4 Stage 1: The Decision of the Bidder to Enter an Alliance

Inside the alliance and after contracting the Bidder receives utility $U^B(\theta|s)$.

Proposition 2 *The expected payoff of the Bidder inside the equity alliance $U^B(\theta|s)$ is decreasing in the signal s.*

Proof: Please see Appendix

This is a surprising result. It implies that the signal s has a negative effect on the expected payoff of the Bidder. Given the positive relationship between the signal and the distribution of the true match quality, it seems counter intuitive that a stronger signal reduces Bidder's utility in equilibrium. In the model this result comes from the fact that the inverse of hazard rate has a negative impact on the equilibrium expected payoff. The inverse of hazard rate measures the extend of the information problem between the two firms and summarizes all the information about the relationship between the signal and the true match quality. A higher signal implies a higher expected match quality between the two partners, and therefore, there is less uncertainty about the match quality. As a result the Bidder buys a bigger stake of the Target and the benefit from forming an alliance is smaller. The main reason for the Bidder to form a strategic alliance when he has merger plans in mind is to reduce the uncertainty about the match quality. As the uncertainty falls the learning benefit coming from the alliance reduces.

Proposition 3 *There exists a unique threshold level for the signal, $\hat{s}$.*

- *if $s < \hat{s}$, the Bidder will propose an alliance.*
- *if $s > \hat{s}$ the Bidder will propose directly a merger.*

Proof: Please see Appendix

Proposition 3 provides a simple decision rule for the Bidder who receives signal about the unobservable match quality and has to make a decision whether to acquire the Target or not. The intuition of this proposition has as follows. The signal is positively correlated with the true match quality and as I mentioned above higher realizations of the signal reveal higher potential realizations of the unobservable match quality and consequently reduce the uncertainty involved with the merger. Therefore, when the Bidder receives a signal that is strong enough in the sense that it lies above the threshold level $\hat{s}$, the optimal decision is to propose a merger directly. When the signal is weak and lies below the the threshold level $\hat{s}$, the utility of the Bidder from being a partner with the Target inside an alliance increases (proposition 2), and hence, the optimal decision for the Bidder is to propose an alliance and postpone the merger decision until later when the uncertainty about match quality will have been resolved.

Proposition 4 *The unique threshold of level of signal of match quality $\hat{s}$ is*

- *increasing in the sensitivity of Target's market value to Bidder's effort δ_B, sensitivity of Target's market value to Target's effort δ_T*
- *decreasing in the Target's cost of effort c_T, the Bidder's cost of effort c_B, and the Target's outside option r*

Proof: Please see Appendix

Proposition 4 how the decision rule $\hat{s}$ is affected by the parameters of the model. Target's market value sensitivities of effort δ_B and δ_T imply that the effort that the Bidder and the Target exert inside the Alliance in order to increase the value of the Target are more "productive". Therefore it is optimal to form an Alliance first increase the value of the Target by exerting effort and then acquire the Target. Higher sensitivities of effort (shift the equilibrium utility of the Bidder $U^B(.)$ to the right and hence shift the optimal cutoff signal level $\hat{s}$ to the right) lead to higher equilibrium utility for the Bidder inside the alliance

5 The Effects of the Signal on Stake Size and Stake Pricing

In this section I analyze the model's predictions for the equilibrium stake size and the equilibrium transfer price for this stake. As I show above, the formation or not of the equity alliance depends on whether the signal of match quality is strong enough. Because the impact of the signal is critical for the formation of the equity alliance, in this section I focus my attention on how the optimal stake and price are affected by the existence of the signal that the Bidder observes in the first stage. The following analysis reveals the direct implications of the observed signal on the optimal stake size that the Bidder buys and the transfer price that he pays for it. My results in this section complement the work of Mathews (2006; 2007) on optimal stake size and pricing in equity alliances.

5.1 The Impact of the Signal on Optimal Stake's Size

Proposition 5 *The optimal equity stake* $1 - q(\theta|s)$ *is increasing in the observable signal* s

Proof: Please see Appendix

The stronger or the more favorable the signal is about the potential synergies the less equity the Target keeps and the more he transfers to the Bidder. This might seem counter intuitive in the first glance but a closer look would make it clear. A stronger signal means that the Target is very attractive to the Bidder, therefore, the bidder wants to buy more now since the there is less uncertainty. This is consistent with the main idea of this paper which motivates the formation of equity alliance when there are corporate control plans. According to my analysis it is optimal to form an equity alliance when the signal is below the threshold level or low enough. A stronger signal denotes less uncertainty and therefore it seems more likely to move into a merger when the uncertainty is fully resolved under the alliance umbrella. In other words, as the signal becomes stronger the Bidder buys more equity from the Target and the "two-steps" acquisition approaches the case of "one-step" acquisition. This result is in accordance with Mathews (2007) who found that the equity stake which is transferred to the Bidder is increasing in the probability of a takeover.

Proposition 6 *The optimal equity stake* $1 - q(\theta|s)$ *is*

- *increasing in the cost of Target's effort* c_T*, the sensitivity of Target's market value to Bidder's effort* δ_B*, the sensitivity of Target's market value to the unobservable match quality* λ*.*
- *decreasing in the cost of Bidder's effort* c_B*, the sensitivity of Target's market value to Target's effort* δ_T*.*

Proof: Please see Appendix

Proposition 6 summarizes how the parameters of the model affect the optimal equity transfer from the Target to the Bidder in the case where they form an equity alliance. Intuitively one would expect that the costlier it is for the bidder to increase the value of the Target within the alliance the less equity he would like to buy at the beginning. Similarly, if Bidder's effort to increase Target's value is very "productive" the more equity the Bidder would like to buy upfront. In order to interpret the rest of the results it would be more intuitive to look at them from the Target's point of view. More precisely, on the one hand, the more costly it is for the Target to increase his own value within the alliance the more equity he is willing to give to the Bidder. On the other hand the easier it is for the Target to increase his own value through effort the less equity he is willing to give up.

5.2 The Impact of the Signal on Optimal Stake's Price

In this subsection, I derive results for the pricing of the equity stake and more specifically how the observed signal affects the price paid by the Bidder for the equity stake transfer.

Proposition 7 *If* $\frac{\delta_B^2}{c_B} - \frac{\delta_T^2}{2c_T} > \frac{u^T(\theta|s) - t(\theta|s)}{q^2(\theta|s)}$*, then, the optimal monetary transfer for the equity stake* $t(\theta|s)$ *is decreasing in the signal* s*. Otherwise, the optimal transfer can be either increasing or decreasing.*

Proof: Please see Appendix

The term $\frac{u^T(\theta|s) - t(\theta|s)}{q^2(\theta|s)}$ represents Target's net profit normalized by the equity share he holds. The above condition implies that if the importance of Bidder's contribution is big enough relative to the importance of Target's contribution, or bigger than the normalized net profit, then the signal has a negative impact on the transfer price. The intuition of this result is the following. After forming a strategic alliance the two partners work together but they both have in mind that this joint project might end up into a merger. Bidder's effort increase the value of the Target and in the case of a subsequent merger the Target can be sold in a higher price. If the importance of Bidder's effort is much higher than that of Target's effort, the Bidder actions will determine heavily the value of the Target as a merger partner. Therefore, as the signal increases and the possibility of a merger becomes higher, the Target's management would like the Bidder to put the effort and increase the value of the Target firm because this will result into a better selling price for the Target's shareholders. In other words the Target sells a block of shares to the Bidder at a lower price as the probability of the merger increases because the effort of the Bidder is important in determining the value of the Target in the market for corporate control.

If the above condition does not hold the the power of the Bidder might still be higher than the power of the Target but not high enough to imply a negative relationship between t and s. Under certain circumstances the Bidder might buy the block cheaper or more expensive as the the signal becomes stronger. A possible scenario is the following. Barclay and Holderness (1989) found that blocks of common stocks are usually sold at a substantial premium. Their explanation for this finding is that blockholders, especially if they hold a large block, can use their voting power in order to push for some corporate decisions to their benefit.Following this reasoning, then, the more equity a blockholder buys the more power he has and, hence, the higher the premium he should pay. As proposition 5 shows the signal increases the amount of equity that the Bidder would like to buy, and therefore, we should expect it will increase the price the Bidder pays. This reasoning is supported by the model but only if the importance of Bidder's effort is not much higher than that of Target's effort.

6 Empirical Implications

This paper models how the firms can decide optimally whether to form a merger or an alliance and derives a set of empirical implications that can be tested in future research. First, the model predicts that, in the case where two firms form a strategic alliance, the Bidder would proceed in a merger only if the expected synergies are high enough after the truthful revelation of the match quality between the Bidder and the Target. This result clearly implies that the management of the Bidding firm needs to be very confident about the success of the merger under consideration and reveals to the market the high expectation for the merger's future performance. Therefore, mergers which are formed as a result of a successful strategic alliances should perform well in the long run and therefore, the long-run abnormal returns for acquirers of previously allied partners should be positive. This hypothesis is empirically testable and might shed some light on the puzzle of acquirer's post-merger underperformance. For example, Rau and Vermaelen (1998) argued that the market extrapolates the good past performance of low book-to-market acquirers and overvalues these mergers which in turn underperform in the long run.

Second, there is considerable evidence that the acquirer's shareholders are losing or at least do not gain around the merger announcement day (Andrade et al., 2001). According to my analysis, a merger announcement after a successful alliance signals strong synergies between the two partners that can be better realized under common management and ownership. In an efficient capital market environment, stock prices adjust quickly in order to incorporate any new information about the expected value of a merger. Hence, the high management expectations about the merger should be reflected in higher cumulative abnormal returns around the announcement day for the Bidder. This is another empirically testable hypothesis that can help us understand where the gains from mergers are coming from. So far, the literature supports the idea that mergers create value which mostly accrues to the Target. One of the main explanations that have been proposed for this finding is that a merger bid reveals bad projects but good management for the Bidder and good projects but bad management for the Target (Jovanovic and Braguinsky, 2004).

Third, the model provides many other empirically testable hypotheses that can serve as guide for future empirical studies. In equity alliances the model predicts a positive association between the equity share transferred to the bidder and the expected synergies. In equity alliances, if the Bidder's bargaining power is sufficiently high, then a negative association between the expected synergies and the price the Bidder pays for the equity block will emerge.

7 Conclusion

In this paper I show that an equity alliance can be motivated by corporate control intentions when the assessment of match quality and subsequent merger synergies is difficult. In a highly volatile business environment, the decision of a merger requires a big commitment. Given that this commitment entails a lot of risk, it might be optimal for the bidding firm to propose and form an equity alliance as an intermediate step in order to reduce the uncertainties that surround the merger. Inside the more flexible environment of an equity alliance, information asymmetries due to adverse selection can be resolved and both partners can exert effort to increase the value of the intentioned future merger.

Using a simple agency model with moral hazard and adverse selection, this paper is the first to provide a theoretically founded rationale for the formation of equity alliances, which is completely disjoint from the motives for mergers. My analysis reveals that the signal of the unobservable match quality between the Bidder and the Target has some important implications. Surprisingly, even though the latter is *positively* related to the true match quality, it *reduces* the Bidder's payoff inside the alliance. The purpose of the formation of an equity alliance is to reduce the uncertainty about the merger. The stronger the signal, the lower the uncertainty and consequently the lower the value of the alliance. For the same reason, the signal is positively related to the size of the equity stake transferred to the Bidder. A strong signal implies a higher probability of transition to a merger later on and, hence, the Bidder acquires a higher equity stake during the formation of the equity alliance and the initiation of the official cooperation and joint production. As far as the pricing of the equity block is concerned, the impact of the signal is ambiguous. The transfer price of the equity block can be increasing or decreasing in the signal depending on the relative power or importance of the Bidder and the Target in the joint production. Therefore, the pricing decision of the equity sale during an alliance initiation is mostly affected by other factors and by the match quality signal.

Finally, the model provides numerous empirical hypotheses which will be tested in a follow-up paper. More precisely, it would be interesting to test whether the stock market reacts positively in a merger announcement, which is the result of a successful alliance. Moreover, the model predicts a good post-merger performance for mergers stemming from successful alliances. Testing the long run-performance of the acquirer might be particularly helpful to understand the post-merger underperformance puzzle. Another promising venue of future research is the analysis of the determinants of the toehold size and of the way this affects the announcement returns.

A Proofs

Proof of lemma 1

The bidder's *effort* problem

The Bidder chooses his effort level in order to maximize his own utility.

$$\max_{\tilde{e}_B} \; [1-q(\theta|s)](\lambda\theta + \delta_T e_T + \delta_B \tilde{e}_B) - t(\theta|s) - \frac{c_B \tilde{e}_B^2}{2} \tag{18}$$

$$FOC(\tilde{e}_B): \quad [1-q(\theta|s)]\delta_B = c_B e_B(\theta|s) \tag{19}$$

which implies the following *optimal effort policy* for the Bidder

$$e_B(\theta|s) = \frac{[1 - q(\theta|s)]\delta_B}{c_B} \tag{20}$$

The SOC is satisfied.

<u>The target's *effort* problem</u>

The Target chooses his effort level in order to maximize his own utility.

$$\underset{\tilde{e}_T}{max} \;\; q(\theta|s)(\lambda\theta + \delta_T\tilde{e}_T + \delta_B e_B) + t(\theta|s) - \frac{c_T\tilde{e}_T^2}{2} \tag{21}$$

$$FOC(\tilde{e}_T): \;\; q(\theta|s)\delta_T = c_T e_T(\theta|s) \tag{22}$$

which implies the following *optimal effort policy* for the Target

$$e_T(\theta|s) = \frac{q(\theta|s)\delta_T}{c_T} \tag{23}$$

The SOC is satisfied.

<u>The Target's *message* problem</u>

Let $U^T(\theta, \tilde{\theta}|s)$ be the Target's utility that has match quality θ with the Bidder but he announces match quality $\tilde{\theta}$. The Target will announce match quality level $\tilde{\theta}$ that maximizes his utility:

$$U^T(\theta, \tilde{\theta}|s) = q(\tilde{\theta}|s)(\lambda\theta + \delta_T e_T(\tilde{\theta}|s) + \delta_B e_B(\tilde{\theta}|s)) + t(\tilde{\theta}|s) - \frac{c_T e_T(\tilde{\theta}|s)^2}{2} \tag{24}$$

Differentiating Target's utility with respect to the message $\tilde{\theta}$ I get

$$\frac{\partial U^T(\theta, \tilde{\theta}|s)}{\partial\tilde{\theta}} = q'(\tilde{\theta}|s)(\lambda\theta + \delta_T e_T(\tilde{\theta}|s) + \delta_B e_B(\tilde{\theta}|s)) + q(\tilde{\theta}|s)(\delta_T e'_T(\tilde{\theta}|s) + \delta_B e'_B(\tilde{\theta}|s))$$

$$+t'(\tilde{\theta}|s) - c_T e_T(\tilde{\theta}|s)e'_T(\tilde{\theta}|s) \tag{25}$$

Applying the FOC of Target's effort problem the above derivative becomes

$$\frac{\partial U^T(\theta,\tilde{\theta}|s)}{\partial\tilde{\theta}} = q'(\tilde{\theta}|s)(\lambda\theta + \delta_T e_T(\tilde{\theta}|s) + \delta_B e_B(\tilde{\theta}|s)) + t'(\tilde{\theta}|s) + q(\tilde{\theta}|s)\delta_B e_B'(\tilde{\theta}|s) \tag{26}$$

In order truth-telling to be optimal, I need the FOC of the message problem to hold at the truth point, i.e $\tilde{\theta} = \theta$. Therefore, I have

$$\left.\frac{\partial U^T(\theta,\tilde{\theta}|s)}{\partial\tilde{\theta}}\right|_{\tilde{\theta}=\theta} = q'(\theta|s)(\lambda\theta + \delta_T e_T(\theta|s) + \delta_B e_B(\theta|s)) + t'(\theta|s) + q(\theta|s)\delta_B e_B'(\theta|s) = 0 \tag{27}$$

The second derivative of Target's utility is

$$\frac{\partial^2 U^T(\theta,\tilde{\theta}|s)}{\partial\tilde{\theta}^2} = q''(\tilde{\theta}|s)(\lambda\theta + \delta_T e_T(\tilde{\theta}|s) + \delta_B e_B(\tilde{\theta}|s)) + q'(\tilde{\theta}|s)(\delta_T e_T'(\tilde{\theta}|s) + \delta_B e_B'(\tilde{\theta}|s))$$

$$+t''(\tilde{\theta}|s) + q'(\tilde{\theta}|s)\delta_B e_B'(\tilde{\theta}|s) + q(\tilde{\theta}|s)\delta_B e_B''(\tilde{\theta}|s) \tag{28}$$

For truth telling the SOC of Target's message problem should hold at the truth point, i.e $\tilde{\theta} = \theta$. Therefore, I have

$$\left.\frac{\partial^2 U^T(\theta,\tilde{\theta}|s)}{\partial\tilde{\theta}^2}\right|_{\tilde{\theta}=\theta} = q''(\theta|s)(\lambda\theta + \delta_T e_T(\theta|s) + \delta_B e_B(\theta|s)) + q'(\theta|s)(\delta_T e_T'(\theta|s) + \delta_B e_B'(\theta|s))$$

$$+t''(\theta|s) + q'(\theta|s)\delta_B e_B'(\theta|s) + q(\theta|s)\delta_B e_B''(\theta|s) \leq 0 \tag{29}$$

The FOC should hold for every match quality level θ. That makes the FOC an identity and I can differentiate it with respect to match quality θ. Hence, I have:

$$q''(\theta|s)(\lambda\theta + \delta_T e_T(\theta|s) + \delta_B e_B(\theta|s)) + q'(\theta|s)(\lambda + \delta_T e_T'(\theta|s) + \delta_B e_B'(\theta|s))$$

$$+t''(\theta|s) + q'(\theta|s)\delta_B e_B'(\theta|s) + q(\theta|s)\delta_B e_B''(\theta|s) = 0 \tag{30}$$

Applying the above equation to the SOC of Target's message problem we get the following condition

$$q'(\theta|s)\lambda \geq 0 \tag{31}$$

The above result implies that the mechanism $q(\theta|s)$ should be increasing in unobservable match quality θ for truthful revelation. This result is standard in the literature of Adverse Selection (Salanie, 2005). I continue solving the mechanism design problem of the Bidder by following Salanie (2005). The utility of the Target who has match quality level θ with the Bidder at the optimum of his program is:

$$u^T(\theta|s) = U^T(\theta,\theta|s) = q(\theta|s)(\lambda\theta + \delta_T e_T + \delta_B e_B) + t(\theta|s) - \frac{c_T e_T^2}{2} \tag{32}$$

differentiating the above expression w.r.t match quality θ and rearranging we have:

$$u^T_\theta(\theta|s) = \underbrace{q'(\theta|s)(\lambda\theta + \delta_T e_T(\theta|s) + \delta_B e_B(\theta|s)) + t'(\theta|s) + q(\theta|s)\delta_B e'_B(\theta|s)}_{=0 \text{ by the FOC of Target's Message problem}}$$
$$\underbrace{+e'_T(q(\theta|s)\delta_T - c_T e_T(\theta|s))}_{=0 \text{ by the FOC of the Target's Effort problem}} \quad + q(\theta|s)\lambda \tag{33}$$

Integrating $u^T_\theta(\theta|s)$ back I obtain the utility of the Target at the optimum

$$u^T(\theta|s) = \int_{\hat{\theta}}^{\theta} q(z|s)\lambda dz + r \tag{34}$$

I recover the constant of the integration by using the fact that if the Target has the lowest match quality with the Bidder then cannot extract any informational rent. Therefore, the Bidder will offer him a contract that will give him utility equal to his outside option r.

But from (32) I know that

$$u^T(\theta|s) = q(\theta|s)(\lambda\theta + \delta_T e_T + \delta_B e_B) + t(\theta|s) - \frac{c_T e_T^2}{2} \Rightarrow \tag{35}$$

Rearranging (32) I have that

$$t(\theta|s) = u^T(\theta|s) - q(\theta|s)(\lambda\theta + \delta_T e_T + \delta_B e_B) + \frac{c_T e_T^2}{2} \tag{36}$$

By using (34) I can replace $u^T(\theta|s)$

$$t(\theta|s) = \int_{\hat{\theta}}^{\theta} q(z|s)\lambda dz + r - q(\theta|s)(\lambda\theta + \delta_T e_T + \delta_B e_B) + \frac{c_T e_T^2}{2} \tag{37}$$

The Bidder's objective is

$$\int_{\hat{\theta}(s)}^{\overline{\theta}} E[(1 - q(\theta|s))y(e_T(\theta|s), e_B(\theta|s), \theta|s) - t(\theta|s) - \frac{c_B e_B(\theta|s)^2}{2}]dF(\theta|s) \tag{38}$$

by substituting $t(\theta|s)$, I get

$$\int_{\hat{\theta}(s)}^{\overline{\theta}} [(1 - q(\theta|s))(\lambda\theta + \delta_T e_T(\theta|s) + \delta_B e_B(\theta|s)) - \int_{\hat{\theta}(s)}^{\theta} q(z|s)\lambda dz - r$$

$$+q(\theta|s)(\lambda\theta + \delta_T e_T(\theta|s) + \delta_B e_B(\theta|s)) - \frac{c_T e_T(\theta|s)^2}{2} - \frac{c_B e_B(\theta|s)^2}{2}]dF(\theta|s) \tag{39}$$

By integrating by parts I have that

$$\int_{\hat{\theta}(s)}^{\overline{\theta}} \int_{\hat{\theta}(s)}^{\theta} q(z|s)\lambda dz = \mu(\theta|s)q(\theta|s)\lambda \tag{40}$$

Plugging back to Bidder's objective

$$\int_{\hat{\theta}(s)}^{\overline{\theta}} [\lambda\theta + \delta_T e_T(\theta|s) + \delta_B e_B(\theta|s) - \mu(\theta|s)q(\theta|s)\lambda - r - \frac{c_T e_T(\theta|s)^2}{2} - \frac{c_B e_B(\theta|s)^2}{2}]dF(\theta|s) \tag{41}$$

and applying the optimal effort policies I have the following

$$\int_{\hat{\theta}(s)}^{\overline{\theta}} [\lambda\theta + \frac{\delta_T^2}{c_T} q(\theta|s) + \frac{\delta_B^2}{c_B}(1 - q(\theta|s)) - \mu(\theta|s)q(\theta|s)\lambda - r$$

$$-\frac{\delta_T^2}{2c_T} q(\theta|s)^2 - \frac{\delta_B^2}{2c_B}(1 - q(\theta|s))^2]dF(\theta|s) \tag{42}$$

The integrand of the above expression is the Bidder's virtual surplus. The Bidder will maximize his virtual surplus with respect to $q(\theta|s)$ to get the optimal equity share of the Target. Plugging the Target's optimal equity share back to the integrand I obtain the Bidder's utility at the optimum while plugging it into the optimal effort policies I obtain the Bidder's and the Target's optimal effort levels.

In order to obtain the endogenous threshold $\hat{\theta}$ the Bidder maximizes the above expression.

The above analysis is correct based on the assumption that the SOC of the Target's message problem holds. If it doesn't then there is no truthful revelation of the match quality on the behalf of the Target and the mechanism design problem falls apart. The SOC of the Target's message problem requires that the Target's equity share $q(\theta|s)$ be increasing in the unobservable match quality θ. This is satisfied by assumption 2 that the inverse of hazard rate is decreasing in unobservable match quality.

Proof of proposition 1

Let

$$\Gamma(\hat{\theta}, s, \delta_B, \delta_T, c_B, c_T, \lambda, r) = \frac{(\delta_T^2 - c_T \lambda \mu(\hat{\theta}(s)|s))^2}{2c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)} + \lambda\hat{\theta}(s) + \frac{\delta_B^2}{2c_B} - r \equiv 0 \tag{43}$$

$$\frac{\partial \Gamma}{\partial \hat{\theta}} = \frac{(\delta_T^2 - c_T \lambda \mu(\hat{\theta}|s))(-\lambda \frac{\partial \mu(\hat{\theta}|s)}{\partial \hat{\theta}})}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2} + \lambda > 0 \tag{44}$$

since $\delta_T^2 - c_T\lambda\mu(\hat{\theta}) > 0$ by assumption 3, and, $\partial\mu(\hat{\theta})/\partial\hat{\theta} < 0$ by assumption 2.

$$\frac{\partial \Gamma}{\partial s} = \frac{(\delta_T^2 - c_T \lambda \mu(\hat{\theta}|s))(-\lambda \frac{\partial \mu(\hat{\theta}|s)}{\partial s})}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2} < 0 \tag{45}$$

since $\delta_T^2 - c_T\lambda\mu(\hat{\theta}) > 0$ by assumption 3, and, $\partial\mu(\hat{\theta}|s)/\partial s > 0$ by assumption 1.
Hence, by the Implicit Function Theorem $\frac{\partial\hat{\theta}}{\partial s} = -\frac{\partial\Gamma/\partial s}{\partial\Gamma/\partial\hat{\theta}} > 0$.

$$\frac{\partial \Gamma}{\partial \delta_T} = \frac{\delta_T(\delta_T^2 - c_T \lambda \mu(\hat{\theta}|s))(\delta_T^2 + 2\frac{c_T}{c_B}\delta_B^2 + c_T\lambda\mu(\hat{\theta}|s))}{c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} > 0 \tag{46}$$

since $\delta_T^2 - c_T\lambda\mu(\hat{\theta}) > 0$ by assumption 3.
Hence, by the Implicit Function Theorem $\frac{\partial\hat{\theta}}{\partial \delta_T} = -\frac{\partial\Gamma/\partial \delta_T}{\partial\Gamma/\partial\hat{\theta}} < 0$.

$$\frac{\partial \Gamma}{\partial c_T} = \frac{-\lambda\mu(\hat{\theta}|s)(\delta_T^2 - c_T \lambda \mu(\hat{\theta}|s))2c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2) - (\delta_T^2 - c_T \lambda \mu(\hat{\theta}|s))^2(\delta_T^2 + 2\frac{c_T}{c_B}\delta_B^2)}{2c_T^2(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} < 0 \tag{47}$$

since $\delta_T^2 - c_T\lambda\mu(\hat{\theta}) > 0$ by assumption 3.
Hence, by the Implicit Function Theorem $\frac{\partial\hat{\theta}}{\partial c_T} = -\frac{\partial\Gamma/\partial c_T}{\partial\Gamma/\partial\hat{\theta}} > 0$.

$$\frac{\partial \Gamma}{\partial \delta_B} = \frac{\delta_B}{c_B}[1 - \frac{(\delta_T^2 - c_T \lambda \mu(\hat{\theta}|s))^2}{(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2}] = \frac{\delta_B}{c_B}[1 - q(\hat{\theta}|s)^2] > 0 \tag{48}$$

since $0 < q(\hat{\theta}|s) < 1$.

Hence, by the Implicit Function Theorem $\frac{\partial \hat{\theta}}{\partial \delta_B} = -\frac{\partial \Gamma / \partial \delta_B}{\partial \Gamma / \partial \hat{\theta}} < 0$.

$$\frac{\partial \Gamma}{\partial c_B} = \frac{(\delta_T^2 - c_T \lambda \mu(\hat{\theta}|s))^2 (\delta_B^2 / c_B^2)}{2(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} - \frac{\delta_B^2}{2c_B^2} = \frac{\delta_B^2}{2c_B^2}[q(\hat{\theta}|s)^2 - 1] < 0 \tag{49}$$

since $0 < q(\hat{\theta}|s) < 1$.

Hence, by the Implicit Function Theorem $\frac{\partial \hat{\theta}}{\partial c_B} = -\frac{\partial \Gamma / \partial c_B}{\partial \Gamma / \partial \hat{\theta}} > 0$.

$$\frac{\partial \Gamma}{\partial r} = -1 < 0 \tag{50}$$

Hence, by the Implicit Function Theorem $\frac{\partial \hat{\theta}}{\partial r} = -\frac{\partial \Gamma / \partial r}{\partial \Gamma / \partial \hat{\theta}} > 0$.

Proof of proposition 2

Differentiating (16) w.r.t. s I get the following

$$\frac{\partial U^B(\theta|s)}{\partial s} = \frac{(\delta_T^2 - c_T \lambda \mu(\theta|s))}{(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)}(-\lambda \frac{\partial \mu(\theta|s)}{\partial s}) < 0 \tag{51}$$

which is negative because $\partial \mu(\theta|s)/\partial s > 0$ for all θ and s $\in [\hat{\theta}, \overline{\theta}]$, by assumption 1, and $\frac{\delta_T^2}{c_T} - \mu(\theta|s)\lambda \geq 0$ for all θ and s $\in [\hat{\theta}, \overline{\theta}]$, by assumption 3.

Proof of proposition 3

By proposition 2, we know that $U^B(\theta|s)$ is a decreasing function of s. Moreover, $U_m^B(\theta|s)$ is an increasing function of s, since $\frac{\partial E[\theta|s]}{\partial s} > 0$. Therefore, it can be at most one $\hat{s} \in [\underline{\theta}, \overline{\theta}]$ where $U^B(\theta|s) = U_m^B(\theta|s)$.

Assuming that $U^B(\theta|\underline{\theta}) > U_m^B(\theta|\underline{\theta})$, the result follows.

Proof of proposition 4

Let

$$R(\theta, \hat{s}, \delta_B, \delta_T, c_B, c_T, \lambda, r) = \frac{(\delta_T^2 - c_T \lambda \mu(\theta|\hat{s}))^2}{2c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)} + \lambda\theta + \frac{\delta_B^2}{2c_B} - r - E[\theta|\hat{s}] \equiv 0 \tag{52}$$

$$\frac{\partial R}{\partial \hat{s}} = \frac{\delta_T^2 - c_T \lambda \mu(\theta|\hat{s})}{c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)}(-c_T \lambda \frac{\partial \mu(\theta|\hat{s})}{\partial \hat{s}}) - \frac{\partial E[\theta|\hat{s}]}{\partial \hat{s}} < 0 \tag{53}$$

since $\delta_T^2 - c_T\lambda\mu(\theta|s) > 0$ by assumption 3, and, $\partial\mu(\theta|s)/\partial s > 0$ by assumption 1, and, $\partial E[\theta|s]/\partial s > 0$.

$$\frac{\partial R}{\partial c_T} = \frac{-(\delta_T^2 - c_T\lambda\mu(\theta|s))[\lambda\mu(\theta|s)2c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2) + (\delta_T^2 - c_T\lambda\mu(\theta|s))(\delta_T^2 + 2\frac{c_T}{c_B}\delta_B^2)]}{2c_T^2(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} < 0 \tag{54}$$

since $\delta_T^2 - c_T\lambda\mu(\theta|s) > 0$ by assumption 3.

Hence, by the Implicit Function Theorem $\frac{\partial\hat{s}}{\partial c_T} = -\frac{\partial R/\partial c_T}{\partial R/\partial\hat{s}} < 0$.

$$\frac{\partial R}{\partial c_B} = \frac{(\delta_T^2 - c_T\lambda\mu(\theta|s))^2}{(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2}\frac{\delta_B^2}{2c_B^2} - \frac{\delta_B^2}{2c_B^2} = (q(\theta|s)^2 - 1)\frac{\delta_B^2}{2c_B^2} < 0 \tag{55}$$

since $0 < q(\theta|s) < 1$.

Hence, by the Implicit Function Theorem $\frac{\partial\hat{s}}{\partial c_B} = -\frac{\partial R/\partial c_B}{\partial R/\partial\hat{s}} < 0$.

$$\frac{\partial R}{\partial \delta_T} = \frac{\delta_T(\delta_T^2 - c_T\lambda\mu(\theta|s))(\delta_T^2 + 2\frac{c_T}{c_B}\delta_B^2 + c_T\lambda\mu(\theta|s))}{c_T(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} > 0 \tag{56}$$

since $\delta_T^2 - c_T\lambda\mu(\theta|s) > 0$ by assumption 3.

Hence, by the Implicit Function Theorem $\frac{\partial\hat{s}}{\partial \delta_T} = -\frac{\partial R/\partial \delta_T}{\partial R/\partial\hat{s}} > 0$.

$$\frac{\partial R}{\partial \delta_B} = \frac{-(\delta_T^2 - c_T\lambda\mu(\theta|s))^2}{(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2}\frac{\delta_B}{c_B} + \frac{\delta_B}{c_B} = \frac{\delta_B}{c_B}(1 - q(\theta|s)^2) > 0 \tag{57}$$

since $0 < q(\theta|s) < 1$.

Hence, by the Implicit Function Theorem $\frac{\partial\hat{s}}{\partial \delta_B} = -\frac{\partial R/\partial \delta_B}{\partial R/\partial\hat{s}} > 0$.

$$\frac{\partial R}{\partial r} = -1 < 0 \tag{58}$$

Hence, by the Implicit Function Theorem $\frac{\partial\hat{s}}{\partial r} = -\frac{\partial R/\partial r}{\partial R/\partial\hat{s}} < 0$.

Proof of proposition 5

$$\frac{\partial(1 - q(\theta|s))}{\partial s} = \frac{c_B\lambda}{\delta_B^2 + \frac{c_B}{c_T}\delta_T^2}\frac{\partial\mu(\theta|s)}{\partial s} > 0 \tag{59}$$

which is positive because $\partial\mu(\theta|s)/\partial s > 0$ for all θ and s $\in [\hat{\theta}, \overline{\theta}]$, by assumption 1.

Proof of proposition 6

$$\frac{\partial(1-q(\theta|s))}{\partial c_T} = -\frac{-\lambda\mu(\theta|s)(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2) - (\delta_T^2 - c_T\lambda\mu(\theta|s))\frac{\delta_B^2}{c_B}}{(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} > 0 \tag{60}$$

$$\frac{\partial(1-q(\theta|s))}{\partial c_B} = -\frac{(\delta_T^2 - c_T\lambda\mu(\theta|s))c_T(\frac{\delta_B^2}{c_B})^2}{(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} < 0 \tag{61}$$

$$\frac{\partial(1-q(\theta|s))}{\partial \delta_B} = -\frac{-(\delta_T^2 - c_T\lambda\mu(\theta|s))2\frac{c_T}{c_B}\delta_B}{(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} > 0 \tag{62}$$

$$\frac{\partial(1-q(\theta|s))}{\partial \delta_T} = -\frac{2\delta_T(\frac{c_T}{c_B}\delta_B^2 + c_T\lambda\mu(\theta|s))}{(\delta_T^2 + \frac{c_T}{c_B}\delta_B^2)^2} < 0 \tag{63}$$

$$\frac{\partial(1-q(\theta|s))}{\partial \lambda} = -\frac{-c_T\mu(\theta|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2} > 0 \tag{64}$$

Proof of proposition 7

Using equation (14), differentiate $t(\theta|s)$ with respect to s,

$$\frac{\partial t(\theta|s)}{\partial s} = -\lambda\frac{\delta_T^2 - c_T\lambda\mu(\hat{\theta}|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2}\frac{\partial\hat{\theta}(s)}{\partial s} + \lambda\int_{\hat{\theta}(s)}^{\theta}\frac{-c_T\lambda\frac{\partial\mu(z|s)}{\partial s}}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2}dz + \tag{65}$$

$$+2(\frac{\delta_B^2}{c_B} - \frac{\delta_T^2}{2c_T})(\frac{\delta_T^2 - c_T\lambda\mu(\theta|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2})(\frac{-c_T\lambda\frac{\partial\mu(\theta|s)}{\partial s}}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2}) - (\lambda\theta + \frac{\delta_B^2}{c_B})\frac{-c_T\lambda\frac{\partial\mu(\theta|s)}{\partial s}}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2} \tag{66}$$

$$= -\lambda\int_{\hat{\theta}(s)}^{\theta}\frac{c_T\lambda\frac{\partial\mu(z|s)}{\partial s}}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2}dz - \lambda\frac{\delta_T^2 - c_T\lambda\mu(\hat{\theta}|s)}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2}\frac{\partial\hat{\theta}(s)}{\partial s} \tag{67}$$

$$-\frac{c_T\lambda\frac{\partial\mu(\theta|s)}{\partial s}}{\delta_T^2 + \frac{c_T}{c_B}\delta_B^2}[(\frac{2\delta_B^2}{c_B} - \frac{\delta_T^2}{c_T})q - (\lambda\theta + \frac{\delta_B^2}{c_B})] \tag{68}$$

We know that $\frac{\partial\mu(\theta|s)}{\partial s} > 0$ by assumption 1 and $\frac{\partial\hat{\theta}(s)}{\partial s} > 0$ by proposition 1, hence,

$$\text{if } \ (\frac{2\delta_B^2}{c_B} - \frac{\delta_T^2}{c_T})q - (\lambda\theta + \frac{\delta_B^2}{c_B}) > 0 \ \text{ then } \ \frac{\partial t}{\partial s} < 0 \tag{69}$$

Therefore, for $\frac{\partial t}{\partial s} < 0$ I need:

$$\frac{\delta_B^2}{c_B}q - \lambda\theta - \frac{\delta_T^2}{c_T}q - \frac{\delta_B^2}{c_B}(1-q) > 0 \tag{70}$$

$$\frac{\delta_B^2}{c_B}q^2 > qE[y] \tag{71}$$

$$\frac{\delta_B^2}{c_B}q^2 - \frac{\delta_T^2}{2c_T}q^2 > qE[y] - \frac{\delta_T^2}{2c_T}q^2 \tag{72}$$

$$\frac{\delta_B^2}{c_B} - \frac{\delta_T^2}{2c_T} > \frac{u^T(\theta|s) - t(\theta|s)}{q^2(\theta|s)} \tag{73}$$

References

[1] Agrawal, A., J. Jaffe and G. Mandelker, 1992, The post-merger performance of acquiring firms: A re-examination of an anomaly, *Journal of Finance*, 47, 1605-1621.

[2] Allen, J. and G. Phillips, 2000, Corporate equity ownership, strategic alliances, and product market relationships, *Journal of Finance*, 55, 2791-2815.

[3] Ambec, S. and M. Poitevin, 2001, Organizational design of R&D activities. Working paper. Center for Interuniversity Research and Analysis on Organizations, Montreal, Canada.

[4] Andrade, G., M. Mitchell, and E. Stafford, 2001, New evidence and perspectives on mergers, *Journal of Economic Perspectives*, 15(2), 103120.

[5] Bagnoli, M., and T. Bergstrom, 2005, Log-concave probability and its applications, *Economic Theory* 26, 445-469.

[6] Banker, R., and S. Datar, 1989, Sensitivity, precision, and linear aggregation of signals for performance evaluation, *Journal of Accounting Research* 27 (1), 21-39.

[7] Barclay M. and C. Holderness, 1989, Private benefits from control of public corporations, *Journal of Financial Economics*, 25, 371-395.

[8] Bernardo, A., H. Cai, J. Luo, 2001, Capital budgeting and compensation with asymmetric information and moral hazard, *Journal of Financial Economics* 61, 311-344.

[9] Bolton, P., and M. Dewatripont, 2005, Contract Theory. MIT Press, Cambridge, MA.

[10] Bradley, M., 1980, Tender offers and the market for corporate control, *Journal of Business*, 53(4), 345-376.

[11] Chan, S. H., J.W. Kensinger, A. J. Keown, and J. D. Martin, 1997, Do strategic alliances create value?, *Journal of Financial Economics*, 46, 199221.

[12] Dodd, P. and Ruback R., 1977, Tender offers and stockholder returns: An empirical analysis, *Journal of Financial Economics*, 5, 351-373.

[13] Dutta, S., 2008, Managerial expertise, private information, and pay-performance sensitivity, *Management Science*, 54(3), 429-442.

[14] Gibbons, R. and K. J. Murphy, 1992, Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence, *Journal of Political Economy*, 100(3), 468-505.

[15] Gromb, D. and D. Scharfstein, 2002, Entrepreneurship in equilibrium. Unpublished working paper. London Business School, London, England.

[16] Hart, O., 1995, Firms contracts and financial structure, Oxford University Press, Oxford, UK.

[17] Hart, O. and J. Moore, 1990, Property rights and the nature of the firm, *Journal of Political Economy*, 98, 1119-1158.

[18] Hertzel, M., M. Lemmon, J. Linck and L. Rees, 2002, Long-run performance following private placements of equity, *Journal of Finance*, 57, 2595 - 2617.

[19] Jensen M. and R. Ruback, 1983, The market for corporate control: The scientific evidence, *Journal of Financial Economics*, 11, 5-50.

[20] Johnson, S., and M. Houston, 2000, A Reexamination of the motives and gains in joint ventures, *Journal of Financial and Quantitative Analysis*, 35(1), 6785.

[21] Jovanovic B. and S. Braguinsky,2004, Bidder discounts and target premia in takeovers, *American Economic Review*, 94(1), 46-56.

[22] Krishna, V., 2002, Auction theory. Academic Press.

[23] Krishnaswami S., E. Pablo, and V. Subramaniam, 2003, When is equity more than just financing? Evidence from strategic alliances, Working Paper, Tulane University, New Orleans, LA.

[24] Laffont, J., and J. Tirole, 1993, A theory of incentives in procurement and regulation. MIT Press, Cambridge, MA.

[25] Los Angeles Times, 1999, "Pioneer and DuPont Are in Merger Talks", March 13.

[26] Loughran, T. and A. Vijh, 1997, Do long-term shareholders benefit from corporate acquisitions?, *Journal of Finance*, 52, 1765-1790.

[27] Malatesta, P., 1983, The wealth effect of merger activity and the objective functions of merging firms, *Journal of Financial Economics*, 11, 155-181.

[28] Margulis, M. and P. Pekar, 2003, Equity alliances take center stage, *Business Strategy Review*, 14(2), 5062.

[29] Martin, K. and J. McConnell, 1991, Corporate performance, corporate takeovers, and management turnover, *Journal of Finance* 46, 671-687.

[30] Mathews, R. D., 2006, Strategic alliances, equity stakes, and entry deterrence, *Journal of Financial Economics*, 80, 35-79.

[31] Mathews, R. D., 2007, Optimal equity stakes and corporate control, *Review of Financial Studies* 20, 1059-1086.

[32] McConnell, J. J., and T. J. Nantell. 1985, Corporate combinations and common stock returns: The case of joint ventures, *Journal of Finance*, 40(2), 51936.

[33] Mitchell, M. and H. Mulherin, 1996, The impact of industry shocks on takeover and restructuring activity, *Journal of Financial Economics*, 41, 193-229.

[34] Mueller, D., 1969, A theory of conglomerate mergers, *Quarterly Journal of Economics*, 83, 643-659.

[35] Myerson, R., 1979, Incentive compatibility and the bargaining problem, *Econometrica*, 47(1), 61-73.

[36] Raith, M., 2003, Competition, risk and managerial incentives, *American Economic Review*, 93, 1425-1436.

[37] Rau, R. and T. Vermaelen, 1998, Glamour, value and the post-acquisition performance of acquiring firms, *Journal of Financial Economics*, 49,223-253.

[38] Robinson, D. T., 2008, Strategic alliances and the boundaries of the firm, *Review of Financial Studies*, 21(2), 649-681.

[39] Roll, R., 1986, The hubris hypothesis of corporate takeovers, *Journal of Business*, 59, 197-216.

[40] Salanie,B., 2005, The economics of contracts: A primer. MIT Press, Cambridge, MA.

[41] Shrieves, R. and D. Stevens, 1979, Bankruptcy avoidance as a motive for merger, *Journal of Financial and Quantitative Analysis*, 14, 501-515.