A THEORY OF THE ROLE OF MEDIUM OF EXCHANGE IN MERGERS AND ACQUISITIONS

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

BY

Rajesh Kumar Tiwari, B.Sc., P.G.D.M.
Denton, Texas

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Tiwari, Rajesh Kumar, A Theory of the Role of Medium of Exchange in Mergers and Acquisitions. Doctor of Philosophy (Finance), May, 1994, pp.182, 10 Tables, Three illustrations, References.

An acquisition bid is like any other proposal for risky investment. The difference arises due to additional source of risk arising from two different sources of information asymmetry due to private knowledge held by the bidder and target. We hypothesize that the bidding process evolves in a manner to optimize bidder's investment in the target through a process of joint signalling. Medium of exchange and bid premium are used as the two signal elements simultaneously by the bidder. We develop a multiple signalling model of the bidding process which is fully revealing in equilibrium. Securities bids are used if the bidder feels the target likely to be risky. Securities bid make the target also a participant in the process of bid formulation. Hence the valuation of bid premium varies according to the medium of exchange employed. Relative size of the bidder compared to the target is considered to reflect the degree of risk-aversion of the bidder management. Hence relative size of bidder also becomes an important variable determining the effect of bid upon the sharing of wealth between the target and bidder. Several testable implications are developed. Results of empirical tests offer support for our results.

ACKNOWLEDGEMENTS

I wish to acknowledge the encouragement and guidance provided by Dr. David P. Schutte in this research. I also wish to acknowledge the support provided by Dawn Haensly. I wish to thank all entrepreneurs who had exposed me to the understanding of the takeover process earlier in my profession. I hope my research will turn out to be meaningful for these fellow travellers.

Denton Rajesh k. Tiwari

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CHAPTER I

INTRODUCTION

The existing models of takeover processes fails to provide a reason for the existence of mixed medium of exchange, involving both cash and securities. In most of the extant models, pure cash bids dominate every other medium of exchange in the case of high synergy bidders, while 100% securities bids dominate over other medium of exchange in the case of low synergy bidders. In actual practice, however, different mixes of cash and securities are observed. The present research extends the multiple-signalling methodology, widely applied to explain diverse corporate finance phenomena, to analyze the formulation of take-over bids. The bid premium and medium of exchange comprise elements of the signalling vector.

Notable among the multiple signaling papers are those by Vermaelen (1980, 1984) in the case of repurchase tender offers, John and Mishra (1990) and John and Lang (1991) in the case of insider trading and capital expenditure, and insider trading and dividends, respectively, and Williams (1988) in the case of dividends, investment, and stock repurchases. These papers analyze corporate finance events as signals of the firms' managers' private information. In order to arrive at unique, separating, signaling equilibrium, the signaling process is characterized in such models as satisfying the twin requirements of (a) fully revealing in equilibrium, and (b) decreasing the marginal cost of signaling with higher quality of private information held by corporate insiders. For fulfilment of the latter condition, some mechanism must align the interests of the shareholders and the managers. Existence of a take-over threat, bonding through compensation schedule, threat of significant loss in the managerial perquisite consumption in the event of bankruptcy etc. provide possible reasons for alignment between the interests of shareholders and managers. The requirement of efficient signaling equilibrium is also sometimes imposed. The optimal signaling equilibrium is required to have the least signaling cost among all the signaling equilibria satisfying the other conditions.

In the case of acquisitions, the medium of exchange has a unique role to play due to existence of information asymmetry. The medium of exchange allows for optimal risk sharing in the acquisition agreement between the bidder and the target. It is feasible to extend the requirement of efficient signaling equilibrium in acquisitions to analyze the choice of the medium of exchange as an outcome of the bidder's optimization problem.

Purpose

The purpose of the proposed research is to develop a formal model of the take-over process with emphasis on the determination of the medium of exchange. In order to focus this research, the model building is guided according to the "information asymmetry" hypothesis[1]. This provides an integrated framework for modelling the value-sharing process in the case of mergers and acquisitions. Overall, the proposed model is expected to provide a methodology for the simultaneous and optimal determination of the following:

1. medium of exchange,
2. bid premium, and
3. probability of cash or securities offer taking place in the case of different bidders, and also the probability of success of these offers in case of various bidders.

The proposed model allows for endogenous determination of the above variables. The relevant exogenous parameters will be identified in the light of the "information asymmetry" hypothesis.

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[1]An assumption of information asymmetry and therefore of informational incompleteness appears to be a more primitive starting point than the assumption of institutional completeness in examining a stock market economy (reference Strong and Walker, 1987, page 71). Information asymmetry here refers to the fact that some persons in the economy do not have the same information as some others have (e.g. managers).

Problem

The market for corporate control (viz. market for mergers and acquisitions) may be viewed as a major component of the managerial labor market (Jensen and Ruback (1993)). It may also be viewed as a sub-set of the broader process of investment in risky assets. An acquisition occurs whenever it is cheaper to expand by acquiring existing assets through the capital markets rather than creating new assets directly. Even if the principal motive of acquisition is to reduce the total supply of a particular product in the market, this may be viewed also as creation of an asset whose function is to increase the firm's market share to a desired level. Another viewpoint treats acquisition as a tax-efficient way of making free cash available to the shareholders. Different acquisitions involve different financing schemes. This has induced some researchers (Harris and Raviv (1988), Stulz (1988), Israel (1991), etc.) to relate the process of acquisition with pure financial restructuring variables. Yet, no available theory appears to have gained wide acceptance[2].

Among all the possible explanations of the process of acquisitions, information asymmetry based models appear to

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[2]Ruback (1988) states:
"We have no accepted theory of the choice of takeover method. In contrast, we have many theories about capital structure choice. But none has survived even simple tests. And the interrelations among the many theories are obscure at best. Saying that the state of the art in capital structure choice is confused would be generous."

be the most promising. As the medium of exchange is directly related to the value sharing process, existence of the information asymmetry affects its formulation. A number of models in finance have studied possible relationships between information asymmetry and medium of exchange. However, the known models appear to focus upon the relationship between information asymmetry and one specific coordinate of the bid package. The existing models explain certain aspects[3] of the take-over process better than others, with certain empirical evidence consistent with individual models. However, the available empirical evidence is also consistent with alternative models. Various alternative models also give mutually conflicting results (Weston et al.,1990).

There is a need to evolve a model based on information asymmetry which explains all the important characteristics of the bid package simultaneously and optimally. The present research uses multiple signaling methodology to analyse the formulation of take-over bids.

A model for the endogenous determination of the values of important bid parameters (bid premium, medium of exchange etc.), based on available information will provide a set of criteria to formulate as well as evaluate bids. This would

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[3] Usually the models try to explain only one of various factors like takeover premium, pre-bid shareholding of the bidder, value reducing defensive strategy, medium of exchange etc.

result in a more efficient bidding process and a better focus on the evaluation of a bid by the concerned parties.

The proposed model is based on only a generally acceptable set of assumptions in the theory of finance relating to investors' preferences (e.g. risk aversion) and information asymmetry (e.g. increased uncertainty). Furthermore, specific comparative-static results based on important bid-related variables are obtained for the purpose of having more precise specification of empirical tests.

The reaction of the market, in terms of change in the price of share on the announcement of a bid, exhibits significant variations across different bidders and target groups. An explanation for linking the likelihood of a specific bid to variables like relative size or overall market condition would help in clarifying our understanding of the process of acquisitions. For this, the proposed research would also try to evolve a framework for the probability of occurrence and success of various types of bids.

However, this research does not propose to deal with the issue of value creation in a take-over process. Understanding the sources and magnitude of value creation would require an analysis of the entire set of business strategies of competing bidders and the target. For the time being, it may be better delegated to future researchers.

CHAPTER II

PRIOR RESEARCH

The available explanations of the take-over process are based upon one or a combination of the following theories:

1. Managerial efficiency
2. Information asymmetry
3. Agency problems
4. Market structure
5. Tax effects

In the light of the existing literature, it is possible to incorporate the theory related to managerial efficiency within the overall framework provided by the information asymmetry hypothesis. The influences of market structure and tax considerations, if common knowledge, do not result in any information asymmetry. These factors affect the overall generation of value in the process of take-over, and hence to the extent are not common knowledge, will result into information asymmetry. Of all these theories, information asymmetry appears to be most promising as an explanation of the formulation of the medium of exchange in the light of the available literature. Hence, it is proposed to model the take-over process within the framework of information asymmetry hypothesis.

Five different sets of research papers may be described as relevant in the context of formulation of the medium of exchange in the case of acquisitions:

a. papers analyzing capital structure and ownership decisions by managers handling risky projects,

b. papers trying to understand the target's behavior due to probable bids as capital structure phenomena,

c. papers with the model of the acquisition process with specific role given to the medium of exchange,

d. papers analyzing sub-sets of the acquisition process, e.g. bid-premium, probability of outcome, etc., and

e. empirical papers providing interesting facts relating to the acquisition process.

The beginning of a bid lies in a bidder perceiving a target as a risky investment opportunity. Hence the literature relevant to the choice of risky projects will be described first.

Capital Structure and Risky Projects

Information asymmetry between the insiders and other investors becomes important in the case of a risky project. Shareholders' ability to hold a well-diversified portfolio makes them efficient risk-bearers. However, the firm's managers usually have non-diversifiable association with the firm due to firm-specific human capital, and also because their transactions may be watched closely by investment analysts. In addition to the capital structure of a firm, the lower diversifiability of a manager's asset portfolio also provides a signaling mechanism, in terms of managerial shareholding. A number of researchers have tried to analyze an efficient mechanism (in terms of signaling variables) for the resolution of information asymmetry based upon some variation of this theme. Their results have been used by other researchers to understand the acquisition process. In this research, a framework will be evolved in the light of a few results of such papers. Hence relevant papers and findings are described now.

Leland and Pyle (1977), Ross (1977), and Myers and Majluf (1984) are regarded as important papers relating informational asymmetry and financial structure. Among the recent papers, Blazenko (1987) develops interesting results based on the viewpoint that managers signal with capital structure because the utility of their future wealth is affected by financial decisions. The results of these papers provide understanding of the implication of information asymmetry upon the optimal capital structure decision of the bidder managed by risk averse managers.

Their models attempt to establish that a firm's capital structure arises to minimize the adverse consequences of informational asymmetry. Leland and Pyle consider the fractional ownership of a firm retained by an entrepreneur as a signal of firm quality. They show that as this fraction increases, the value of the firm increasess correspondingly. If entrepreneurial ownership is sufficiently high, then the increase in ownership is associated with increased debt, thereby providing an indirect link between firm value and firm borrowing.

Ross (1977) considers a model where the managerial compensation scheme includes a penalty in the event of bankruptcy. Since debt financing results in higher probability of bankruptcy, it is interpreted by investors as a signal of a high quality project. However, this formulation ignores the preference structure of managers and consideration of their reaction to uncertainty.

Blazenko considers the framework of efficient capital markets. The firm's common shares are held in shareholders' well-diversified portfolios so that risk-neutral valuation of the project is appropriate. Yet, since the managers share the firm's profits through a compensation plan, their preferences determine firm capital-structure policy. A compensation plan that depends upon firm performance is required to induce managerial effort. Otherwise, in the presence of asymmetric information, if managers are paid only fixed wages and are risk averse, they will undertake no real asset investment, claiming negative net present values. Further, second-order stochastic dominance ensures that, for any manager with a concave utility function, equity is preferred to debt. The intuitive reason behind this result is that equity financing results in a lesser variability of return. Debt financing increases the "total risk" (measured by variance, for example) of equity holding in the firm. Hence debt financing becomes a credible signal of the quality of the project to be undertaken for investment.

Two of Blazenko's results are of particular interest, viz., his propositions 3 and 4, for the case of "Asymmetric Information and Managerial Preference." They are reproduced below:

Proposition 3: If signaling equilibria exist, investors' best estimate of the true probability of project success under equity financing is lesser than under debt financing.

Proposition 4: A sufficient condition for the existence of a rational-expectations signaling equilibrium is that managers be sufficiently risk-averse.

As a corollary to Proposition 4, Blazenko shows that no signaling equilibrium exists if a manager is risk-neutral. Blazenko further states, "Debt is a credible signal only if managers' risk aversion is great and, correspondingly, equity preference is strong. If risk aversion is not great and if investors interpret debt to mean high quality, managers use debt even if quality is low because the aversion to financial risk is low. As a result, there are no inhibitions against falsely signaling as a high-quality project with overvalued bonds."

Acquisition Process as a Capital Structure Phenomena

The Modigliani and Miller (1958) framework analyzes conditions under which capital structure is irrelevant. The subsequent literature has tried to focus on conditions which impute a purpose to capital structure. Harris and Raviv (1991) identify four categories of determinants of capital structure:

1. ameliorate conflicts of interest among various groups with claims to the firm's resources, including managers (the agency approach),

2. convey private information to capital markets or mitigate adverse selection effects (the asymmetric information approach),

3. influence the nature of products or competition in the product/input market, or

4. affect the outcome of corporate control contests.

It needs to be pointed out here that the rationale in the case of analysis of other corporate finance phenomena, viz. value effects from dividend and financing announcements, optimal managerial compensation scheme, and acquisitions, is invariably based upon one or more of the above aspects. The acquisition process, therefore, may be viewed as one of several mechanisms available for the purpose of serving the same underlying objective(s). I will not try to specify the underlying objective(s) here.

Yet, the various mechanisms (acquisitions and dividend policy, say) must be having their own specific roles, otherwise there would have been significant degree of inter-substitutability observed in practice[4]. Inthe case of acquisitions, one-time replacement of the controlling group of managers is obviously a specific feature. In this way, a bid may be analyzed as a bargaining game (between competing sets of managers) under imperfect information.

Several empirical studies suggest the importance of leverage (Palepu (1980)), and the extent of managerial equity ownership (Kim and Sorensen (1986), Agrawal and Mandelkar (1987), etc.) in regard to the probability of occurrence and outcome of a bid. Furthermore, capital restructuring is at times used as an anti-take-over device in the face of a bid. While these do not provide any conclusive evidence, they do suggest that the effect of any bargaining tactics or signal may be influenced by factors

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[4]Perhaps there is some amount of inter-substitutability among different mechanisms. However at times, different corporate finance decisions are announced simultaneously, which would not have been the case if the degree of substitutability were quite large.

like capital structure and managerial equity ownership. Given the facts of a bid situation, the bid premium and the medium of exchange appear to be the logical candidates for employment as bargaining tools by the contending parties, since these affect capital structure and managerial equity ownership directly.

In terms of Myers and Majluf's (1984) framework, a firm's decision to issue equity (debt) may be indicative of the insiders' perception of overvaluation (undervaluation) of equity by the marketplace. Any capital structure decision of a firm may be analyzed using this as a basis for the signaling framework. Quite a few empirical papers have tried to model bidding process and interpret their findings against this setting (e.g. Travlos (1987), Sung (1991)).

However, Myers and Majluf framework assumes perfect alignment between the interests of the shareholders and the managers. In the presence of agency problems, this may not be an adequate characterization of firm's behavior. They also suggest that in certain situations, managers of a value maximizing firm would prefer to pass up a positive net present project due to undervaluation of existing assets in place. Other researchers (described earlier) have come up with alternative models incorporating managers' risk preferences into the capital structure theory. In a multiple signal framework, such alternative models allow for adoption of all the positive NPV projects by a firm, along with all the possibilities of the Myers and Majluf's framework. Overall, alternative models based upon risk-averse managers and multiple-signaling framework appear to provide a more appealing explanation of the corporate finance behavior of firms.

A few papers have attempted to analyze the effect of capital and ownership structure upon the elements of signaling in the case of acquisitions. Stulz (1988) appears to be one of the early papers suggesting simultaneous optimum values for capital structure variables (as against corner values in case of Myers and Majluf's framework). Existence of an optimal set of values for multiple control parameters makes it feasible, theoretically, that two perceptibly widely different values of signals may be the appropriate characterization of the firm's specifics and yet the sign of the firm's returns may be positive in case of both the signals. Stulz's model suggests the existence of optimal values for the leverage and incumbent managements' equity ownership in case of any potential target. While elaborating the intuition behind these, Stulz argues that it is risky for the management to own shares. Hence the management's equity ownership is negatively related to managers' degree of relative risk aversion. Since managers exhibit decreasing absolute risk aversion, equity ownership is an increasing function of managerial wealth. Furthermore, as more corporate debt is sold, the risk to managers of losing their position through bankruptcy increases, thereby causing them to bear more risks for a given investment in the firm.

Harris and Raviv (1988) adopt the capital structure setting in the case of take-overs and focus on the effect of leverage upon the take-over method and outcome. They suggest that the incumbent management of a take-over target can and does affect the type of take-over attempt (tender offer or proxy contest) and its probability of success by using various resistance devices (capital structure variables based) in different degrees. This ultimately gets reflected as price effects and take-over outcome as per their diagrammatic model depicted below:

Potential Effects		Take-over	Price
Gains and ⇒ over	Resistance ⇒	Methods and ⇒	and Take-
Control Benefits	Strategy	Probability of Success	Outcome

Their model assumes risk-neutrality on the part of the incumbent as well as the rival management. Because of this, results of their model are in the nature of price effects (or marginal shifts) due to a take-over attempt and allow for optimal parameter values for the leverage (not for managements' shareholding as obtained in Stulz's paper in addition to leverage). However, even in this paper, the optimal choice of capital structure results in the endogenous determination of take-over method, outcome, and price effects.

Stulz's, and Harris and Raviv's research formulate the take-over case from the target's perspective. With certain additional assumptions required to incorporate information asymmetry likely between the bidder and the target (and further, between them and rest of the market), their technology may be used to analyze the bidders' optimal bid formulation (which provides the idea of the methodology in my paper).

Israel (1991) proposed a framework in which capital structure affects the outcome of corporate control contests through its effect on the cash flows between voting equity and nonvoting risky debt. Higher debt levels result in lower profitability for the bidder, and, hence, in a lower probability of acquisition. Hence he suggests a rationale for the existence of an interior optimal debt level for any potential target firm. However, equity ownership structure plays no role in his model, though the relative bargaining power (linked to equity ownership) between the target and the bidder does play a role.

If we extend Israel's analysis conceptually further, any bidder firm also does exist as a potential target firm.

Hence the bidder firm also has an optimal capital structure. Due to the "emerging market opportunity" (a randomly distributed variable), the bidder identifies a target, also having an optimal capital structure in Israel's framework. However, the bargaining power between the bidder-target set is likely to be a random variable, though the post-acquisition firm will have a (definite) optimal capital structure according to Israel's framework. In this situation, the bid-premium is likely to be shaped by the relative bargaining power, and the transition from the pre-acquisition optimal capital structure can be made feasible through an optimal choice of the medium of exchange. Otherwise the post-acquisition firm may have to undergo a capital restructuring in order to achieve the optimal capital structure, which does not appear to be the usual case in practice. This suggests an interesting possibility that a capital-structure preserving medium of exchange (viz. stock exchange) is likely if the capital structure of the bidder and the target is quite similar. On the other hand, a cash bid is likely in case it helps the bidder in achieving the potential optimal capital structure in the case of a target having a capital structure very different from its own. While I have not proceeded any further on this line of thought, an empirical testing of this result would indicate whether a model not paying specific attention to equity ownership structure (Israel's model) is more efficient than the other possible model structure.[5]

Specific Role of Medium of Exchange

There is a growing literature on take-over process in financial economics, and other areas like strategic management. The recent theoretical literature has been modelling the take-over process assuming central roles for factors like cost of bidding, free-rider problem, negotiation/auction process, role of the large shareholder, preemptive take-over bidding, likely tax-benefits and value reducing defensive strategies. The choice of the medium of exchange has been explained as an outcome of bargaining under asymmetric information (Hansen, 1987) or as a tactic in the preemptive take-over bidding process (Fishman, 1989) or formulated in the light of likely tax-benefits. In the case of other models, no systematic effort appears to have been made to explore the role of the medium of exchange. At the most, the medium of exchange has been treated as a

[5]As Israel mentions, Morck, Schleifer, and Vishny (1988) document that mean of the ratio of market value of debt of firm value for a sample of 454 firms was 0.248, the means for the subsets of firms that became targets of friendly and hostile takeovers were 0.285, and 0.330, respectively. If we assume that cash is likely to be the medium of exchange relatively more in case of hostile bids, and the average bidder has the same leverage as an average firm, the difference between the leverages of bidder and target firms appears to be higher in case of cash bids. However, generalizability of this inference remains uncertain.

passive signal of the value of firm (bidder or target).

Increasingly more research papers are trying to model the bidding process using game-theoretic strategies. However, many of such papers assume risk-neutral market participants. While this simplifies the model formulation, it also results in a model where the information asymmetry gets resolved only through a strategic bidding game. Risk-premium, as a compensatory mechanism for uncertainty, fails to find a place in such models, though the rest of the theory of finance uses the device quite extensively. Incorporation of possibilities of risk-aversion on the part of firm's managers would make such models more realistic.

Hansen models the take-over process as a two-agent (the target and a bidder) bargaining game under asymmetric information. With asymmetry on both sides of the transaction, a signaling equilibrium develops whereby the target uses both exchange medium offered and the amount of any stock offer as signals of the acquiring firm's value. Throughout, a first-and-final offer is assumed to be an optimal bargaining strategy for the bidder under the given assumptions[6]. The model comes up with a number of testable

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[6] Hansen has based this upon a paper by Samuelson (1984) to analyze cash offer. Samuelson shows that under certain assumptions, and with only cash offer possible, an optimal bargaining strategy for the bidder is to make first-and-final offer. However, existence of stock offer in practice dilutes the generalizability of this result.

implications. The main implications are: (a) probability of trade associated with the optimal stock offer decreases with the size of the bidder, (b) the bidder's expected gain from the optimal stock offer decreases with its size, and (c) in the absence of tax effects, the probabilities of stock offer, and successful trade in case of stock offer are increasing in the bidder's debt. However, the level of target's debt has an ambiguous effect upon these characteristics of the offer. Moreover, as a bigger size of the bidder is likely to reflect lesser uncertainty about the bidder's existing assets[7], intuitively, there does not appear to be any reason for the probability of trade associated with stock offer to decrease with the size of the bidder.

Given its set of underlying assumptions, Hansen's model is elegant and transparent. The assumption of signal-content in the medium of exchange is of overriding importance. The assumption that the take-over process provides a signal about the acquiring firm's value appears to be reasonable and I propose to adopt it for my analysis in this research. However, while Hansen models the target's valuation function of the bidder's existing assets only in terms of a single

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[7] Chan and Chen (1991) suggest that less riskiness in the future cash flow stream may explain the larger size of a firm compared to another firm having a riskier future cash flow stream.

variable (viz. exchange ratio), I propose to model it as a vector of two signals (medium of exchange and bid premium).

In terms of its technology, Hansen's model suffers from two major shortcomings:

(i) While the uncertainty due to the target's private knowledge has been modelled in detail in his analysis, characterization of uncertainty due to the bidder's private knowledge is inadequate. He assumes that the target will be able to infer the value of the bidder's assets through the exchange ratio, as if a precise univariate inverse mapping from the exchange ratio to the bidder's assets will always exist in the case of all possible combinations of the bidder and the target in equilibrium.

(ii) The model assumes the relationship between bid premium and probability of the bidder offering and the target accepting the bid to be the same in the case of both securities and cash bids.

Consequently, Hansen's model comes up with implication (a) above, suggesting that the probability of acceptance of a bid will decrease in bidder's size. The reason for bigger size of the bidder adversely affecting this probability adversely is not clear.

Fishman (1986 & 1989) focuses on the role of the medium of exchange in preempting competition. His analysis is based upon the game-theoretic concept of perfect sequential equilibrium. The model is developed for a set-up involving two potential bidders for a given target, all financed by equity only. Securities are used by lower-valuing bidders and have the advantage of inducing target management to make an "efficient" accept/reject decision. Cash serves to preempt competition from other potential bidders by signaling a high valuation of the target. The model comes up with several implications, a few of which may not be empirically testable. The main implications are: (a) the higher-valuing bidders (of the target's value) use cash, while the lower-valuing bidders use debt to preempt competition, (b) advance disclosure by the target of its private information makes preemption more difficult, (c) the target is more likely to reject a securities offer as compared to a cash offer, and (d) competing bids are more likely to be observed following an initial securities offer.

His implications (a) and (b) appear contradictory. According to implication (b), it is to the advantage of the target to disclose private information in advance. Such an action by the target would limit the pre-emption advantage enjoyed by any bidder. Furthermore, unless the very first bidder establishes it very credibly that he is likely to be the most efficient bidder in managing the assets of the given target. However, this presumes that the most efficient bidder usually makes the first pure cash bid, which may be a difficult position to support. The basic assumption in Fishman's research which needs to be questioned is that the purpose of signaling is to influence only the competing bidder. The paper fails to provide a rationale for not treating the possibility of using the medium of exchange in order to influence the target as an important motive of the bidder. Moreover, the appropriateness of "perfect sequential equilibrium" in the context of acquisitions is also not clear. Hence the updating rule given in the paper may not adequately characterize the probability of formulation and acceptance of a bid.

Brown and Ryngaert (1991) develop a model based upon the trade-off between the tax-advantage of a stock offer and the negative valuation of the bidder's assets by the target in the case of a stock offer. However, their model does not take into account the possibility of asymmetric information about the value of the target. They show that the percentage of stock in an optimal bid will be either zero, or 50 or 100 percent.

Eckbo et al. (1990) model the take-over process under asymmetric information assuming that percentage of cash in the offer signals the bidder type. Their model is based upon two discrete values of the target's assets under the bidder's control. The bidder does not seek to unravel the true value of the target through his bidding strategy. Rather, he optimally chooses the offer attractive to both low and high value targets. Their game structure employs sequential equilibrium concept of Kreps and Wilson (1982) to identify equilibria. These are further refined to arrive at unique optimal point by using the "intuitive criterion" proposed by Cho and Kreps (1987). They infer that the bidder's benefits increases with the size (i.e. percentage) of cash in the offer. In their empirical tests, they find that bidders' returns are significantly larger in the case of mixed offers than for either all stock or all cash bids. However, their results do not exhibit any significant relationship between the percentage of cash and the bidders' returns in the case of mixed offers.

Berkovitch and Narayanan (1990) formulate a model linking the role of the medium of exchange among competing bidders, and returns to the bidder and the target. They assume two discrete types of (informed) bidders having high or low synergy in the (uninformed) target. The target infers the bidder type from the offer comprising of amount of cash and fraction of equity in the combined firm. Separating equilibrium is arrived at by using the sequential equilibrium concept of Kreps and Wilson. Their model predicts that the fraction of synergy captured by the target decreases with the level of synergy. Also, as competition increases, the cash component of the offer as well as the proportion of cash offered increases.

Eckbo et al. and Berkovitch and Narayanan are the only available models where it is feasible to have mixed offers as optimal bids. However, structures of their models are quite restricted due to modeling the bidder's synergy as discrete values and ignoring the effect of private information held by the target.

A few research papers (Brown et al.(1991) and a number of other papers using Myers and Majluf's (1984) framework) begin with the assumption that the process of bidding reveals information about the assets of the bidder. However, this implies that such a revelation of private information by the managers of bidding firm should result in continued higher valuation of the bidder's assets by the marketplace, even in the case of non-acceptance of their bids. There does not appear to be any empirical support available in the existing financial literature supporting this. It appears that in the case of unsuccessful bids, the bidder's share price usually reverts to the pre-bid level (Bradley et al. (1983) Opler (1988)). Bradley et al. (1983) also report that in the case of failed bids, the target's share prices also revert to pre-bid levels in case no other bid emerges over a period of time. It is plausible that the information revealed in the process of bidding relates to the bidder's ability in managing the assets of the target.

Other Papers and Findings

Researchers have often tried to focus upon a specific feature of the acquisition process, other than the medium of exchange. Bid premium, bidder's initial shareholding, availability of free cash, probability of success of a bid have been the themes or the sub-themes of individual papers with interesting implications. I will briefly describe a few more informative of such papers here.

Jagdeesh and Chowdhary (1988) extend the original free-riders framework of Grossman and Hart (1980) by examining the conditions warranted for the sustainment of game-theoretic equilibrium based on Cho-Kreps intuitive criterion (1987). They assume risk-neutral market participants and discrete values for the synergy levels of various bidders. They finally formulate a model for the bidder's pre-tender offer share acquisition strategy. Their model predicts that lower-value bidders opt for relatively lower open market purchases in order to credibly signal their types and bid a lower amount in the tender offers. However, this model tries to explain only a sub-set of the entire take-over process, that too under restrictive assumptions mentioned earlier.

The bid premium has sought to be analyzed by many researchers as one of the dimensions of the acquisition process. However, the factors underlying and the effect upon the bidder and the target's returns due to bid premium appear to be relatively less explored and understood in the available literature.

The existence of bid premium could be attributed (partially) to the upward sloping supply schedule of the target's voting rights. Stulz (1988) suggests that the optimal bid premium is an increasing function of the fraction of voting rights of the target controlled by management. Fishman (1986) considers bid-premium as a device for deterring potential competition. A high valuing bidder offers high bid premium, low valuing bidder offers low premium, in which case competition would ensue.

A tax based model would predict higher premium for cash offers as compared to securities offer, due to immediate taxability in cash offer. Alternatively, it is also possible to model bid premium as an outcome of the division of the increase in the combined value of the target and the acquiring firms. This way, the magnitude of bid premium may be related to the underlying firm characteristics, capital structure, managerial ownership, information asymmetry, riskiness of the firms, number of bidders, initial shareholding of the bidder, etc. Bradley, Desai and Kim (1988) observe that multiple/single bidder nature of contest and initial shareholdings of the bidder are significant factors in explaining the sharing of total acquisition gains.

Jagdeesh and Chowdhary (1990) suggest that the tender offer premium is positively related to the size of the bidder's initial fraction of share ownership in the target. They contrast this result with a model by Shleifer and Vishny (1986), which predicts an inverse relationship between the bidder's pre-tender holdings and the bid premium in the case of pooling equilibrium.

Vermaelen (1984) analyzes the properties of bid premium in case of repurchase tender offers. In his model, bid premium, the fraction of shares repurchased, and fraction of insider holdings are positively related to the value of information[8] released through the multiple signal. He infers that the pricing function is increasing in bid premium, while its second derivative with respect to bid premium is zero.

The available empirical findings by Walking (1985) and Samuelson and Rosenthal (1988) provide indirect evidence that the probability of success of a bid increases in the bid premium. However, effect of bid premium, in conjunction with any other signal element (e.g. the medium of exchange),

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[8]We will describe the value of information derived from the signal vector through a "pricing function", since the market is assumed to set prices according to the joint signal.

does not appear to have been explored by the researchers so far.

Very few papers have tried to analyze the probability of success of a bid, notable among such analysis is one by Walking (1985). He used LOGIT analysis to map the predicted probabilities to the zero-one range by employing the following LOGIT model:

$$P(S_A \geq S_S) = \frac{e^{BX}}{(1+ e^{BX})} \tag{1}$$

Where,

$P(S_A \geq S_S)$ = probability that shares acquired exceeds or is equal to shares sought

X = matrix of explanatory variables

B = vector of coefficients

The predictive accuracy of his LOGIT model in the case of tender offers was 84 percent for the estimation sample and 82 percent for the validation sample. The explanatory variables employed in this case were bid-premium, target management opposition, solicitation fee, percentage of shares bidder controls, and opposing bid indicator. The dependent variable was a binary (0 or 1) variable. The binary nature of dependable variable rules out any possibility of incorporation of probability measures given by this model as multiplier to other explanatory factors affecting the returns of the bidder or the target.

Samuelson and Rosenthal (1988) examined movements in the prices of target stock as predictors of the ultimate success or failure of tender offers. They suggest that in general, the larger the price increase in the tender period, greater the probability of success of the bid. They measure the inferred probability of success by the percentage amount that the stock price of target increases above the fallback price (price likely if market assesses a zero probability of success) and towards the tender price. Using a sample of 109 cash tender offers during the years 1976 to 1981, they concluded that:

(a) movements in target stock prices during the offer period are informative of success or failure of the tender offer. The higher the relative stock price, the greater the chance of tender success, and

(b) the market's probability predictions improve monotonically over time.

They state that their study may only be viewed as an initial attempt to analyze the probabilistic forecasts implied by market price movements and as such carries with it important limitations. Apart from the sampling bias, their model appears to be missing too many explanatory variables required for proper understanding of the acquisition process.

All these models of the acquisition process are highly structured for some specific sub-process, freezing rest of the process in a manner convenient for the sake of tractability. Hence there is a need to evolve a model, based on information asymmetry hypothesis, which considers all the variables simultaneously to provide the mechanics of optimal bid formulation from the viewpoint of the bidder.

Empirical Findings

Lately, there appears to be a surge in the empirical analysis of the medium of exchange in case of acquisitions. The medium of exchange is used as an explanatory variable along with other explanatory variables (identified in terms of the particular analytical model being tested). The data is usually stratified or filtered in order to control for interfering variables which are unlikely to be of interest, or to observe the differential influences of the alternative media of exchange. Bulk of the researchers have used the event study type methodology to analyze the returns for various classes of security holders.

Studies attempting to analyze the effect of the method of payment appear to be equivocal in their finding that cash take-overs and security exchange mergers may be motivated by different considerations depending upon the characteristics of the acquiring and the target firms. Carleton et al. (1983) used a conditional logit model to study the probabilities of acquisitions in a cash offer, in a securities exchange, and also the case of firm not being acquired. In their sample of acquisition events relating to the period 1976-77, they observed that "lower dividend payout ratios and lower market-to-book ratios increase the probability of being acquired in a cash take-over relative to being acquired in an exchange of securities." They also concluded that there did not appear to be any significant difference in the financial characteristics between the acquiring firms using cash or securities for acquisition.

In his study, Travlos (1987) inferred that financing a take-over through exchange of common stock conveyed the negative information that the bidding firm was overvalued. On the other hand, the stockholders of cash-financing bidding firms appeared to earn "normal" rates of return at the announcement period. Furthermore, the holders of nonconvertible bonds appeared to suffer weak losses when the acquisition was financed with common stock, but not so in the case of cash offer. Travlos thereby inferred that the wealth transfer to bondholders was not the source of the negative stock returns to the bidders in stock exchange offers. He also tried to examine the effect of relative size of target vis-a-vis bidder and bid-premium upon the bidder's returns. The coefficients of both the variables are reported to be negative at statistically insignificant levels. In addition, he also concludes that stock exchange offers do not have larger probability of failure than cash offers. This finding contradicts Fishman's (1986, 1989) analytical result that a target is more likely to reject a securities offer as compared to a cash offer.

Asquith et al (1987) report that in the case of a sample of 343 completed mergers relating to the period 1975-1983, the medium of exchange had a differential impact upon the bidder's as well as the target's returns. The bidding firm's returns were positive for cash bids and negative and significantly smaller for equity payment bids. The target's excess returns were observed to be positive and statistically significant for all forms of merger financing. The average return associated with mergers financed with common stock was substantially smaller than the average return for cash mergers. Furthermore, they observed that the differences between mergers initiated with a tender offer and those without disappeared when the medium of exchange was considered. They also report that the relative size of the target (vis-a-vis the bidder) had a positive coefficient on cash medium of exchange in the case of bidders' returns, as also reported by Sung (1991).

Their empirical research is a detailed one, and brings out clearly the importance of the medium of exchange and the relative size of the target. However, consideration of only the very first bid might have suppressed the significance of some the possible explanatory factors. Omission of bid-premium, and non-consideration of mixed bids may be pointed out as weaknesses of their analysis.

Franks et al (1988) tried to design their empirical methodology based simultaneously on the theories of capital structure choice and acquisitions. They conducted the research in the context of U.S.A. and U.K. markets, so that the prevalent institutional differences may provide for differential effect of the medium of exchange in the two settings.

Their results suggest that the returns[9] to the target shareholders in cash acquisitions were significantly in excess of those in the case of equity acquisitions. In the U.S. market, bidder shareholders gained significantly in cash acquisitions and suffered losses in equity acquisitions. In the U.K. market, neither cash nor equity acquisitions resulted in significant abnormal returns to the bidder shareholders in the month of acquisition. They also conclude that a higher percentage of all-cash bids were contested or revised, which contradicts the Fishman's (1986, 1989) model's prediction that competing bidders appear more

[9]For some reason, Franks et al use the term "bid premium" for representing cumulative abnormal return to a firm over a specified window. We will denote the difference between the nominal value of bid and pre-bid market price of the target's equity as bid premium.

frequently in equity offers than in cash offers.

Their analysis is limited to a sample of successful acquisitions only, and fails to include bid-premium and relative size of the target. Hence despite a larger number of sample points, their results may not be adequately revealing of the causal factors[10].

Peterson and Peterson (1991) examined the wealth changes of the shareholders of acquiring and acquired firms with a sample of 272 completed mergers consummated between 1980 and 1986. They concluded that the distribution of the wealth gains did not differ among mergers using different media of exchange and that the relative size of the two parties was the primary determinant of the distribution of wealth changes. Their results indicated that the coefficient of the log of the ratio of the market values of equity for the acquiring firm to that of the acquired firm was positive in the case of the wealth changes of the acquiring as well as acquired firms. They infer that smaller target firms received greater returns, but share less in the total wealth changes to the combination of merged firms. These results are at variance with the

[10]They mention that underwriters in the U.K. played an important role in acquisition finance where the bidder lacked cash, and also where the bidder required external validation of the valuation of its offer. Such association of underwriters may be expected to result in reduced information asymmetry, which also should affect bid premium.

findings by Asquith et al (1987). They defined relative size as the ratio of the market values of the equity shares of the target and the bidder. They found that the coefficient of relative size was significantly negative for stock bids and significantly positive for pure cash bids in the analysis of bidders' returns. Considering only completed mergers might have led to selection bias in the sample. Perhaps most of the sample firms involved high synergy situations, resulting in the ultimate success of the bid. The amount of synergistic gain could be related to the relative size. Hence relative size might have overshadowed the role of medium of exchange in the sharing of the synergistic gains as a consequence of sample selection bias.

Bradley et al (1988) analyzed the amount and sharing of synergistic gains from corporate acquisitions based upon a sample of 236 completed tender offers belonging to the period 1963-84. They inferred that successful tender offers generated significant synergistic gains, resulting in significant positive abnormal returns for the stockholders of both target and acquiring firms. However, most of the gains were captured by the stockholders of the target firms. The gains to target stockholders have increased over time at the expense of the stockholders of the acquiring firms. In the recent period, acquiring firms' stockholders actually suffered a significant abnormal loss. Their study tries to understand secular trends in case of successful tender offers, without analyzing the underlying determinants.

Stulz et al (1990) analyzed the distribution of take-over gain between the target and the bidder for a sample of 104 successful tender offers. They concluded that the target's gain was negatively related to the bidder's gain and the institutional ownership. In their sample of multiple-bidder contests, the target's gain increased with managerial ownership and decreased with institutional ownership. They interpret this as implying that blockholders (especially managers who value their incumbency) who use their stake to increase the bidder's cost increase the target's share of take-over gains if the take-over succeeds, and converesely, those who use their stake to decrease the bidder's cost decrease the target's share.

Sung (1991) used a sample of 253 successful tender offers during the period 1974-1980 to analyze the effect of overpayment and the medium of exchange on bidder returns. He also included the relative size of the target compared to the bidder, multiplied by dummy for cash or stock financing, as an explanatory variable. His results indicate that relative size had a significantly positive (negative) effect upon the bidder's returns in cash (stock) financing, which is similar to results obtained earlier by Asquith et al

(1987).

Overall, relative size of the target and the bidder appears to be having a significant yet differential effect upon the bidder's and the target's returns in different media of exchange. The ownership structure of the target's shareholding is also reported to be a significant explanatory factor. However, the effect of the ownership structure of the bidding firm does not seem to have been explored sufficiently.

Lang et al (1991), based upon a sample of 88 tender offers, found that the coefficients of managerial ownership of bidder's equity, medium of exchange, and the log of relative size of the target vis-a-vis bidder were not significant in explaining bidder's returns. Their results appear to be at variance with the results described earlier. Agrawal and Mandelker (1987) report that when managers own a larger share of equity, they tend to bid for higher variance targets. They interpret this as indicating that executive shareholdings in the firm have a role in reducing managerial incentive problems. Hence firms with significant managerial shareholding are in a better position to undertake higher variance (or riskier) projects.

In his research, Cook (1987) used the event study technique to study the impact of different media of exchange upon the acquiring firm's bondholders' return. He segmented his sample also by percentage financing needs met through internally generated cash. The results showed that firms which generated at least 75% of their acquisition cash needs by operations tended to exhibit positive returns. Firms internally generating 0%-25% of the cash requirement for acquisition mostly exhibited negative market-adjusted returns. In other groups, the results obtained did not have sufficient degree of statistical significance. Overall, differentiation as a function of the amount of acquisition cash needs generated by operations did appear to occur. Intuitively, it appears to be reasonable to think that the percentage financing needs met internally (generally cash) may serve as a proxy for relative size of the target vis-a-vis the bidder. Cook's research design appears to be having reasonable control over independent variables. However, this study provided only an indirect idea about the impact of the take-over process upon the acquiring firm, as it did not cover the common stockholders.

Overall, the available literature appears to suggest that the bidder and the target's returns are influenced by a number of factors and their mutual interactions. Relative size, managerial ownership of shares, and the medium of exchange may be seen also as factors having bearing upon the risk in the asset portfolio of the bidding firm as well as its managers. In this research, we incorporate this possibility in our model for the determination of the medium of exchange in the case of acquisitions.

All these studies (except for Sung (1991)) have focussed primarily upon the very first bids. However, any rationale ought to be capable of explaining the observed behavior for any bid. There is an obvious need for a general model which may explain and be tested empirically using information pertaining to each and every bid. I will now try to construct a model for this purpose using a multiple signaling framework.

CHAPTER III

PROPOSAL FOR A NEW MODEL OF BIDDING PROCESS

The failures to observe favorable effects of higher percentage of cash upon bidder's returns, by Eckbo et al. (1990) in the Canadian market and by Morck et al. (1988) in the U.K. market, are strikingly in contrast to the empirical findings reported by other researchers (Asquith et al. (1987), etc.). Perhaps, the institutional structure of the market has a significant bearing upon the optimality of cash as the medium of exchange. It also is conceivable that optimality of cash as the medium of exchange may not be universal, but may be specific to a given bidder-target set. There appears to be a need for a model which can address such possibilities.

In the existing models of acquisitions under asymmetric information, conditions for separating equilibrium are identified in which value of bidder and/or target is revealed by the medium of exchange. In order to come up with an optimal medium of exchange, the set of feasible equilibria is refined by using some specific game-theoretic criterion (e.g. intuitive criterion proposed by Cho and Kreps (1987)).

By viewing the process of acquisition as a proposal for risky investment, we may formulate the process of optimal choice of medium of exchange and bid premium, simultaneously, as a wealth maximization problem faced by the bidder. This has the advantage of a much simpler characterization of the bidder process, and does not require imposition of any game-theoretic criterion. Towards this, I will begin first by identifying an appropriate set of signaling vectors in case of bid proposal for a target. I will then analyze the choice of financing of a risky project. This will allow me to relate the bidding managers' objectives with the bidder's choices. Among all the feasible signal vectors, I will identify the optimal signal by requiring it to be efficient, i.e. imposing the least cost of signaling upon the bidder.

Information Asymmetry: Efficacy of Multiple Signaling Equilibria

A multiple set of signals should be able to map the coordinates in the returns state-space more precisely. If the role of signals is to reduce information asymmetry, i.e. specify the likely state-space vector more precisely to the uninformed, a multiple set of uncorrelated signals is likely to be more efficacious, and also perhaps more cost effective than any single signal.

Other corporate finance phenomena (dividend policy, insider trading, financing decision etc.) have been formulated in the multiple signaling framework with very interesting results. John and Lang (1991) come up with a model for insider trading around dividend announcement where the optimal mix of two signals conveys private information to the market at lower cost than any single signal by itself. Williams (1988) models simultaneous sale of stocks, investment in real assets, and announcement of dividend. However, he leaves the properties of separating equilibria when firms have multiple private attributes as a problem for further exploration.

The available models of the bidder's formulation of a bid are univariate in their structure. Only one of the factors, the medium of exchange, or the bid-premium or the bidder's initial shareholdings, is considered as the bidder's decision-variable, as described in earlier chapter on prior research. However, the extant empirical literature classifies and cross-relates the acquisition returns to targets, bidders, shareholders, bondholders, and their combinations according to a number of criteria:
whether,

1. a tender offer or a merger offer,
2. successful or unsuccessful,
3. single or multiple bidder contest,
4. cash or securities offer,
5. affected by institutional changes,
6. high or low bid premium.

Various empirical studies can be cited for each one of the above criteria, providing support for the significance of each of the factors in explaining the returns or the probability of success in the case of a bid or an eventual acquisition. We propose that a multiple signaling analysis is a more efficient way of analyzing the process of acquisition compared to multiple number of analyses each focussed upon individual underlying factors.

The elements of multiple-signal vector, for describing a bid, can be; (a) whether a tender or a merger offer, (b) single or multiple bidder contest, (c) the medium of exchange, (d) the bid premium and (e) the bidder's initial shareholding. Asquith et al. (1987), among other researchers, report that the observed difference (in terms of returns to the bidder and/or the target) in the case of tender and merger offers arise due to differing medium of exchange. Predominantly, cash is employed as the medium in case of tender offers and the occurrence of securities as the medium of exchange is relatively higher in case of merger bids.

While the occurrence of multiple bidder situation is likely to affect the outcome of a bid, this will not be a choice variable under control of a bidder. Hence single or multiple nature of contest should not be treated as an element of multiple signaling vector. The bidder's initial shareholding and the medium of exchange both may affect the bidder's holding of the merged firm in case of success of the bid. As reported by Jagdeesh and Chowdhary, in their discussion of related empirical evidence about the implications of their model, available empirical evidence provides mixed results. Walking (1985) reports that the size of the bidder's pre-tender offer shareholding is positively related to the probability of success. Hence it appears that the bidder's initial shareholding is formulated in the light of the expected value of the bid to the bidder. If the likely benefit from the acquisition and/or the probability of success of the bid is low, the bidder will like to have low initial shareholding in the target. Hence even in the case where the likely benefit of acquisition is high, bidder may opt for low initial share-holding if the probability of success of the bid is likely to be low (e.g. due to some competing bidder likely to be having even higher benefit from the acquisition of the same target). Hence there does not appear to be sufficient reason to include the bidder's initial shareholding as an element of signaling vector without having a reasonably adequate model of the probability of success of a bid. Therefore, we will model our signaling vector with medium of exchange and bid-premium as the elements. As mentioned earlier, empirical researchers report significant effect of these factors upon the bidder's and target's returns.

Risky Projects - Choice of Financing

Recent developments in finance attribute the importance of financing policy to information asymmetry and managerial objectives. The effect of any given set of managerial objectives upon the choice of financing may differ according to the specifics of the projects under consideration. Stulz (1990) suggests that agency costs of managerial discretion result into the optimal capital structure decision becoming a function of the volatility of a given period's cash flow. As the volatility of a given period's cash flow decreases, it becomes less probable that the resources available to managers will differ significantly from the resources that the shareholders would optimally like the management to have. Hence, the usefulness of debt as a disciplining device becomes less important if the volatility of the new project is smaller than the assets in place.

Diamond (1984) shows that increase in the specific (diversifiable) risk of a project results in decrease in the expected utility for a risk-averse entrepreneur. It may be argued that the manager's personal investments (capital as well as skills) in their positions with the firm make their stakes similar to that of an entrepreneur. Then, Diamond's results may be extended in the case of financing choice by the managers for new project. Under similar framework, Leland and Pyle (1977) suggest that the entrepreneur cannot sell off the firm-specific risk separately from the return of the new project, because the firm specific component of risk is not observed elsewhere. Hence the entrepreneurs may signal credibly the quality of new project through the amount of equity retained by them. Furthermore, the amount of equity retained by the entrepreneur decreases in the specific risk and the coefficient of risk aversion. They also show that greater project variance implies lower optimal debt.

Blazenko (1987) shows that in the case of asymmetric information, no signaling equilibrium exists if the manager is risk neutral. Overall, there appears to be sufficiently strong logical support to assume that in case the managers have more information than other investors, maximization of shareholders value would require alignment between the managers and shareholders' interests through appropriately designed incentive structure. However, the scope for the diversification of managers' personal assets portfolio is rather limited. Hence, if an appropriately designed incentive scheme exists, the managerial objectives and equity stake (and thereby risk aversion) would be important factors affecting any financing decision of the firm. Furthermore, the riskiness of the new project would be an important determinant of a firm's financing decision in case of a new project. Both leverage and managerial shareholding signal the managers' inside knowledge about the value and riskiness of assets. In case of a new risky project, it would then be the marginal shifts in the leverage and managerial shareholding which may serve as the signal of quality of the new project. The current value of these variables in case of a firm would be indicative of the quality of the assets in place, given the existing management's attitude towards risk. Managers' signaling to the outside investors in case of any new risky project would be therefore shaped not only by the quality of the project, but also by their attitude towards the incremental risk due to the new project.

Managers' risk aversion is likely to be high only in cases where a marginal increment in risk of the project may have the potential to affect their well-being significantly in the event project does not do well in future. If the existing firm has substantial risk bearing cushion (e.g. low variability and high cash flow businesses), managers' risk aversion may be low due to one or both of the following two reasons:

(i) A risky project may provide the managers option theoretic benefits[11] at the cost of the existing debtholders especially if they also have equity stakes in the firm.

(ii) Due to non-significant level of debt-servicing obligation of the firm, the managers enjoy agency-theoretic advantages[12] at the expense of other shareholders.

In such an instance, debt (or equivalently cash financing) may not be a credible signal of the new project quality, or even of the existing assets of the firm. In fact, issuance of equity might be perceived to be a more credible signal of the quality of new project (viz. it is likely to be high risk project). This suggests that the usefulness of debt or equity as a signal of the new project will depend upon two factors: (a) the riskiness of the project, and (b) the risk-bearing capacity[13] of the existing

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[11]Higher latitude to default at the expense of the debtholders, and thereby getting more scope for undertaking risky projects constitutes option theoretic benefits for the existing shareholders of a firm.

[12]Managers' tendency to consume more perquisites in case of higher levels of capital provided by outsiders is the relevant agency-theoretic advantage in this case.

[13]We may understand risk-bearing capacity of the bidder as an outcome of the risk-aversion of incumbent managers and the bidder's size. Higher relative size of the bidder vis-a-vis target would imply that bidder managers would get less affected, in case the target turns out to be a 'lemon' later on, compared to a case when the target is relatively larger. The term "risk bearing capacity" has earlier been used by Diamond and Verrecchia (1991) in case of market makers. In their model, limited risk bearing capacity implies more price impact of a trade. Agrawal and Mandelker (1987) report that when managers own a larger share of equity , they tend to bid for higher variance targets. In our framework, higher

firm. While equity financing would always be a signal of the high-risk nature of the new project, cash might not always be the signal of the low-riskiness of the new project. Only when the existing firm has limited risk-bearing capacity (vis-a-vis the new project), cash financing would be credible signal of the low risk nature of the new project.

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managerial ownership of equity, in the light of managers' risk- aversion, would imply that the bidding firm is relatively less risky. In other words, the risk bearing capacity of the bidder is high, allowing thereby the bidder to absorb more risk (i.e. high variance targets).

CHAPTER IV

APPROACH TOWARDS A NEW FRAMEWORK

Under the assumption of rational expectations equilibrium[14], individuals are assumed to understand the functional relationship between the equilibrium price of the risky asset and the joint signal (Huang and Litzenberger (1988)). In the case of a bid, the bid premium and the medium of exchange may be treated as joint signals for communicating the bidder's efficiency in managing target's assets. In the light of my analysis earlier, the bid premium and medium of exchange are likely to be endogenously determined in the bidding process, depending upon the relative strengths and riskiness, the capital and ownership structures (indicative of managerial risk-aversion) of the target and the bidder. However, these signals by themselves are likely to be only partially revealing. Otherwise, the very first bid would reveal all the relevant information. Bidder, target and rest of the market will know everything about the likely value of the bid. The target will either accept this bid or

[14]In our analysis, efficient signaling equilibrium comprises two stages: (a) existence of rational expectations equilibrium, and (b) choice of efficient optimal signaling vector. It needs to be noted that we do not insist on the existence of efficient signaling in case of each and every bid. We propose that when this condition is satisfied, bid gets accepted or terminated finally. Otherwise the bid gets revised or fails.

an appropriately amended bid. This way the bidding will stop with the very first bid.

The signaling firm's management is likely to have full information about its own risky asset. Under certain conditions (to be specified in detail in our framework), the market will have reasons to believe that Spence's (1974) condition of decreasing marginal cost of signaling is fulfilled due to managerial risk-aversion. Then the firm's management will find it feasible as well as optimal to design the signal package such that the signaling equilibrium is fully revealing. A management team in the knowledge of the high value of the firm's assets is likely to be less concerned about things not turning out well later on. Hence a risk-averse manager will have lower marginal cost of signaling if the quality of their private information is higher.

This remains true even in the case of a bidding situation. However, due to private information held by the bidder and the target separately about the values of their own assets and quality of management, the bidding management group is faced with double sets of information asymmetry. Due to the private knowledge being in its own hand in the first set (viz. bidder's private knowledge), the bidder management may provide credible signals to the market in order to maximize its objective function. However, the bidding management may not always be able to elicit credible signals from the target about the latter's private information. The target management may not have sufficient motivation to reveal its private information for a number of reasons (e.g. agency problem, maintenance of business secrets etc.). The bidding management may not always perceive his well-being (or wealth) likely to be affected significantly in the event of the target turning out to be a lemon later on. This may happen due to absence of risk-aversion on the part of bidding management or if the target management provides revealing signals voluntarily. In such a case, the bidder need not devise any mechanism to minimize the effect of possible adverse selection and the medium of exchange is likely to be pure cash.

On the other hand, a risk averse management team of bidder may not perceive the target's signals to be sufficiently revealing. Then the bidding management will find it useful to create a situation in which the target's interests also get aligned with the bidder's interests, so that a fully revealing signaling equilibrium may become feasible. A securities exchange bid may be viewed as the mechanism for this precise purpose. Hence while a securities bid will signal some degree of bidder's discomfort with the target's perceived value, it would also signify higher marginal cost of signaling for both the management teams. Hence a securities bid is likely to be more credible signal of the bidder's likely benefit form the acquisition.

In the case of a securities bid, since the target management team also becomes a direct beneficiary of the future cash flows, the relationship between bid-premium and probability of acceptance of a bid differs compared to a pure cash bid. In the case of a securities bid, the target has higher incentive to reveal information if the perceived value of bid is lower than actually warranted in light of target's private knowledge. The target will have the motivation to do so in view of his likely long term association (i.e. becomes subject to penalty in the future if things do not turn out well, thereby fulfilling Spence's criterion of marginal cost of signaling). However, if the perceived value of bid is higher than the privately known value of the target to him, target management may not reveal truthfully. Even then the bid may be beneficial to the bidder due to his high managerial capability. A higher valued target (in his private knowledge) will have lower marginal cost of signaling in case of a securities bid, but not in case of a pure cash bid. Hence we also need to formulate a framework for the probability of acceptance of a bid by the target specifically for the situation of a securities bid.

The pre-bid values of capital and ownership structures will jointly determine the marginal cost of signaling for any firm. In the case of the target, this would get translated into the cost of signaling imputed to defensive actions. In the case of the bidder, this would relate to the marginal cost of the joint signaling through bid premium and medium of exchange.

The various media of exchange are to be understood in terms of their relative riskiness, with cash component representing the risk-free offer, bonds (and its variants), preferred stock and equity offers representing the riskier offer, degree of riskiness increasing in that order.

I will assume a risk-neutral valuation of the offer by the market. However, I will assume a risk-averse behavior on the part of the bidder since the bidder-managers may not be able to diversify their (bidding) firm-specific capital (financial and skill-related) sufficiently by investing in the market portfolio[15].

I will first describe a framework for the choice of financing of acquisition as a proposal for investment in a risky project. I shall then identify the decision criteria likely to be adopted by the bidder and the target. The bidder's objective will be assumed as maximization of the

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[15]We will like to quote Stiglitz (1982) in this context. He states:

"The fact that market prices do not reflect the true value of firms has two important consequences:
Owner-managers who know that their firms are undervalued will diversify imperfectly. Firms which they control will behave in a risk-averse manner, even though their output (profits) has a zero correlation with the market, and the market values them in a risk-neutral manner....."

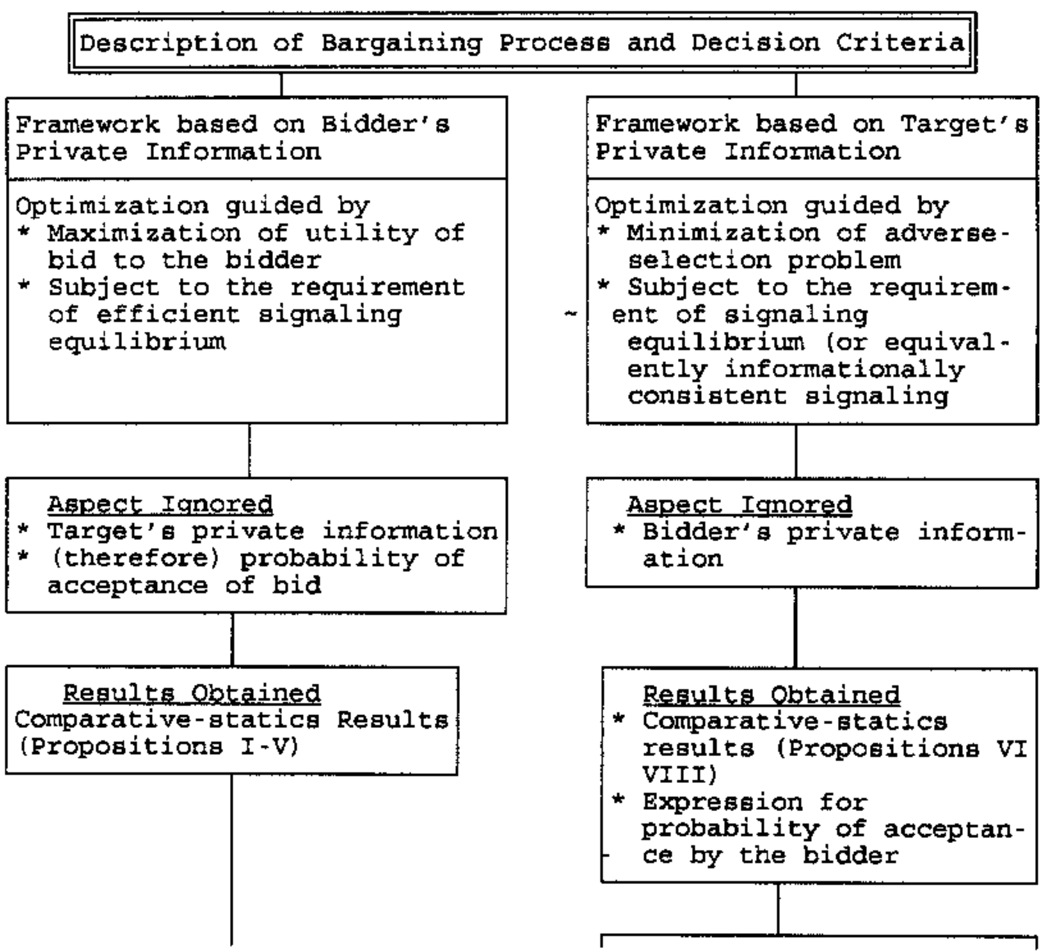
expected value of the bid. In order to restrict the signaling vector to a unique solution, I shall impose an additional requirement of the signaling vector being efficient (i.e. having the least cost to the bidder among all the feasible signals). To begin with, I shall separately develop two different models focussing upon the private information held by the bidder and then by the target. This provides us a clearer understanding of the comparative statics results by allowing us to work with a smaller number of parameters at one time. Comparative-statics methodology will be employed to come up with testable implications, relating the shifts in the signal vector with the underlying information structure. Later on, I shall develop a framework for analyzing the probabilities of bidder making a securities offer and the target accepting that. These frameworks will be subsequently integrated into an overall optimization problem for the bidder, inclusive of both sets of the information asymmetry.

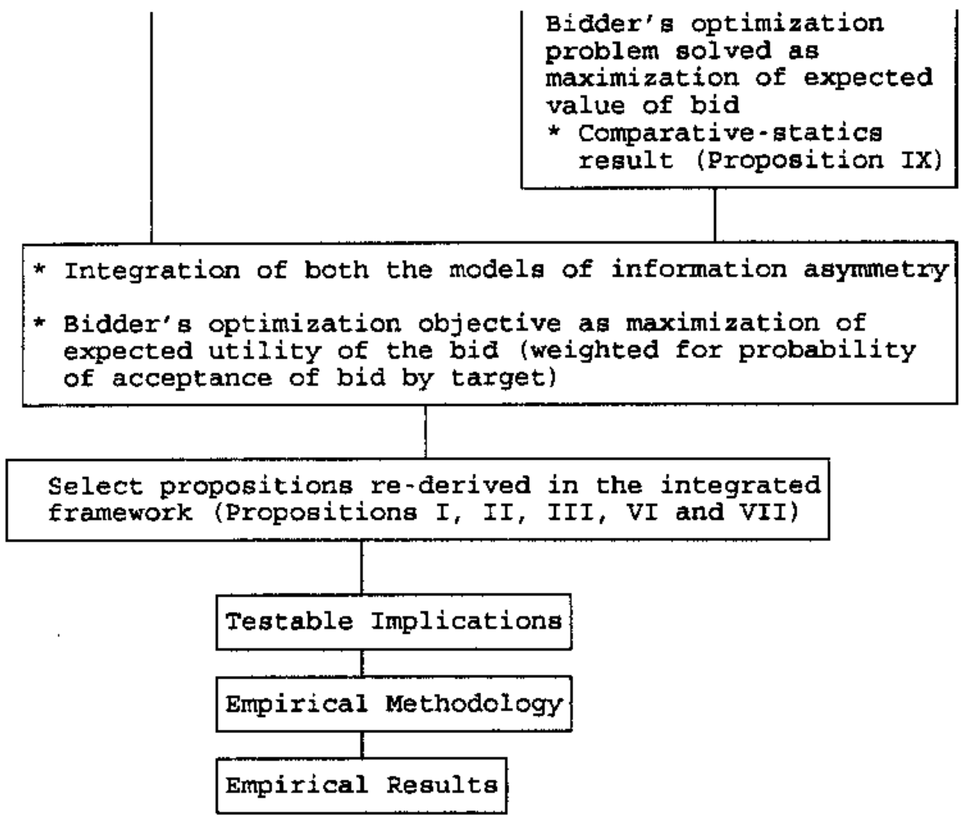
In the case of framework based on the bidder's private knowledge, the signaling problem will also be analyzed as an equivalent non-mimicry problem. In the equivalent problem, a bidder with higher quality of management maximizes his utility of bid subject to a non-mimicry constraint. This constraint stipulates that managers of another bidding firm having lower quality of management have no incentive to mimic the optimal signal vector of the higher quality bidder.

I shall attempt to identify a proxy for the measurement of probability of success of a bid. One set of my empirical models will employ bid premium multiplied by this probability factor as an explanatory factor. A few of the testable implications will be tested for empirical support later on. The results of empirical tests offer support for my analytical results. The entire scheme is diagramically depicted in Figure 1.

Figure 1

The Scheme of Analysis





The Process of Acquisition

The existence of information asymmetry affects the process of acquisition in two different manners:

1. It creates opportunities for the advantageously placed groups to acquire informational advantage vis-a-vis others and then seek to convert this advantage and their superior managerial capabilities into profit opportunity.

2. The target and the bidders formulate their respective bid strategy in light of the perceived uncertainties in: (1) the asset values of the other parties, (2) in their own assets, and (3) the quality of management of the bidder. Various market participants are likely to be

endowed with different information sets at the time of making a bid and in equilibrium (i.e. at the time of acceptance of the bid), as is depicted in Figure 2.

Figure 2

Bidding Process: Information Sets

Bidder

Past performance history of bidder/target
Bidder's quality of management

Market's pricing function

value of target's assets under his management

Target

Past performance history of bidder/target
True value of target's assets[16]

Market's pricing function

* Bidder's quality of management

Market

Past performance history of bidder/target
Market's pricing function

* True value of target's assets
* Bidder's quality of management

Unshaded region: information known perfectly
Shaded region: information available partially

As mentioned earlier, it does not appear that the bid signals the market information about the value of existing assets of the bidder. The available empirical literature does not provide any such evidence, though some researchers provide evidence of decrease in the market value of bidder in the case of failed bids (Bradley et al. (1983)). Similar logic is applicable in the case of the target's assets as well. Only in cases where the other bid materialized later

[16]under control of a bidder with given quality of management

on, the target's market value did not revert to its pre-first bid level (Ruback, (1988)). We will assume that bidder's return by investing in a target is solely due to the bidder's efficiency in managing the target's assets (including bidder-specific synergy). Payment up to the pre-bid value of target does not signal bidder's efficiency in managing the assets of the target. Hence in terms of signaling implication, the relevant investment in the target consists only of the bid premium paid by the bidder.

However, the bidder is uncertain about the true value of gains from the target's assets under its management. The bid premium and the medium of exchange signal jointly to the target (and the market) the bidder's private knowledge about the likely gain from the acquisition. The target then evaluates the bid in the light of its own private information and accepts the bid only if the value of bid (as understood by the target) is no less than the target's own valuation of its assets. Our analysis will first consider the properties of signaling equilibrium due to private information held by the bidder. The signaling framework will be based upon the interaction of the bid premium and the medium of exchange.

Bargaining Process and Decision Criteria

The bargaining process begins with the bidder's information set regarding the value of the target's assets and the pricing function. Based on the knowledge of probability distribution of the target's assets, the bidder is assumed to be guided by the following two considerations in his bargaining strategy:

1. The value of the bid is not less than the lowest probable value of the target's assets (i.e. pre-bid market price or some reservation price known to the bidder).

2. In order to induce the target to accept the bid, the bidder will offer a bid premium.

The overall decision criterion to be employed by the bidder will be maximization of the expected gains from making the bid. The bidder will make a bid only if the total expenses (e.g. legal and publicity expenses, cost incurred for acquiring information about the target, etc.) associated with a bid do not exceed the expected value of the bid. We may expect that in the case of most of the situations the constraint due to bid-related expenses may not be binding. However, by making a bid the bidder will attract the attention of other possible bidders for the same target. Till the time the bidder has not announced his bid, he has the option to exercise his bidding rights at any time, along with freedom to study the target in detail. This will allow him to gather more information in order to improve his bid signal to his maximum advantage. In case the ultimate bid fails, the bidder may lose effectively the privilege to exercise this option for considerable length of time. This may be the largest component of the total expenses of making a bid. We will not try to analyze the total expense of making a bid in this research and will assume that the bidder's objective is to maximize the expected value of the bid (as if it will always exceed the aggregate bid related expenses).

The target will accept a bid only if the perceived value of the bid exceeds the value of existing assets of the target in his private knowledge, or some reservation price expected from another bidder. If the bid does not consist entirely of cash, the target will use some valuation methodology (call it pricing function) based on the known characteristics of the bidder. We assume that both market and target employ the same pricing function to value the bid (and infer the bidder's quality of management from the bid signal vector). In case the market perceives a difference between the value of the bid estimated using the pricing function, and the value of the target's assets under current management, arbitragers will trade in target's securities (and also in bidder's securities). This trade will continue till the gap in two values is reduced to a level commensurate with the probability of success of the bid. In case this probability is less than one, there still would be a value gap in the nature of risk-premium due to uncertainty regarding the future outcome of the offer.

Given the bid signal, the target will either accept or reject the bid. It may also release additional information favorable to him (e.g. may allow the bidder to scrutinize the target's books or the condition of equipment on-site). In situations other than acceptance, the bidder will re-assess its prior information set (in the sense of Bayesian updating) and may decide to end the bid. Otherwise, the bidder will reformulate the bid and continue the bargaining process till the target accepts the bid (which should be an equilibrium situation) or end the bid. Signaling equilibrium may be expected to almost always exist in the case of acceptance of the bid by the target. However, the reverse may not be always true. A bid may not get accepted even when signaling equilibrium exists. This will happen if bidder's quality of management is revealed to be less than that of a competing bidder in managing the target's assets. In cases where equilibrium fails to emerge, bid will fail always almost.

Since the target will own a fraction of the merged firm in the case of acceptance of securities bid, he also will share the value loss if in his private estimation bidder has the ability to generate low value by managing the target's assets. Hence the target will find the offer less beneficial than the nominal value of the bid premium offered to him by the bidder. Till the point bid premium is not less than this value loss, the target will still find the offer beneficial. The target will not accept the bid in case such value loss (due to actual low value of target's assets under bidder's management) exceeds bid premium. Thereby target will signal the market an upper bound on the true value likely to be created. However, this may be only a partially revealing signal, since this may only indicate that the true value of target's assets under the bidder's control will be lower than the one conveyed by the bid signal. It may fail to convey the true value of the target's assets to the bidder due to absence of a fully revealing signaling vector in the case of the target[17]. The bidder will be aware of such a possibility. In case the target does not accept the bid, the bidder will reformulate the signal vector in the light of new information regarding upper bound on likely value to be created.

In the entire process, bidder's optimization objective may be understood as a sequence of following three stages:

(1) convey bidder's quality of management (in managing target's assets) to others (target and the general market) in order to get the best valuation of the bidder's wealth (i.e. existing as well as potential assets),

(2) minimize the effect of adverse selection (i.e. the target turns out to be a lemon later on due to information asymmetry prevailing at the time of bidding), and

[17]The bid signal vector is formulated by the bidder. Target has access to only one dimensional signal with two possible values "yes/no" to the bid. Such a limited signal will not be able to span the target's information set sufficiently to allow for separating equilibrium.

(3) then maximize the expected value of the gain from the bid, i.e.

$$\text{Max}_{(\text{signal parameters})} \text{ [Probability of success of bid * Expected value of bid if successful]}$$

The final stage above always includes earlier two stages as necessary pre-requisites. However, specification of the first two stages is helpful in modelling the mechanism through which the bidder maximizes the expected value of bid.

The existing models of the medium of exchange fail to include all the above aspects into consideration. Hansen (1987) in his model seems to have assumed that the relationship between the offer value and the probability of success of a bid will be the same under any medium of exchange. Hence his analysis ignores the linkage between the probability of success of a bid and the expected value of bid if successful. However, the valuation of offer value (or alternatively bid premium) would also depend upon the target's private knowledge in case of an exchange offer. Hence the probability of acceptance of a bid will be affected by the target's perception of the bid premium, conditional upon any private information available to the target, rather than the bidder's valuation of the bid premium (i.e. the nominal value of bid premium implicitly built into the exchange ratio by the bidder). Until the bid is accepted by the target, there would be a likelihood that the value of offer (exchange ratio in the case of securities offer) will be different from the implicit cash bid equivalent (as intended by the bidder in his calculations). Hence for the same bid premium, the probability of acceptance of a bid will be different in case of pure cash and securities medium of exchange. Till the final resolution of the bidding process, efficient signaling equilibrium condition (allowing revelation of the value of target's value) may not be satisfied. Hence the bidder needs to ascertain the probability of success of the bid based on two factors: (a) the exchange ratio, and (b) the probability distribution of the value of target's assets. The value of exchange ratio (to the target) will depend also upon the latter factor in case of a securities bid, but not in case of a pure cash bid.

Fishman (1986, 1989) does not appear to consider all of the above factors while suggesting that the medium of exchange and the bid-premium are designed to deter potential competition (i.e. to increase the probability of success of the bid). His model is silent on the bidder's need to get the best value for his assets and/or his superior managerial capability in managing target's assets. Higher probability of success (by deterring potential competition) may not be exclusively the optimal decision criterion for a bidder.

Brown and Ryngaert (1991) consider only the expected value of bid, with bidder's optimization objective as the minimization of acquisition costs, given the bidder's private information and likely tax implication of the medium of exchange. Hence their model suggests three discrete values for the percentage of stock in an optimal bid, will be either zero, 50 or 100 percent.

I will hypothesize a negative exponential utility function for the bidder management. The effect of inherent business risk in the target upon the utility of the bidder's managers will be accounted for through a variance term (as a commensurate measure of normal business risk). I will also draw upon the analysis done earlier by Blazenko linking financial structure with managerial preference and asymmetric information. Then I shall describe the target's decision criterion.

Acquisitions: A Multiple Signal Framework

In order to avoid any confusion due to inconsistent use of terminology in different frameworks, I will like to maintain uniform notations throughout our analysis. Toward this, I describe the various notations to be used now.

1. The pre-bid market value of bidder and target's equity shares will be denoted by V_b and V_t, respectively.

2. The bidder makes a total offer having nominal value c to the target in exchange for the target's assets. c

comprises V_t and bid-premium, to be denoted by M.

3. Bidder offers the (nominal) amount c either in cash or by transferring a fraction $(1-\alpha)$ of the voting rights in the post-acquisition firm. The total amount (cash plus $(1-\alpha)$ of the voting rights) equals c. Bidder retains for himself a fraction α $(0 < \alpha \leq 1)$ of the voting rights of the post-acquisition firm. This way, the bidder's management team decides, at time t=0, to make an offer $[M, 1-\alpha]$ to the target[18]. For notational convenience, $1-\alpha$ will be denoted by p, i.e.

$$1 - \alpha \equiv p, \text{ and}$$
$$[M, 1-\alpha] \equiv [M, p], \text{ and}$$
$$[V_t+M, 1-\alpha] \equiv [c, 1-\alpha] \equiv [c, p]$$

4. I will denote the bidder's likely efficiency, in the bidder's private knowledge, in managing the target's assets as θ.

5. I will describe the likely value creation by the bidder by acquiring and managing the target's assets through a payoff function $q(M,\theta)$. By paying bid-premium M, bidder will generate a total value $q(M,\theta)$.

6. The payoff function represents a set of assets such that a target acquired by paying bid-premium M at time = 0

[18] $\alpha = 1$ will correspond to pure cash bid. $\alpha < 1$ will correspond to mixed and pure securities exchange bids.

results in a random cash flow of $q(M,\theta) + u$ at $T = 1$ for the bidder with quality θ in case of the given target. u is a normally distributed random variable with mean zero and variance σ_t^2. The source of σ_t^2 lies in the history of the target's returns, in the sense that σ_t^2 characterizes the inherent riskiness in the current business of the target.

7. The market infers the quality of the bidder's management in light of bid-premium M and the bidder's shareholding α.

8. In case the bidder's quality of management θ is common knowledge (in addition to V_b), the notation Q(c) will be used to represent $q(M,\theta)$.

$$q(M,\theta)\big|_{\theta\ \text{common knowledge}} = Q(c) = Q(V_t+M)$$

This notation will be used in the framework of information asymmetry due to the target's private knowledge only. Substitution of M by c as the first argument in Q(c) is merely for the sake of convenience in the framework based on the target's private knowledge. The value of pay-off function Q(c) or $Q(V_t+M)$ will be given by $q(M,\theta)$.

John and Lang's (1991) multiple signal (dividend and insider holding) framework can be adapted for application in case of the bidder's signal (bid premium and medium of exchange). In this framework, I ignore the amount of uncertainty arising due to private knowledge of the target, which will be integrated later on in Chapter VI in the model being developed in this chapter.

The parameter $\theta \in \Theta = [\theta_l, \theta_h]$ $\{0 < \theta_l < \theta_h\}$ is assumed to be known to the bidder management, but not observed directly by the target. Bidder managers observe θ and σ_t^2. In light of θ and σ_t^2, they choose α and M optimally. Outsiders attempt to infer θ from α and M. Except for θ, all other parameters of the subsequent problem are common knowledge, including the prior distribution π of θ and distribution of u.

Higher θ represents more favorable private information. For all feasible M ($M \geq 0$) and for all $\theta \in \Theta$, we have $q(M, \theta_2) > q(M, \theta_1)$ if $\theta_2 > \theta_1$. The range of values of M, where $q(M,\theta)$ is not less than M, defines feasible range of M. The function $q(.,\theta)$ is positive, continuously differentiable, strictly increasing, and strictly concave in investment with the corner condition being $q_M(0,\theta) = \infty$ for all $\theta \in \Theta$. I make the assumption here that in the range $\theta \in \Theta$, the bidder makes the bid and pays bid-premium only if he considers himself to be efficient in managing the target's assets such that the additional value generated exceeds the bid-premium. From this assumption, it also follows that the first derivative of $q(M,.)$ with respect to M will at least be equal to one in the range the bidder will make the bid based upon his private knowledge. If $\theta = \theta_l$, the bidder will be expected to be only as efficient as the existing management team of the target in managing the target's assets. Any bidder having lower quality of management will lose by making a bid for the target.

The bidder manager is risk-averse and has a negative exponential utility function with coefficient of absolute risk-aversion h, $h \geq 0$. There exists a compensation scheme such that the management's interests are closely tied to those of shareholders. The bidder managers optimize their personal assets portfolio by maximizing the value of the bidder firm[19]. However, the same compensation scheme induces risk-averse behavior among the managers. The investors are assumed to be able to diversify their assets portfolios adequately, so that risk neutral valuation is appropriate for the market as a whole.

The bidder management maximizes his expected utility of the end-of-period wealth **W**, given his private information θ and idea of σ_t^2. W is a function of the value of the bidder's existing assets, pay-off function and the market's valuation schedule of the likely benefit of the acquisition to the bidder. The market's valuation of the likely benefit of acquisition to the bidder can only depend on common knowledge, and M and α. Let $P(M,\alpha)$ be called the pricing

[19] I do not explicitly include agency problems in our framework. Existence of agency problems will affect the value of h. Higher the magnitude of agency problems, lower would be the effective value of h due to risk aversion being lower than in case of perfect alignment of interests between investors and managers.

function representing the market's valuation of the expected benefit of the given bid to the bidder. Like $q(M,\theta)$, $P(M,\alpha)$ also is assumed to be strictly increasing, concave and continuously differentiable in both its arguments. We may quote Jarrow (1988) to describe the characteristics of pricing function. He states,

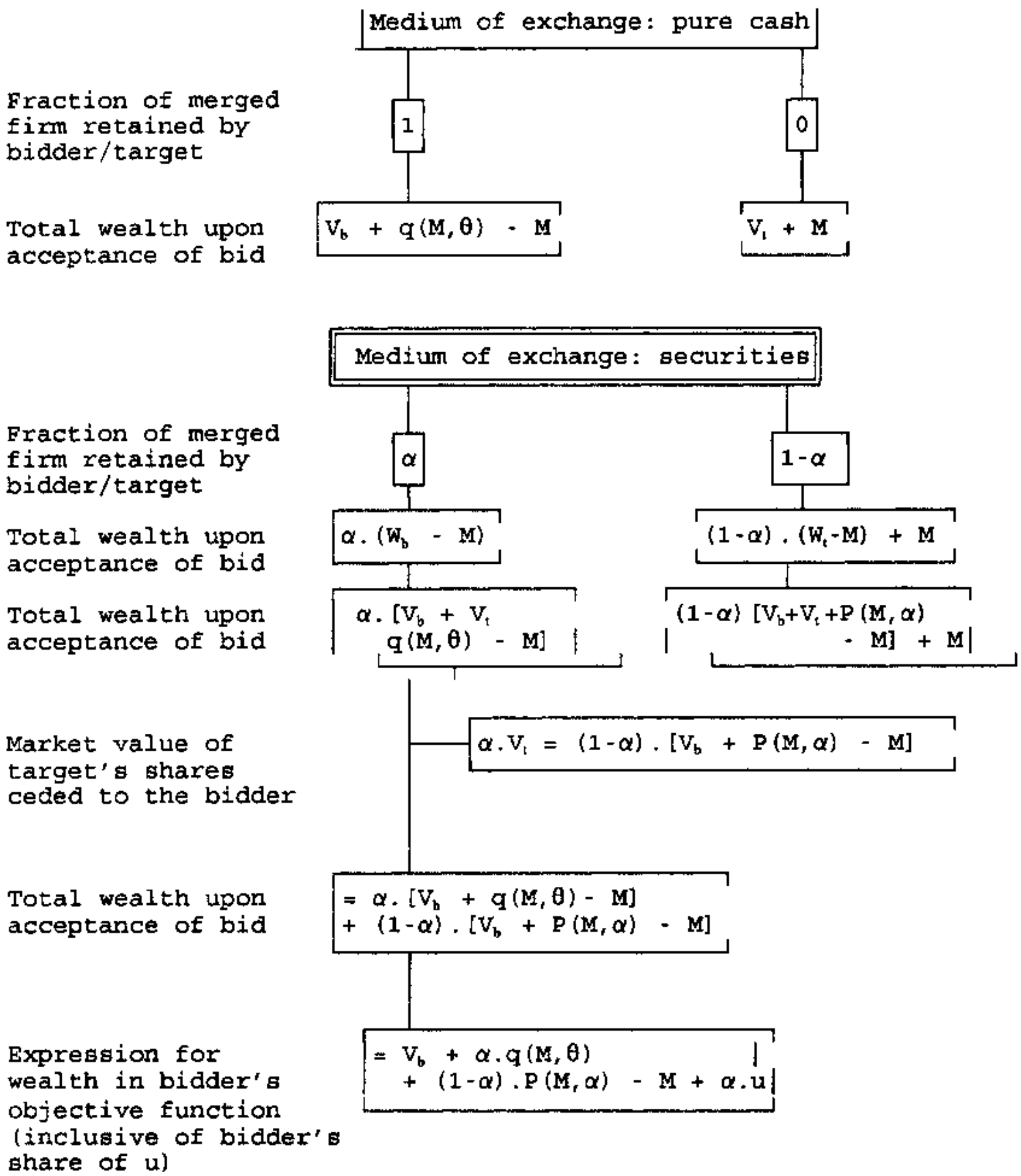
> "The pricing function represents an aggregation or filtering of all the investors' private information sets. This filtering utilizes more information than any single investor may possess. If an investor is sophisticated in his understanding of the market process, he may be able to infer the functional form of pricing function-perhaps through repeated observations of the market price over time, or perhaps by understanding the equilibrium price mechanism well enough to perform the necessary calculations (using preferences, information sets, and so on to determine the equilibrium prices directly)."

The transaction between bidder and target is shown in Figure 3.

Figure 3

Transactions between Bidder and Target

	Bidder	Target
Wealth before bid	Existing assets (V_b)	Existing assets (V_t)
Valuation of synergy	$q(M,\theta)$	$P(M,\alpha)$
Extra wealth in case of acceptance of bid	Value of pay-off function - bid-premium $= q(M,\theta) - M$	Bid-premium = M
Total value of merged firm	$W_b = V_b + V_t + q(M,\theta)$	$W_t = V_b + V_t + P(M,\alpha)$



The optimization problem for the bidder may be specified as follows: choose the medium of exchange (α) and the bid premium M to maximize bidder's expected utility of wealth, conditional on the pricing function P. Hence the optimization problem becomes:

$$\text{Max}_{\alpha,M\geq 0} \quad V_b + \alpha.q(M,\theta) + (1-\alpha).P(M,\alpha) - M - \frac{h\sigma_t^2\alpha^2}{2} \qquad (2)$$

The value of the post-merger firm will be different in the bidder's knowledge (equal to $V_b + V_t + q(M,\theta) - M$) and in the target's knowledge (equal to $V_b + V_t + P(M,\alpha) - M$). For the exchange of the target's assets, the bidder's offer will be priced according to the target's knowledge of own assets and pricing function. The term $\alpha.[V_b + V_t + q(M,\theta) - M]$ represents the value of fraction of the post-acquisition firm retained by the bidder. Since the target will own a fraction $(1-\alpha)$ of the bidder's original assets (V_b) and synergy $(P(M,\alpha)$ less bid-premium, it will value this fraction equal to $(1-\alpha).[V_b + P(M,\alpha) - M]$. The value of fraction of his assets transferred by the target to the bidder will be $\alpha.V_t$ and would therefore be equal to $(1-\alpha)[V_b + P(M,\alpha) - M]$. Hence under the assumption of risk-neutral pricing by the market, the term $\{(1-\alpha)[V_b + P(M,\alpha) - M]\}$ will be equal to the exchange value accruing to the bidder in the form of ownership of the target's assets (excluding bid premium). Let $\{M(\theta),\alpha(\theta)\}$ denote the solution to (2). Let $V(\theta,M,\alpha)$ denote the value of the merged firm under symmetric information. Given risk-neutral pricing by the market,

$$V(\theta,M,\alpha) = V_b + V_t + q(M,\theta) \qquad (3)$$

The bidder selects $M(\theta)$ and $\alpha(\theta)$ optimally to satisfy the incentive compatibility condition (2), given θ and the pricing function $P(M,\alpha)$. After the announcement of the bid, outsiders transact in the bidder's and target's shares in the belief that the merged firm's total market price equals its concurrent true value:

$$V_b + V_t + P[M(\theta),\alpha(\theta)] = V[\theta,M(\theta),\alpha(\theta)] \qquad (4)$$

Otherwise, arbitragers will take advantage of a value gap in the prevailing prices of the securities of the bidder and target till the above condition is satisfied. If the above condition fails to be satisfied despite the arbitragers' presence in the market, it would imply weak (i.e. significantly less than one) probability of success of the bid because the target does not believe that the bid represents a fair exchange. The above equation is called "competitive-rationality condition" by John and Mishra (1990). A signaling equilibrium $\{M(\theta),\alpha(\theta),P[M(\theta),\alpha(\theta)]\}$ must satisfy both the incentive-compatibility condition (2) and the competitive-rationality condition (4). These conditions will define an optimal value of the signaling vector $[M,\alpha]$ for the bidder with true value θ as the argument in pay-off function. However, in case a number of signal vectors satisfy the stated conditions, we will assume a selection rule requiring the optimal signal vector to be efficient. In case of a bid, the bid premium M may be viewed as the cost of signaling for the bidder. Hence the condition of efficient signaling equilibrium will result in selection of signal vector with the lowest value of M ($M \geq 0$) satisfying conditions (2) and (4) simultaneously. At the same time, this value of M will allow the bidder to retain the maximum advantage in case the target turns out to be a better investment later on than what was perceived while making the bid.

In order to study the properties of the signaling equilibrium, I will compare the differences likely in the joint signal in case of two bidders having different values of θ but similar h. Let $j = 1,2$ denote the two competing bidders with their respective parameters and functions subscripted by j. In equilibrium for the bidder j for a target, the competitive-rationality condition (4) gives:

$$V_b + P[M(\theta),\alpha(\theta)] = V[\theta,M(\theta),\alpha(\theta)]$$

The RHS in the above equation may be replaced by the RHS in the relationship (3):

$$V_b + V_t + P[M(\theta),\alpha(\theta)] = V_b + V_t + q(M,\theta)$$

$$\text{or, } P[M,\alpha] = q(M,\theta) \qquad (5)$$

Hence in efficient signaling equilibrium, (2) becomes:

$$\text{Max}_{\alpha,M\geq 0} \quad V_b + q(M,\theta) - M - \frac{h\sigma_t^2\alpha^2}{2} \qquad (6)$$

In order to have a separating signaling equilibrium, the bidder (say j=1) with lower quality θ should have no incentive to mimic the higher quality bidder (say j=2). Hence the bidder 2 must pick the vector of signals $[M_2,\alpha_2]$ satisfying the non-mimicry constraint:

$$V_b + \alpha_2 . q(M_1^*,\theta_1) + (1-\alpha_2).P(M_2,\alpha_2) - (M_2-M_1^*) - \frac{h\sigma_t^2\alpha_2^2}{2} \leq V_b + q(M_1^*,\theta_1) - \frac{h\sigma_t^2\alpha_1^{*2}}{2} \qquad (7)$$

We will require one additional condition of "non-mimicry" in order to allow bidder 2 to separate itself from bidder 1. The quantum of excessive bid premium paid to the target by the bidder 1 in order to mimic bidder 2 would be $(M_2-M_1^*)$. Bidder 2 is likely to be able to generate extra amount of value $[q(M_2,\theta_2) - q(M_1^*,\theta_1)]$, compared to the value likely to be generated by bidder 1. In order to win the bidding game, bidder 2 will transfer a fraction $(1-\alpha_2)$ of this extra value, which should dominate the extra value (equal to $(M_2-M_1^*)$) included in the bid by the bidder 1 in order to mimic bidder 2. Hence non-mimicry would require another condition to be satisfied:

$$(1-\alpha_2).[q(M_2,\theta_2) - q(M_1^*,\theta_1)] \geq (M_2-M_1^*) \qquad (8)$$

Where M_1^* and α_1^* are the distinct optimal choices for firm 1 obtained as solutions to equation (2) and (4). The condition (7) and (8) lead to a few testable hypotheses as described next.

Proposition I: A more efficient bidder will retain higher equity stake in the merged firm.

Proof: Using equation (6), the non-mimicry condition (7) may be stated as:

$$V_b + \alpha_2.q(M_1^*,\theta_1) + (1-\alpha_2).P(M_2,\alpha_2) - (M_2-M_1^*) - \frac{h\sigma_t^2\alpha_2^2}{2}$$
$$\leq V_b + q(M_1^*,\theta_1) - \frac{h\sigma_t^2\alpha_1^{*2}}{2}$$

Or,

$$(1-\alpha_2).[P(M_2,\alpha_2)-q(M_1^*,\theta_1)] - (M_2-M_1^*) \leq \frac{h\sigma_t^2}{2}(\alpha_2^2 - \alpha_1^{*2})$$

Since bidder 2's bid is optimal, using relationship (5) the above condition will become:

$$(1-\alpha_2).[q(M_2,\theta_2)-q(M_1^*,\theta_1)] - (M_2-M_1^*) \leq \frac{h\sigma_t^2}{2}(\alpha_2^2 - \alpha_1^{*2}) \qquad (9)$$

In view of non-mimicry condition (8), the LHS in equation (9) will be positive, which implies that $\alpha_2 > \alpha_1^*$.

Q.E.D.

This proposition may be interpreted as saying that higher valuing bidders offer higher percentage of cash in the bid. Higher percentage of cash in the bid by bidder 2 reduces the marginal benefit of false signaling to bidder 1. However, this also results into bidder 1 absorbing higher amount of risk in the target.

<u>Proposition II</u>: Increased risk in the target would result in lower bidder's equity stake in the merged firm.

Proof: In equation (6), higher σ_t^2 would require reduced α in order to obtain the same level of utility for the bidder. From equation (2), first order necessary condition for maximization with respect to α becomes:

$$0 = q(M,\theta) - P(M,\alpha) + (1-\alpha).\frac{\partial P}{\partial \alpha} - h.\sigma_t^2.\alpha = D \text{ (say)}$$

And, $$\frac{\partial D}{\partial \alpha} = -2\frac{\partial P}{\partial \alpha} + (1-\alpha)\frac{\partial^2 P}{\partial \alpha^2} - h.\sigma_t^2 < 0$$

(Since the pricing function is assumed to be strictly increasing and concave in α.)

Using implicit function rule;

$$\frac{\partial \alpha}{\partial \sigma_t^2} = -\frac{\partial D/\partial \sigma_t^2}{\partial D/\partial \alpha} = \frac{h.\alpha}{\text{(negative figure)}} < 0$$

Q.E.D.

Intuitively, this result will mean that a bidder will reduce the percentage of cash in the bid for a riskier target. Alternatively, the bidder may reduce bid premium and maintain the percentage of cash at the same level in case of a riskier target. However, lower bid premium will signal lower value of the bidder's quality in managing the target's assets, which may be counter-productive. Furthermore, lower bid-premium will affect adversely the likelihood of the target's acceptance of the bid.

Proposition III: Increased risk aversion of the bidder will result in lower bidder's equity stake in the merged firm.

Proof: As in the proof of Proposition II, using implicit function rule, we get,

$$\frac{\partial \alpha}{\partial h} = -\frac{\partial D/\partial h}{\partial D/\partial \alpha} = \frac{\sigma_t^2 . \alpha}{(\text{-negative figure})} < 0 \qquad \text{Q.E.D.}$$

Intuitively, higher risk-aversion among bidding managers will cause them to undertake lower amount of extra risk. The value of their firm-specific human capital (and perquisites) will be then more sensitive to any significant increase in the probability of bankruptcy in case of more risk-averse managers. Hence such managers are likely to reduce their risk-exposure by having lower stake in the merged firm.

Our analysis may be extended further to ascertain conditions under which the bidder will make a pure cash bid (i.e. $\alpha = 1$). In terms of equation (2), for a given bid-premium a pure cash bid (call it $\alpha(p) = 1$) would dominate a non-pure cash bid ($\alpha(np) < 1$) if

$$V_b + \alpha . q(M,\theta) + (1-\alpha) . P(M,\alpha) - M - \frac{h\sigma_t^2\alpha^2}{2} \Big|_{\alpha = \alpha(np) < 1}$$

$$< V_b + \alpha . q(M,\theta) + (1-\alpha) . P(M,\alpha) - M - \frac{h\sigma_t^2\alpha^2}{2} \Big|_{\alpha = \alpha(p) = 1}$$

Or, $$V_b + \alpha(p) . q(M,\theta) + (1-\alpha) . P(M,\alpha(p)) - \frac{h\sigma_t^2\alpha(p)^2}{2}$$

$$< V_b + q(M,\theta) - M - \frac{h\sigma_t^2}{2}$$

Since here the condition for optimality of pure cash bid is being discussed, the value of $\alpha(np)$ in the function $P(M,\alpha)$ is less than one which is not the optimal value of α (= 1) in this case. Hence the competitive rationality condition (4) is not satisfied in this case. This means that $P(M,\alpha)$ falls short of $q(M,\theta)$, thereby making LHS fall short of RHS. Solution of the above equation leads to the condition for the optimality of pure cash bid as:

$$\frac{h\sigma_t^2}{2} - \frac{h\sigma_t^2\alpha^2}{2} < (1-\alpha) . [q(M,\theta) - P(M,\alpha)] - M \Big|_{\forall\alpha < 1}$$

Or, $$\left(\frac{h\sigma_t^2}{2} - \frac{h\sigma_t^2\alpha^2}{2} \right) - M < (1-\alpha) . [q(M,\theta) - P(M,\alpha)] \Big|_{\forall\alpha < 1} \qquad (10)$$

The term within parentheses in (10) may be identified as the extra amount of risk absorbed by the bidder in case of pure cash bid. The term within the square brackets in the RHS may be described as the latent payment by the bidder to the target arising due to the bidder's private knowledge (causing technology function and market's pricing function to be giving different values for the same bid signal vector). Hence the relationship (14) may be interpreted as indicating that pure cash is the optimal medium of exchange if the bidder's loss (resulting from higher risk-bearing plus payment of bid premium) does not exceed the latent payment to the target in case of any combination of securities offer.

As the bidder's risk aversion or the target's riskiness (σ_t^2) will increase, the probability of pure cash being an optimal medium of exchange will decrease. Also, as the market pricing function $P(M,\alpha)$ approaches the true pay-off function $q(M,\theta)$, the RHS in equation (10) will decline. Hence the probability of the bidder having pure cash as the optimal medium of exchange will decline. Intuitively, increase in the value of $P(M,\alpha)$ will correspond to higher valuation of bidder's capability, which will also result in higher value of bidder's equity. Hence a stock offer would fetch a higher price to the bidder.

It may be seen that the optimality of medium of exchange may depend also upon the relative size of the target and the bidder. The factors $h\sigma_t^2$ and M will increase with the relative size of the target. Hence higher relative size would imply lower probability of pure cash being the optimal medium of exchange. For a bidder with given $q(M,\theta)$, and $P(M,\alpha)$ and h, the specific values of M and σ_t^2 will determine the optimal medium of exchange. For a target with known history of business performance (i.e. amount of and variability in cash flow), increase in the relative size of the target compared to the bidder will result in the bidder paying higher gross amount as bid premium. The bidder will also by acquiring a target with higher risk due to variance being an additive function.

In this framework, a securities offer (i.e. other than pure cash) would signal higher riskiness in the target. A pure cash bid would be a credible signal of the lower riskiness in the target only when there are reasons to believe that the risk-aversion of the bidder management is high (due to large relative size of the target or low risk-bearing capacity in the bidding firm). In case a pure cash bid is made by a firm whose managers' risk-aversion is not high, a signaling equilibrium may not exist (in light of corollary to Blazenko's (1987) proposition 4 that there may not be any signaling equilibrium if the managers are not sufficiently risk-averse). The abnormal returns in case of cash bids by large bidders may hence be diffuse.

Intuitively, due to the existence of information asymmetry, there will always be some probability of the bidder overestimating the target's value. However, the probability as well as the impact of the event of actual overestimation upon the bidder would be very different depending upon the relative sizes of the bidder and the target. Even if the expected value of a bid remains invariant to a factor like size of the bidder, the likelihood of bankruptcy would increase by a higher percentage in case of a cash offer by a smaller bidder for the larger target than in case of an offer by a bigger bidder for a smaller target.

For the purpose of this paper, "size" will be defined as the market value of the equity of a firm. Defined this way, size represents the market's assessment of the future cash flow of the firm appropriately adjusted for risk. Assuming that financial market mechanism will allow for inter-temporal movement of funds from surplus period to deficit period, a bigger size of the bidder is likely to allow more latitude in undertaking risky projects. Seen this way, size also reflects the risk-bearing capacity of a firm. This feature of size makes the risk-sharing mechanism more important in case of bidders smaller in size than the target, compared to bidders larger in size.

Bid Premium: A Differential Signaling Approach

In our model, bid premium is viewed as a joint signal along with the medium of exchange. For the purpose of this research, I will adapt Blazenko's (1987) framework to derive testable implications in case of bid premium. My analysis provides two testable implications, stated below as propositions:

<u>Proposition IV</u>: In case of a pure cash bid, the bidder's return will increase with bid premium.

Proof: First note that for a given bidder-target set, the optimal value M^* of bid-premium in case of equilibrium will be endogenously determined and will be unique. This way, the value of M^*, under equilibrium condition, will be an exogenous value reflecting the peculiar characteristics of the particular bidder-target set. However, for different sets of bidder-target, M^* will differ according to the particular group.In case of a pure cash bid, M^* will be a proxy for bidder's quality of management θ. Since θ is an exogenous variable, M^* also may be treated as an exogenous variable across different bidders (for the same or different targets). Hence we may try to ascertain the effect of change in bid-premium upon the value of bid to the bidder.

Without any loss of generality, we assume the bidder's investment in a firm equal to the bid premium. Then in the case of debt-financing (or equivalent cash medium of exchange in case of a bid), the value of the merged firm to the bidder will be

$$(V_b + q(M,\theta) - M - \frac{h\sigma_t^2}{2}).$$

Hence, $$\frac{\partial V}{\partial M} = \frac{\partial [q(M,\theta) - M]}{\partial M} > 0$$

(Since $\frac{\partial q}{\partial M}(M,.) \geq 1$ from our assumptions.)

Q.E.D.

Alternatively, in terms of Blazenko's framework[20],

Bidder's wealth =

$$(V_b + q(M,\theta) - M) \equiv (V_b + p.w.M - M);$$

Where,

(as defined by Blazenko) p = probability of target yielding higher return (= z) in manager's assessment

1-p = probability of target yielding zero return

w.M = q(M, θ) ≡ z in Blazenko's framework

Then, $$\frac{\partial (V_b + p.w.M - M)}{\partial M} = p.w - 1 \quad (11)$$

For a bidder to have a positive NPV bid, p.w (probability of higher return time the factor of higher

[20]Blazenko describes a two period model, where future state will result in either zero or high (z) payment from the investment made in the initial period.

return) must not be less than one. Hence RHS in equation (11) will be positive.

Q.E.D.

Proposition V: In case of a securities bid, the bidder's return will decrease with bid premium.

Proof: This proof is based upon the description of rational-expectation equilibrium, as described in the proof of Proposition 3 in Blazenko (1987). In case of securities bid, the value of his share of the merged firm to the bidder will be

$$\alpha.(V_b + V_t + p.w.M)$$

where,

α = fraction of post-merger firm retained by the bidder

$$= \frac{V_b + \Phi_E.w.M - M}{V_b + V_t + \Phi_E.w.M}$$

Φ_E = investors' expected probability of realization of higher return if managers bid through securities offer

Information asymmetry due to private information held by the bidder would imply that investors' expected probability of success of the project will be less than the probability known to the managers, and then

$$\Phi_E . w \le p.w \le 1 \tag{12}$$

Since, if p.w $\geq$ 1, the expected benefit of the bid would exceed the bid premium in the private assessment of the bidder. Hence the bidder will find it profitable to offer cash rather than securities bid.

$$\frac{\partial \alpha}{\partial M} = -\frac{V_b}{(V_b + V_t + \Phi_E.w.M)^2}$$

$$\frac{\partial [\alpha(V_b + V_t + p.w.M)]}{\partial M} = (V_b + V_t + p.w.M).\frac{\partial \alpha}{\partial M} + \alpha.p.w$$

$$= \left[\frac{pw(V_b + \Phi_E.w.M-M)}{(V_b + V_t + \Phi_E.w.M)} - \frac{V_b.(V_b + + V_t + p.w.M)}{(V_b + V_t + \Phi_E.w.M)^2} \right]$$

$$\left[= \frac{1}{(V_b + V_t + \Phi_E.w.M)} [pw(V_b + \Phi_E.w.M-M) - \frac{V_b.(V_b + V_t + p.w.M)}{(V_b + V_t + \Phi_E.w.M)}\right] \quad (13)$$

However, from (12),

$$\frac{(V_b + V_t + p.w.M)}{(V_b + V_t + \Phi_E.w.M)} \geq 1$$

and $p.w.(V_b + \Phi_E.w.M - M) < V_b$

Hence the term within the square bracket in (13) will be negative, i.e.

$$\frac{\partial [\alpha.(V_b + V_t + p.w.M)]}{\partial M} < 0 \quad (14)$$

Q.E.D.

The intuition behind these results is that higher cash payment by risk-averse managers would signal lower riskiness and thereby higher valuation of the benefits to the bidder. Securities medium of exchange would signal perception of higher riskiness in the target. In this case, higher bid premium would imply higher payment to the target in the event the target does not turn out to be a lemon. However, the riskiness of the target will continue to be perceived to be high due to securities being the medium of exchange. In case the bidder's existing assets value is significantly larger than the potential value of the target, the target shareholders will not get "sufficiently punished" in case it turns out unfavorably later on. This way, the bidder sells a call option to the target shareholders with the proportion of cash flows accruing to the target shareholders being higher along with higher bid premium, but with no compensatory adjustment in case of the target turning out to be a lemon. The value of existing assets of the bidder results in this asymmetric effect of bid premium upon the target's wealth between the two cases (of low and high realization of target's value as actually to be observed in future). Hence, the higher bid premium in case of securities medium of exchange is at the cost of advantage to the bidder.

In light of propositions IV and V, the signaling implication of change in bid premium would be opposite in two cases of the medium of exchange, pure cash (i.e. $\alpha = 1$) and less than 100% pure cash(i.e. $\alpha < 1$, I will denote this set as securities bid now onwards). It needs to be noted that what matters here is the medium of exchange offered to the target, not the one through which financing for the bid may have been arranged. Hence, in case the bidder arranges to finance the 100% cash bid by selling debt, in terms of my signaling model it will be treated as a pure cash bid. While in both the cases, the pricing of the debt instrument will be done in light of the post-merger value of the firm, in the latter case it will be subject to the target's decision criterion in the same way as in case of an equity swap. Hence if the bidder swaps the target's shares with his debt instruments, I will treat this as a security exchange event in terms of signaling implications.

CHAPTER V

BID FORMULATION: FRAMEWORK OF TARGET'S PRIVATE INFORMATION

I will now describe a framework specifically incorporating the effect of the target's private information upon the optimal choice of medium of exchange by the bidder. In this framework, the bidder formulates the offer to the target in light of his pay-off function and the value of the target's assets. The pay-off function is known to the target and also the market without ambiguity. Finally this framework will be integrated with the earlier framework based upon the bidder's private information.

In the spirit of Hansen's (1987) formulation, this section tries to analyze the medium of exchange formulation assuming the bidder's perspective with there being only one bidder and one target. This restriction may easily be relaxed to reach generalized results. The following sequence describes the chronological structure of the offer:

1. Target has a reservation value for his assets equal to $V_t + v_M$. V_t is the pre-bid market value of the target's equity, and v_M is the extra value required by the target to tender his shares. The source of v_M could be the target's belief about undervaluation of his assets by the market or expectation of a minimum offer from potential bidders.

2. The bidder makes an offer [c, 1-α]. 1-α is the fraction of the post-acquisition firm offered to the target and c (equal to V_t + M) represents the nominal value of offer, with M representing the bid-premium. In case the value of α is one, the entire offer amount V_t + M will be offered in cash. As stated in chapter 4, I will denote 1-α by p for notational convenience, i.e.

$$[c,\ 1-\alpha] \equiv [c,\ p]$$

3. For simplicity, it will be assumed that the bidder makes either 100% cash or 100% securities offer. A mixed offer may be treated as a linear combination of these two types of offers. If the bidder makes a mixed offer [c, p] such that nominal value of fraction p of the post-acquisition firm is equal to c_p (< c), and the rest of the amount c - c_p is to be paid in pure cash, I will treat offer [c,p] as consisting of two different bids (one pure cash and other pure securities bid) such that:

$$[c,\ p] = \underset{\text{(pure securities)}}{[c_p,\ p]} + \underset{\text{(pure cash)}}{[c-c_p,\ 0]} \qquad (15)$$

Results of further analysis in this research may be extended to include mixed offers as a combination of two different offers as described in the above relationship.

4. The bidder perceives the value of V_t + v_M (= v for

notational convenience) as a random variable defined over range [l,h] with distribution F(v). v is known precisely only to the target. The other market participants infer the value of v from the public information about the offer made by the bidder to the target. Within the range of my interest, F(v) is assumed to be an increasing and continuously differentiable function.

5. The value of the target's assets v when under the control of the bidder becomes Q(v). Since in this framework bidder and market know θ precisely, I will use the notation Q(v) to denote $q(M,\theta)$. While the bidder will offer c to the target, the value of argument in Q(.) will be v, the true value of the target's assets, rather than c.

6. The value of the bidder's assets V_b is given by the pre-bid market value of the bidder's equity. Depending upon its assessment of V_b, v, F(v) and Q(v), the bidder makes the offer. The perceived value of c (by the target as well as by other market participants) would be a function of c and p both.

Quantification of the Advantage of Medium of Exchange

For the purpose of further analysis, the term "securities" will refer to all non-cash media, with the understanding that suitable adjustments may be made to incorporate the peculiar characteristics (in terms of risk-return profile) of any specific medium without any loss of generality. In response to the bidder's offer c, the target's natural response would be to accept the offer if and only if $v \le c$[21]. Hence in case of acceptance of cash offer, the expected wealth (to be denoted by $E(W_b|c)$) of the bidder would be:

$$E(W_b|c) = \int_1^c [Q(v)-c] \ f(v) \ dv + V_b = F(c).E(Q|c) + V_b - c.F(c) \quad (16)$$

$$\text{Where,} \quad E(Q|c) = \int_1^c \frac{Q(v) \ f(v) \ dv}{F(c)}$$

In case of securities offer, the target will infer the expected value of bid to him (i.e. extra benefit over the existing value of the target's assets) from the fraction p of the post-acquisition firm offered to him by the bidder. The bidder formulates the exchange ratio p such that the value of the bid, as transferred to the target with securities rather than cash being the medium of exchange, remains the same (at c) to him (bidder). Due to bid medium being securities, the target also directly shares the possible value loss in case the target's actual value is

[21]This will be true in case of both pure cash offer and securities exchange offer (which the bidder designs to pay the target an implicit value of c). If equilibrium exists at the end of final bidding, bidder will be able to credibly convey that the value of his exchange offer is indeed c. Hence even before attainment of equilibrium, bidder will make his analysis in case of securities offer as if the value of his offer is c.

less than c. The target will still accept the bid if the expected value of the bid is greater than v. In case of acceptance of securities bid by target, bidder's expected value of the securities and alternate cash bid should be equal, under the assumption of rational expectations equilibrium.

In case of securities bid, the expected value of gain from the bid to the target (in the calculations of the bidder) will be:

Expected gain to the target in case of acceptance of securities bid

$$= p.[V_b + \int_l^c Q(v)\ f(v)\ dv] - \int_l^c v\ f(v)\ dv$$

$$= p.[V_b + F(c).E(Q|c)] - \int_l^c v\ f(v)dv$$

In case of pure cash bid, the expected value of gain from the bid to the target (in the calculations of the bidder) will be:

Expected gain to the target in case of acceptance of cash bid

$$= \int_l^c (c-v)\ f(v)\ dv$$

$$= c.F(c) - \int_l^c v\ f(v)\ dv$$

In order to induce the target to accept the bid, the value of the above expected gain to the target will be positive. Equivalence between the two bids in equilibrium[22]

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[22]I will define equilibrium as existing when the bid signal vector employed by the bidder is sustained by the target's private information. Implicitly, I am assuming that

would imply that:

$$p = \frac{c.F(c)}{[F(c).E(Q|c) + V_b]}$$

In case of securities bid, if the target knows that $v < c$, the actual value of Q(v) will be less than Q(c) in the target's knowledge. Hence the target will require exchange ratio α equal or greater than p^* (as defined below) in order to have the same value as in case of an equivalent cash offer:

$$p \geq p^* = \frac{c}{[Q(c) + V_b]} \qquad (17)$$

However, if the target insists for $p \geq p^*$ (with bidder not agreeable to pure cash offer equal to c), it would reveal that $v < c$ (assuming V_b and Q(.) to be common knowledge in this framework of information asymmetry) and the bidder would bring down the bid premium and submit a cash offer instead. Hence an equilibrium will be reached only when the values of c and p simultaneously satisfy the following condition:

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price function (exchange ratio and bid premium based) is informationally consistent, as defined originally by Rothschild and Stiglitz (1976). Hansen (1987) assumes a similar characterization of equilibrium in describing his pricing function used by the target to evaluate the bidder's assets through the exchange ratio. This description of equilibrium also satisfies the requirements of efficient signaling equilibrium employed in case of my model based on the bidder's private information.

$$p = \frac{c.F(c)}{[F(c).E(Q|c) + V_b]} = \frac{c}{[Q(c) + V_b]} \quad (18)$$

However, in case of stock exchange offer, the bidder's expected wealth W_b may be related with p):

$$E(W_b|p) = \int_1^c Q(v)\ (1-p)\ f(v)\ dv + V_b.(1-p) \quad (19)$$

(bidder's share of: additional value generated + own assets)

$$= (1-p)\ [\int_1^c Q(v)\ f(v)\ dv + V_b]$$

$$= (1-p)\ [F(c)\ E(Q|c) + V_b]$$

$$= (1-p)\ F(c).[E(Q|c) + V_b] + (1-p).[1-F(c)].V_b \quad (20)$$

The difference between $E(W_b|p)$ and $E(W_b|c)$, for a given c (the nominal value of bid), may be thought of as the benefit of stock offer over cash offer (to be denoted by G):

$$G = E(W_b|p) - E(W_b|c)$$

$$= F(c).(1-p).[E(Q|c)] + V_b.(1-p) - F(c).[E(Q|c) - c] - V_b$$

$$= c.F(c) - V_b.p - p.F(c).E(Q|c) \quad (21)$$

Hence, assuming informational asymmetry only due to target's private information, preference between cash and stock offer would depend upon the offer price c, existing assets base of the bidder V_b, pay-off function Q(.) and distribution function F(v) of the assets of the target. For any given value of c, if G > 0, then it would be advantageous for the bidder to go for stock offer rather than cash offer.

In equilibrium, the value of RHS in (21) will be zero.

However, this does not imply that the bidder will be neutral between making a pure cash or alternatively equivalent securities bid. Reaching of equilibrium might require the bidder to offer securities bid or vary the bid premium. Till the time the bidder is able to come up with the optimal bid signal vector which results in a stable equilibrium, the benefit of securities offer over pure cash bid as given by (21) may not be zero. Existence of equilibrium would connote agreement between the target and the bidder about the value of the offer, which will result in either acceptance of the bid by the target or termination of the bidding process altogether (due to resulting clear perception of low quality of bidder's management of target's assets). In case equilibrium fails to obtain, the bid will not be accepted by the target. However every bid does not get accepted by the target. Hence the requirement of efficient signaling equilibrium needs to be understood as a characterization of the ideal conditions under which the bidder formulates the bid. While imposition of this condition upon present analysis is useful, it does not restrict the comparative-statics analysis by requiring the value of RHS in relationship (21) to be zero always.

From equation (21), it may be shown that G will be decreasing in V_b:

$$\left.\frac{\partial G}{\partial V_b}\right|_{\partial c=0} = -p - \frac{\partial p}{\partial V_b} . [V_b + F(c) . E(Q|c)]$$

$$\frac{\partial p}{\partial V_b} = \frac{-c}{[V_b+Q(c)]^2} = \frac{-p}{[V_b+Q(c)]}$$

Hence,

$$\left.\frac{\partial G}{\partial V_b}\right|_{\partial c=0} = -p.\left\{ 1-\frac{[V_b + F(c).E(Q|c)]}{V_b+Q(c)} \right\}$$

But $Q(c) > F(c).E(Q|c)$, which implies that

$$\frac{\partial G}{\partial V_b} < 0 \qquad (22)$$

The above relationship between G and V_b may be used to examine the effect of increase in the bidder's size upon bidder's return in case of cash and securities bid (as optimal medium of exchange). Increase in the bidder's size (or equivalently, decrease in the relative size of the target) will make cash a more favorable medium of exchange. Hence in case of a cash bid (optimally formulated in the framework of private information held by the target), increase in the relative size of the target would affect the bidder's return adversely (as a consequence of the private information held by the target). Conversely, an increase in the target's relative size would add to the advantage of securities as the medium of exchange. These two results are stated below as testable propositions:

Proposition VI: Increase in the relative size of the target compared to the bidder will have an adverse effect upon the bidder's return in case of a pure cash bid.

Proposition VII: Increase in the relative size of the target compared to the bidder will have a favorable effect upon the bidder's return in case of a securities bid.

From relationship (21), it is possible to find out the critical value of the bidder's size V_b^*, at which it would make no difference to the bidder to make cash or stock offers. For such an equivalence, the net benefit of stock offer over cash offer should become equal to zero, i.e.

$$G = c.\ F(c) - V_b^*.p - p.F(c).E(Q|c) = 0$$

$$\text{or, } c.F(c) = p.[V_b^* + \int_1^c Q(v)\ f(v)\ dv\ ]$$

$$= \frac{p.[\ V_b^* + \int_1^c Q(v)\ f(v)\ dv\ ]}{[V_b^* + Q(c)\ ]}$$

$$\text{or, } V_b^* + Q(c) = \frac{V_b^*}{F(c)} + \frac{1}{F(c)} . \int_1^c Q(v)\ f(v)\ dv$$

$$\text{or, } V_b^* \left[\frac{1}{F(c)} - 1\right] = Q(c) - \frac{1.}{F(c)} \int_1^c Q(v)\ f(v)\ dv$$

$$\text{or, } V_b^* = \frac{F(c).\{\ Q(c) - [1/F(c)].\int_1^c Q(v)\ f(v)\ dv\ \}}{[\ 1 - F(c)]} \qquad (23)$$

Since G is decreasing in V_b, for any given c we have:

If $V_b > V_b^*$, pure cash offer preferable.

If $V_b < V_b^*$, securities offer preferable.

The precise value of V_b^* will be a function of F(.) and Q(.) and is hence likely to be case-specific. However, for the purpose of our empirical testing, I will assume the point of equality between the sizes of the target and the bidder as the appropriate point of discontinuity. While this specification may seem arbitrary, it does have some common sense appeal. For an average investor, the market value of a firm's equity is the most obvious indicator of the firm's future potential, inclusive of the likely cash-flow and the riskiness of its business. Since the point of discontinuity also gets formulated in light of the same factors, equality of relative size may be a weak (or common sense) approximation for V_b^*. While we will include the point of equality in the bidder's and the target's size as one of explanatory variables in empirical tests in this research, the results will require caution in their interpretation.

This result may be stated as a proposition:

Proposition VIII: A pure cash (securities) medium of exchange will have more (less) favorable effect upon the bidder's returns if the bidder is larger than the target.

Impact of Incremental Shift in the Offer Value upon the Optimum Medium of Exchange

For a given set of V_b, F(v) and Q(v), equation (21) may be partially differentiated with respect to c to obtain the relationship between change in differential benefit of stock offer over cash offer vis-a vis any shift in offer price. The analysis is given in Appendix, which shows that:

$$\frac{\partial G}{\partial c} > 0 \tag{24}$$

Increase in the value of c here will be due to higher bid premium, since the relative size of the bidder was assumed to be constant in this analysis. In case of a framework based upon the bidder's private information, the effect of increase in bid premium upon the bidder's return for different media of exchange has earlier been formulated through Propositions IV and V. Since these two sets of results (relationship (24) and Propositions IV and V) are similar, the effect of bid premium upon the bidder's return in the integrated framework (of bidder and target's private information) will be same as described in Propositions IV and V.

Intuitively, as the offer value increases, the value of the target's private knowledge becomes increasingly important. Hence a securities exchange offer, which causes the target to become a long term beneficiary of the acquisition, makes the bidding negotiation more informed of the target's private knowledge, and hence becomes more favored with an increase in c.

Results obtained in this section are based upon characterization of information asymmetry regarding the target's assets by specifying an appropriate probability schedule. Results in earlier sections were obtained by modelling the information asymmetry regarding the target's assets through a variance term, and the focus was upon the information asymmetry arising due to private information held by the bidder. The results of these two analyses appear to be mutually reinforcing. For any given target, the appropriateness of the medium of exchange is affected by signaling considerations, and by excessive payment considerations in the frameworks for information asymmetry arising on the bidder and the target's sides, respectively.

In the bidder's asymmetry framework, the medium of exchange would signal the bidder's comfort with the perceived risk in the target, if the bidder is sufficiently risk-averse. In the target's asymmetry framework, V_b^* serves as the point of transition from pure cash to other media for the appropriateness of the medium of exchange. The relative size of the target (see equation (10)) may only indirectly be associated with the optimality of a given medium of exchange. Cash (securities) is likely to have higher probability of being the optimal medium of exchange in case the relative size of the target, other factors remaining constant, decreases (increases) in case of both the frameworks.

It may be mentioned that while cash represents a pure risk-free medium of exchange, equity shares represent the highest range of risky medium. Bonds and preferred stock, etc. represent increasingly higher packets of risk. Hence the analysis of this section may be extended, in structure, to preference between any combination of securities (each having differing risk characteristics). However, for any fixed offer price c, analysis of this section would favor only one set of exchange instruments, depending upon the specific set of V_b, c, F(v) and Q(v).

Probability of Bidder Making and Target Accepting Securities Offer

For a given value of bid premium, the bidder may decide the equivalent exchange ratio p using the relationship (19) which characterizes the expected relationship between c and p likely to exist in equilibrium. However, fulfillment of equilibrium requirements will be revealed only through the unraveling of the target's decision. Hence, a priori, the bidder will construct an exchange ratio p based upon his knowledge about the likely equilibrium condition. For this p, the probability of the bidder making an exchange offer may be developed using relationship (21). The bidder will make securities exchange offer if the likely benefit of exchange offer exceeds the benefit in case of pure cash offer, i.e.

$$\Pr\ (\text{stock offer}) = \Pr\ (G > 0)$$

$$= \Pr\ [c.F(c)\ >\ p.V_b\ +\ p.F(c).E(Q|c)]$$

$$= \Pr\ [\int_l^c Q(v)\ f(v)\ dv\ <\ c\ F(c)/p\ -V_b]$$

$$= \Pr\ \left\{ \frac{\int_l^c Q(v)\ f(v)\ dv}{[c.F(c)/p\ -\ V_b]}\ <\ 1 \right\} \quad (25)$$

It may be seen that the probability of a bidder making a securities bid decreases in the exchange ratio p and the relative size of the bidder vis-a-vis the target (V_b).

The target managers/shareholders are likely to accept an equity exchange offer if the perceived value of the offer (equal to the product of exchange ratio and the likely value of the post-acquisition firm) is not less than the value of the target firm's assets 'v' as known to them. This condition may be expressed for the bidder i as:

$$\Pr\ (\text{success}\ |\ \text{stock offer})_i = \Pr\ \{v \le p.[V_b+Q(v)]\} \quad (25a)$$

As the results of comparative-statics analysis given in Appendix indicate, probability of success of a stock offer

1. increases in the nominal value of the bid,
2. increases in the exchange ratio, and
3. decreases in the size of the bidder.

The likelihood of occurrence and acceptance of an equity exchange offer may be considered as a prototype of all types of securities exchange offer. The results of this section, though derived specifically for stock exchange offers, may be generalized to include all types of exchange media. No such formulation is required specifically for

cash bid due to the absence of any uncertainty in the value of the bid to the target.

Optimization of Bid Signal by the Bidder: In Target's Private Information Framework

The process of formulation of the medium of exchange may be viewed as an optimization problem under the framework of information asymmetry due to the target's private information. The bidder's objective function will be the expected benefit of the bid, and the control variables will be the nominal value of bid (or bid premium) (c), percentage of cash/securities component (r), and exchange ratio (p). For any given nominal value of cash bid 'c', the bidder will try to anticipate the likely value of equilibrium value of p under the available information set, as described by relationship (17). This exchange ratio 'p' will be equivalent to c in the sense that the expected value of the bid to the target (in the bidder's calculations) remains the same under the alternate media of exchange. Hence for the purpose of optimization, only c and r need to be treated as control variables. This gives rise to two first order necessary conditions (FONCs) which need to be solved simultaneously. The analysis below presents the solution and analysis in this case.

Let,

r = percentage of cash in the bid

$1 - r$ = percentage of stock (i.e. securities) in the bid

c = nominal value of offer

p = exchange ratio

Expected value of bid = ψ (say)

$$\psi = \Pr(\text{success} \mid \text{stock offer}) * \text{Benefit(stock offer)} * (1-r) + \Pr(\text{success} \mid \text{cash offer}) * \text{Benefit(cash offer)} * r$$

Let $\Pr(\text{success} \mid \text{stock offer}) = TP_i$

We know that: $\Pr(\text{success} \mid \text{cash offer}) = F(c)$

$$\text{Benefit(stock offer)} = (1-p).[F(c).E(Q|c) + V_b]$$

$$\text{Benefit(cash offer)} = F(c).E(Q|c) + V_b - c.F(c)$$

Hence,

$$\psi = r.F(c).[F(c).E(Q|c) + V_b - c.F(c)] + (1-r).(1-p).[F(c).E(Q|c) + V_b].TP_i \tag{26}$$

For optimization, we will ascertain the first order necessary conditions now.

1. For optimum c:

$$0 = (\partial\psi/\partial c) = r.f(c).[F(c).E(Q|c) + V_b - c.F(c)] + r.F(c).[f(c).Q(c) - F(c) - c.f(c)] - (\partial p/\partial c).(1-r).[F(c).E(Q|c) + V_b].TP_i + (1-r).(1-p).f(c).Q(c).TP_i$$

$$+ (1-r).(1-p).[F(c).E(Q|c) + V_b].(\partial TP_i/\partial c) \qquad (27)$$

2. For optimum p (exchange ratio):

Since p is a function of c and r (i.e. once c and r are given, p is determined automatically according to equation (17)), we need not consider separately an FONC pertaining to p.

3. For optimum r (percentage of cash/securities):

$$0 = (\partial\psi/\partial r) = F(c).[F(c).E(Q|c) + V_b - c.F(c)] - (1-p).[F(c).E(Q|c) + V_b].TP_i$$

$\Rightarrow$

$$TP_i = \frac{F(c)}{(1-p)}\left(1-\frac{c.F(c)}{F(c).E(Q|c)+V_b}\right) \qquad (28)$$

$$\frac{\partial TP_i}{\partial c} = \left[\frac{f(c)}{1-p}+\frac{F(c)}{(1-p)^2}.\frac{\partial p}{\partial c}\right].\left[1-\frac{c.F(c)}{F(c).E(Q|c)+V_b}\right]$$

$$-\frac{F(c)}{1-p}.\left[\frac{F(c)+c.f(c)}{F(c).E(Q|c)+V_b}-\frac{c.f(c).F(c).Q(c)}{[F(c).E(Q|c)+V_b]^2}\right] \qquad (29)$$

Equation (29) has been obtained by differentiating both sides of (28) with respect to c. Substituting expressions for TP_i and $(\partial TP_i.H/\partial c)$ from (28) and (29) into equation (27) and solving, we obtain:

$$0=r.[f(c)F(c)E(Q|c)+V_b.f(c)-2cf(c)F(c)+f(c).F(c).Q(c)-F(c)^2]$$

$$+(1-r).[f(c).F(c).E(Q|c)+V_b.f(c)-2c.F(c)+f(c).F(c).Q(c)-F(c$$

$$+2\frac{F(c)}{1-p}\frac{\partial p}{\partial c}.[F(c).E(Q|c)+V_b-c.F(c)]-\frac{c.f(c).F(c)^2.Q(c)}{F(c).E(Q|c)+V_b}]] \quad (30)$$

Let

$$A = f(c).F(c).E(Q|c)+V_b.f(c)-2c.F(c)+f(c).F(c).Q(c)-F(c)^2$$

Let

$$d = +2\frac{F(c)}{1-p}\frac{\partial p}{\partial c}.[F(c).E(Q|c)+V_b-c.F(c)]-\frac{c.f(c).F(c)^2.Q(c)}{F(c).E(Q|c)+V_b}$$

(31)

Then (30) may be rewritten as:

$$r.A + (1-r).(A+d) = 0 \quad (32)$$

$$\text{or, } -r.d + A + d = 0$$

$$\text{or, } r = (A+d)/d = 1 + A/d \quad (33)$$

Relationship (32) may be perceived as a relationship between the marginal benefit (with respect to nominal bid value c) of cash and stock bids. Since feasibility of r requires that $0 \leq r \leq 1$, we have $A/d \leq 0$. Hence A and d will always be opposite in sign. We may interpret A as the marginal benefit of a pure cash bid (with respect to offer value c) and d as the marginal benefit of securities bid over pure cash bid. Hence the marginal benefit of pure cash over securities bid will be -d. This implies that the marginal benefit of the cash offer and the benefit of cash offer over stock offer would always have the same sign in the feasible region. Till the point the marginal benefit of pure cash offer is non-negative, it will continue to dominate stock offer. For determining the sign of d, we may first ascertain the sign of A.

$$A = f(c).F(c).E(Q|c) + V_b.f(c) - 2.c.f(c).F(c) + f(c).F(c).Q(c) - F(c)^2$$

Obviously, the sign of A will be affected by the values of 'V_b', Q(c), F(c) and c. Hence size of the bidder, his pay-off function, probability distribution of the target's value and the offer value emerge as the key variables for our analysis. If $A < 0$ (i.e. marginal benefit of cash offer is negative), then $d > 0$. This implies that in the equation (32):

$$r.A + (1-r).(A+d) = 0$$

The percentage of stock offers would gain at the expense of cash in equilibrium, in case the nominal value of bid 'c' is increased. If $A > 0$ (i.e. marginal benefit of cash offer is positive), then $d < 0$. Then the percentage of cash component would gain the expense of stock component, if the bid value is increased. As already shown, cash will dominate securities as the medium of exchange till the marginal benefit of cash is non-negative. However, at a point of transition (when the marginal benefit of cash just becomes negative), it is possible to get a mixed medium of exchange as the optimum solution.

Relationship between Bidder's Size and Optimal Bid

A larger size would allow the bidder to survive in comparatively more number of adverse states of nature (i.e. adverse situations in the future if the target turns out to be a lemon later on). Hence the larger bidder may afford to bid higher than the smaller bidders without assuming excess probability of bankruptcy. Consequently in the bidding game, the optimum offer value may be higher in case of a bidder with greater size. This implies that keeping other factors invariant, the bidder larger in size is more likely to be successful. This can also be analytically derived by using the results in the previous chapter. The equation (32) (a first order necessary condition) may be expressed as an identity (say P):

$$P = A + d.(1-r) = 0$$

Where A, d and r are the same as defined earlier. For deriving the relationship between the optimal bid value (c^*) and the bidder's size (V_b), we may use implicit function rule as follows:

$$\frac{\partial c^*}{\partial V_b} = -\frac{(\partial P/\partial V_b)}{(\partial P/\partial c^*)}$$

However,

$$\frac{\partial P}{\partial V_b} = \frac{\partial A}{\partial V_b} + (1-r).\frac{\partial d}{\partial V_b}$$

$$= f(c^*) + 2\,\frac{F(c^*)}{(1-p)}\,\frac{\partial p}{\partial c^*} + \frac{c^*.f(c^*).[F(c^*)]^2.Q(c^*)}{[F(c^*).E(Q|c^*) + V_b]^2} > 0$$

The exchange ratio p is an increasing function of the offer c^*, and all the other terms are positive. Since the identity in P (first order necessary condition) represents the optimum point with respect to c, the value of $(\partial P/\partial c)$ has to be negative in order to satisfy the second order necessary condition. Hence we have:

$$\frac{\partial c^*}{\partial V_b} = -\frac{(\text{positive number})}{(\text{negative number})} > 0 \qquad (34)$$

This result may be stated as a proposition.

Proposition IX: The optimal value of the bid will be an increasing function of the bidder's size.

CHAPTER VI

INTEGRATED FRAMEWORK FOR BID FORMULATION

It is possible to integrate the two frameworks focussing individually upon the bidder and the target's private knowledge. The target will value the offer based on his private knowledge. Hence an offer having the value $\{(1-\alpha)[V_b + P(M,\alpha)] + M\}$ (as described in Chapter IV) will have a value of $\{(1-\alpha)[V_b + P^t(M,\alpha)] + M\}$ in the target's estimation. $P^t(M,\alpha)$ will be the target's estimate of the value creation by the bidder with the market's pricing function $P(M,\alpha)$ adjusted by target for true value of his assets. Hence the target will accept a bid if v does not exceed $\{(1-\alpha)[V_b + P^t(M,\alpha)] + M\}$. Hence the probability of acceptance of a bid becomes:

$$\begin{aligned} &\mathrm{Prob}(v \le (1-\alpha)[V_b + P^t(M,\alpha)] + M) \\ &= F([1-\alpha]\{[V_b + P^t(M,\alpha)] + M\}) \end{aligned}$$

Anticipating signaling equilibrium, the bidder will formulate his bargaining tactics by assuming $P^t(M,\alpha) = P(M,\alpha)$ and make the bid. In other words, the bidder's best estimate of $P^t(M,\alpha)$ will be $P(M,\alpha)$ for the purpose of bid formulation. The target's response will result in satisfaction of this condition in the event of ultimate success of the bid. Hence for our purpose, we will assume the probability of acceptance of the bid by the target to be given as:

$$\text{Prob(success of bid)} = F([1-\alpha]\{[V_b + P(M,\alpha)] + M\})$$

The bidder's objective function (given by relationship (2) earlier) now becomes (in order to maximize the expected value of the bid):

$$\text{Max}_{\alpha,M\geq 0}\ F([1-\alpha]\{[V_b + P(M,\alpha)] + M\}).[V_b + \alpha.\int_{1}^{M} Q(v,\theta).f(v)\ dv + (1-\alpha).\int_{1}^{M} P(v,\alpha).f(v)\ dv - M - \frac{h\sigma_t^2\alpha^2}{2}] \quad (35)$$

In addition, the signal vector should also satisfy "competitive rationality condition" given by relationship (4).

We can use relationship (35) to arrive at the comparative-static results arrived at earlier. As has been shown in earlier chapters, Propositions IV and V are obtained in both the frameworks (as the same). Hence we can assume that these propositions will hold even in case of an integrated framework. We will now try to obtain only other propositions in the integrated framework. However, derivation of the results is not clear-cut in all the cases. We will derive below select propositions using the optimization technique under our integrated framework of information asymmetry.

Proposition I: A more efficient bidder will retain higher equity stake in the merged firm.

Proof: See Appendix.

Proposition II: Increased risk in the target would result in lower bidder's equity stake in the merged firm.

Proof: See Appendix.

Proposition III: Increased risk-aversion of the bidder would result in lower bidder's equity stake in the merged firm.

Proof: See Appendix.

Proposition VI: Increase in the relative size of the target compared to the bidder will have an adverse effect upon the bidder's return in case of a pure cash bid.

Proof: See Appendix.

Proposition VII: Increase in the relative size of the target compared to the bidder will have a favorable effect upon the bidder's return in case of a securities bid.

Proof: See Appendix.

CHAPTER VII

PROBABILITY OF SUCCESS OF A BID: A FRAMEWORK FOR EMPIRICAL TESTING

The market's perception of any bid is shaped significantly by its assessment of the likelihood of success of the given bid. Hence the observed market's reaction to the value of bid (e.g. abnormal returns in terms of event-study methodology) may be expressed as a product of the probability of success of the bid and the value of acquisition.

$$\text{Value of Bid} = P \times V \qquad (36)$$

Where,

P = Probability of success of the bid

V = Value of acquisition

A few research papers in finance have earlier tried to devise frameworks for empirical testing of P, the notable among such efforts being one by Walking (1985). As already described, the binary nature of Walking's model does not allow its application in case of empirical testing of continuous variables based models, as in case of propositions IV - VII.

A model similar in structure to Walking's model appears to be one evolved by Flinn and Heckman (1982) in the context of modelling of labor force dynamics. They develop the following empirical cdf of accepted wages:

$$P(x \mid x \geq rV) = \frac{F(x) - F(rV)}{1 - F(rV)}, \qquad x \geq rV \tag{37}$$

Where,

rV = reservation wage (point of truncation of acceptable wages)

F = cdf of the wage distribution

The acquisition bidding process may be perceived to be having quite a number of similarities with the process of wage acceptance in terms of the following characteristics:

(i) The pre-bid market price may be viewed as similar to the reservation wage.

(ii) The distribution of availability of information is truncated similarly in both the cases due to censoring caused by a higher wage and higher bid incidence.

The model given by equation (37) maps into space [0,1]. Hence this model appears to satisfy the basic requirements as P in equation (35), and has similar structural form. For the purpose of empirical testing, two further simplifying assumptions will be made:

(i) cdf has the form of a normal distribution (alternative distributions also may be tried).

(ii) The variance of the equity price of the target is the relevant value of variance and the pre-bid share price is the mean for the purpose of deriving standardized value of variables.

The relationship (37) may now be expressed as:

$$\text{Prob (success}|\text{Bid} = x) = \frac{\text{Probnorm}(x) - .5}{1 - .5} = b \qquad (38)$$

(under the assumption of standardized normal variables. Then F(rV) = .5, if rV is chosen as the mean point of the distribution for the purpose of standardization)

It may be mentioned that the model given by equation (38) is quite similar in structure to Stulz's (1988) model for the probability of success of a bid. His model relates probability of success with bid premium and the target managers' holding of target's voting rights (α) as given by

$$\text{Probability of success} = \frac{u(p) - z(\alpha)}{u(p) - d(p)}$$

Where,

u(p), d(p) = upper and lower probability limits of the opportunity cost of tendering for the target shareholders

$z(\alpha)$ = fraction of non-management shareholders that must tender for the bid to be successful

The relationship (38) may be applied in case of individual events of bid for the purpose of empirical testing in case of any medium of exchange. At the macro-level there will be a large degree of variation in the values of Prob(stock bid) and Prob(success|stock bid) across various bidder-target sets. However, shift in the variance of market return should affect these factors in the same direction in case of each of the acquisitions. Hence it should be possible to assess empirically the testable implications of the model (e.g. probabilities of stock bid and/or of success of a stock bid vary systematically according to change in the variance of the market return σ_m^2) at the level of the aggregate number of acquisitions during various years. This may obviate the necessity of assuming a specific functional form for Prob(success|bid) as in the case of individual firms.

Problems in Empirical Testing of Probability of Success of a Bid

The probability of success of a bid is likely to be shaped by a multitude of factors; bid premium, medium of exchange, general business environment, likelihood of emergence of competing bids. Yet, it may affect the market response to a bid in a manner distinctive from the above factors. The result of inclusion of the probability of success as an explanatory variable is likely to be: (a) sharpening of the effect of some of the other explanatory variables, and (b) increased multi-collinearity among the explanatory variables.

Moreover, the effect of the probability of success of a bid upon the cumulative abnormal returns is likely to be routed through other explanatory variables, in the sense of their expected values. The sensitivity of the other explanatory variables to the probability related factors may not be easy to hypothesize and estimate. For example, it is difficult to say whether the sensitivities of two factors, bid premium and the medium of exchange, to the factor of probability are similar.

Adjustment in the dependent variable cumulative abnormal return (CAR) may be another possibility. However, this would amount to assuming equal sensitivity to the probabilistic factor in case of each one of the explanatory variables. In case the assumption of equal sensitivity does not hold true, it would result in biased error terms. Walking (1985) identified bid premium, solicitation fees and bidder ownership of target ownership as having positive correlations with offer success. He also pointed out that measurements that ignore the leakage of prior information introduce a systematic bias into the analysis of tender offer outcomes. However, his research does not bring out the interaction between these factors (or their cumulative impact through the probability of success) and other important explanatory variables.

Overall, models of the acquisition process are likely to remain noisy due to inadequate understanding of the proper place of probability of success of a bid. The level of noise decreases with a large number of possible explanatory variables up to some extent. It is likely to be insightful to include the probability of success as a multiplier to the bid premium, with which its relationship is likely to be more clear.

However, empirical testing of hypotheses related to Prob(stock bid) and Prob(success|stock bid) requires information about the total number of acquisition bids (for all the targets during the year, counting one event for each bid). In addition, information about the total number of non-cash bids is also required. While the first information may perhaps be gathered through a very detailed search of all the relevant announcement media for a particular year, details regarding the second information set is unlikely to become available even this way. At times, the details regarding the medium of exchange does not get disclosed in the published information sources.[23] Lack of sufficient information is likely to result in weaker CARs in such cases, which obviously cannot be analyzed for their relationship with the medium of exchange due to absence of data.

Even then, it appears to be possible to devise a

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[23] It may be mentioned that Mergerstat documents "N/A" under the item "method of payment" in case of a number of acquisitions during each year for the period 1981-90. For the year 1990, "N/A" accounted for 31% of the list of events.

methodology for evaluating the testable implications indirectly with available data on the break-up of the medium of exchange in case of completed acquisitions. I shall use the result in Proposition II for this purpose (i.e. increase in σ_t^2 will in decrease in α or equivalently 1-p). I make the assumption that increase in market uncertainty (to be proxied by variance of market return σ_m^2) will result in increase in σ_t^2 across a large sample of target firms. Under this assumption, effect of change in σ_m^2 is analyzed in Appendix - C.

Let,

A = number of successful stock (other than pure cash) bids during a particular year

B = number of successful pure cash bids during the same period

N = total number of bids made during the same period

A, B, and N may be related to Pr(stock), Pr(success|stock), and Pr(success|cash) on the following lines:

A = N.Pr(stock).Pr(success|stock) (39)

B = N.[1-Pr(stock)].Pr(success|cash) (40)

Where,

Pr(stock) = Probability of bidder making stock offer = P(st)

Pr(success|stock) = Probability of success of stock offer = P(s|st)

From the target's viewpoint, there is no uncertainty in the value of the bid in case of cash offer. Hence the shift in market uncertainty is unlikely to affect the probability of success of a cash bid i.e. Prob(success|cash). The latter may change from year-to-year depending upon other relevant factors and will obviously vary across "target-bidder" sets. However, for the purpose of this analysis, I will assume it to remain a constant (say 1/b) at the macro-level over the years, since it should be affected by firm-specific factors rather than economy-wide systematic type of factors.

From (39) and (40),

$$\frac{A}{B} = b.\frac{P(st).P(s|st)}{[1-P(st)]}$$

Or, $$\frac{A}{B}.\left[\frac{1}{P(st)} - 1\right] = b.P(s|st)$$

Hence, $$\frac{\partial}{\partial\sigma^2}\left(\frac{A}{B}\left[\frac{1}{P(st)} - 1\right]\right) = b.\frac{\partial P(s|st)}{\partial\sigma^2}$$

Solving, I arrive at:

$$\frac{\partial(A/B)}{\partial\sigma^2} = \frac{1}{\left[\frac{1}{P(st)}-1\right]}.\left\{\frac{A}{B.[P(st)]^2}.\frac{\partial P(st)}{\partial\sigma^2} + b.\frac{\partial P(s|st)}{\partial\sigma^2}\right\} \qquad (41)$$

But, $$\frac{\partial P(st)}{\partial\sigma^2} < 0 \text{ and } \frac{\partial P(s|st)}{\partial\sigma^2} > 0$$

Hence the RHS in equation (41) is likely to be ambiguous. The negative effect of increase in market uncertainty (σ_m^2) upon P(st) will be offset by the increase in P(s|st). The observed relationship between A/B and σ_m^2 is likely to be ambiguous and weak due to the two offsetting effects. I will conjecture that the effect of change in σ_m^2 upon P(st) will be weaker in actual observation. Over the period of time, institutional changes affecting the supply of cash for acquisitions is likely to be having a much larger effect upon P(st) than any change in σ_m^2. However, shifts in availability of cash is unlikely to affect the probability of success of a cash or securities bid per se. Hence the effect of change in σ_m^2 is likely to be attenuated by the effect of institutional changes. Hence, any change in market uncertainty is likely to have an overall effect upon A_t/B_t more in line with the resultant shift in P(s|st). However, the exact relationship between A_t/B_t and σ_m^2 is not known. Hence for the purpose of empirical testing, I will estimate the following model with a number of functional forms of $1/\sigma_m^2$ (say $f(1/\sigma_m^2)$):

$$\frac{A_t}{B_t} = \beta_0 + \beta_1 \, f\left(\frac{1}{\sigma_{mt}^2}\right) + \epsilon \qquad (42)$$

CHAPTER VIII

EMPIRICAL METHODOLOGY

On the basis of the theoretical results obtained in this paper, it was proposed to test the following results for empirical verification:

H_oI. Cash (securities) offer is the more highly valued medium of exchange in case of a bidder bidding for a target below (above) a threshold size (which may be determined and would be around the bidder's size in general). (Based on relationship (23), page 104)

H_oII. The probability of making stock offer decreases with rise in the business uncertainty (to be proxied through variance of the return on market portfolio - σ_m^2). (Based on relationship (V), page 175)

H_oIII. The probability of acceptance of a stock offer increases with rise in business uncertainty (σ_m^2). (Based on relationship (iii), page 174)

H_oIV. The optimum bid price (i.e. nominal value of bid) is a positive function of the size of the bidder. (Based upon relationship (34), page 116)

Based on the result arrived at in chapter VII, equation (42), H_0II and H_0III were then substituted by a single hypothesis:

H_0IIIA: The ratio of securities and cash bids, in case of successful bids, will be affected adversely by increase in business uncertainty (proxied by σ_m^2).

In light of the analyses done later on in course of this research, four more hypotheses were included for empirical testing:

H_0V: In case of a cash bid, the bidder's return will be a positive function of the bid premium. (Based upon Proposition IV, page 88)

H_0VI: In case of a securities bid, the bidder's return will be a negative function of the bid premium. (Based upon Proposition V, page 90)

H_0VII: Increase in the relative size of the target will have an adverse effect upon the bidder's return in case of pure cash bid. (Based upon Proposition VI, page 103)

H_0VIII: Increase in the relative size of the target will have a favorable effect upon the bidder's return in case of securities bid. (Based upon Proposition VII, page 103).

H_0VII and H_0VIII may be viewed as refined statements of H_0I, without having the disadvantage of assuming an arbitrary cut-off point for relative size as required in case of H_0I.

Data Description

In testing the above implications the following types of data have been used:

(i) Daily prices of and returns on equity shares of bidder and target firms on and around the date of announcement (event-date) of a bid for acquisition. Also, the daily return and variance of daily return on the market portfolio for each of the years during 1964-90 were obtained. Daily returns were obtained from CRSP tape, while the price data were obtained from NYSE/NASDAQ "Daily Stock Price Record."

(ii) Number of deals involving different medium of exchange over the period 1964-1990 were obtained from Mergerstat Review.

(iii) The total number of outstanding and total equity capital structure of the bidding and target firm as on the event date were obtained from NYSE/NASDAQ "Daily Stock Price Record."

Sample Selection

For the period 1986-89, a list of acquisition events made available by SEC relating to the same period was scanned in light of criteria described below. For the period 1976-84 other published sources (Mergerstat, other dissertations, news clippings) were employed to narrow down the search for appropriate events of acquisition. From the list of bidding events so generated, a total number of 557 acquisition attempts during the period 1976-1989 were obtained by the following selection methodology:

(i) At least one of the bidding or target firms for any specific event was listed for a minimum of two years on NYSE or NASDAQ.

(ii) All the bids for a specific target, whether by the same or different bidders, were included in the sample. Table - 1 presents the annual occurrence and break-up by the medium of exchange for the identified sample.

Table - 1

Description of Sample

Period	No of Target Firms	No of Bidders	No of Bids 100% cash	100% securities	Mixed
1976	19	34	35	9	3
1979	1	2		1	2
1980	15	25	16	4	11
1981	5	9	5		8
1983	2	3	3		1
1986	35	10	55	5	7
1987	73	38	123	4	10
1988	121	45	96	3	16
1989	87	44	132	4	14
Total:	358	210	465	30	62

(iii) Information about the medium of exchange in the included bid was published in The Wall Street Journal. The event-date was taken as one day before the corresponding news item in WSJ.

(iv) Only the bids separated from any other bid by at least two days were included in the sample. It was also ensured that there was no other confounding event within 10 days before and 10 days later of the bid.

The size of a firm was measured as the market value of its outstanding equity as on the last date of the month before the month of first event date in case of the target. Table - 2 reports the break-up of the offers according to a set of partitioning criteria, viz. bidder, target, relative size (target larger or smaller than the bidder), and medium of exchange. The discrepancy between the numbers of bidding and target events is due to a large number of bidders which were not listed on any stock exchange (e.g. MBOs). As may be seen, there are only seven events pertaining to securities exchange offer by bidders smaller in size than the target. In terms of my framework based upon information asymmetry due to bidder's private information, such a case would indicate high level of risk in the target (being securities exchange bid) and low risk-bearing capacity of the bidder (due to risky target being larger).

Table - 2

Number of	$Size_{target} < Size_{bidder}$			$Size_{target} > Size_{bidder}$			
	100% Cash	Others	Sub-total	100% Cash	Others	Sub-total	Total

Target Events	156	35	191	309	57	366	557
Bidding Events	146	33	179	49	7	56	235

Hence a risk-averse bidder will have little incentive for pursuing such a target, which explains the low number of observed events of this type.

Measuring Event-Responses

The market's assessment of the appropriateness of a given medium of exchange was proxied through cumulative abnormal returns (CARs), as is done in case of standard event study methodology. Following Dodd and Warner (1983) CARs, based upon one-factor market model, was estimated first using the regression model:

$$AR_{it} = R_{it} - a - b.R_{mt} \tag{43}$$

$$CAR_i = \Sigma_t \, AR_{it}$$

Where,

AR_{it} = abnormal return on day t for security i

R_{it}, and R_{mt} = actual return on day t for security i and market portfolio, respectively

Coefficients a and b were estimated through the following one-factor market model based upon CAPM estimated for a recent past period of 180 days:

$$R_{it} = a + b.R_{mt} \tag{44}$$

Based upon CARs, specific methodologies for analyzing the market's assessment of the appropriate medium of exchange (i.e. to test the testable implication I) are described in the coming paragraphs.

The reaction of a firm (target or the bidder) as measured through abnormal returns will depend upon the premium (bid value minus pre-bid share price), medium of exchange and the probability of consummation of the bid. My model has been developed from the perspective of its appropriateness in case of the bidder. However, it may be expected that the loss of value due to less appropriate medium of exchange would result into transfer of additional value to the target at the cost of the bidder. Hence the empirical analysis undertaken in case of the bidder's return may be replicated in case of the target's return, expectation being to observe results quite opposite to those hypothesized in the case of the bidder. While significant results in case of the target returns may not be treated as substitutes for significant results in case of the bidders' returns, these will reinforce the credibility of our propositions. Measures for empirical testing of probability of success in case of a given bid may be assumed to be given by the relationship (38) of chapter VII. Alternatively, in order to keep the analysis tractable, the probability related variables may be ignored.

In order to account for the possibility of heteroskedasticity in the data, all the β-coefficients were divided by the square root of the corresponding element of the consistent parameter covariance matrix, and hence the t-statistics were obtained. White (1980) shows that under very general conditions, the covariance matrix formed through least square residuals is a consistent estimator of the covariance matrix. Hence it may be used as an estimate of the true variance of the least square estimator.

Of all the empirical models estimated, the models having wealth changes (CAR * value of firm's equity) appeared to fit best. Hence I will describe the empirical methodology and results in terms of cumulative abnormal wealth change (CAW). Moreover, the derivations of the theoretical results earlier have been in the context of implications upon the total wealth of the bidder, which provides the justification for using CAW. The target's CAW would be shaped by the expected value of the bid premium rather than bid premium. Hence in order to allow for the effect of probability of success of a bid, I will use probability-adjusted bid-premium as defined below:

Bid Premium (Probability adjusted) = b. Bid Premium

Where,

$$m = \text{Prob (success} \mid \text{Bid} = x) = \frac{\text{Probnorm}(x) - 0.5}{1 - 0.5}$$

(from equation (38))

Our data-set allows different partitioning, explanatory variables, and values appropriate as risk-premium, with the dependent variable being the target's CAW, and bidder's CAW, with or without explicit consideration for the probability of success of a bid. In light of this analysis, empirical testing methodologies are proposed now.

Empirical Testing Methodology

Case I: Bidder's CAW, no consideration for Probability (success|bid)[24]

In order to analyze the importance of the medium of exchange in this setting, the following model is proposed:

$$CAW_{ij} = \beta_0 + \beta_1.G_{ij} + \beta_2.H_{ij} + \beta_3.T_{ij} + \beta_4.D + \beta_5.K + \beta_6.K.G_{ij} + \beta_7.D.H_{ij} + \beta_8.D.T_{ij} + \beta_9\ K.T_{ij} + \epsilon_i \quad (45)$$

Where,

CAW_{ij} = CAW of bidder i in case of bid for target j

G_{ij} = bid-premium (nominal value of bid per share minus pre-bid value of target's share) for bidder i and target j

H_{ij} = percentage of cash in bid for target j by bidder i

T_{ij} = log of the market value of the equity shares of the target and bidder

β_k = corresponding regression coefficients

[24]Since the medium of exchange is being incorporated as separate variable in the models, the value of bid here will denote its nominal value.

$D = 1$ if $size_{bidder} > size_{target}$

0 otherwise

$K = 1$ if 100% cash bid

$= 0$ otherwise

In case the effect of explanatory variables actually switches sign depending upon the relative size of the target and/or the medium of exchange, even the model proposed in equation (45) may not be able to capture all the likely variations distinctly due to the absence of appropriate cross-interaction terms. This may bias the parameter estimates, and the t-statistics also may be low due to high standard error of the parameter estimates. However, if a number of cross-interaction terms are included, multi-collinearity may pose a problem by resulting in increased values of the standard errors of the parameter estimates, along with incorrect signs and/values of the parameter estimates. One way to avoid these problems is to partition the data so that one less number of dummy variable is required, resulting also in lesser number of cross-interaction terms.

Table - 3

Expected Signs of β-Coefficients

Testable Required Hypothesis	Appropriate Variable(s)	Expected Sign for Support

H_0I	$D.H_{ij}$ (β_7) $K.T_{ij}$ (β_9)	+ve -ve
H_0V	$K.G_{ij}$ (β_6)	+ve
H_0VI	$K.G_{ij}$ (β_6)	+ve
H_0VII	$K.T_{ij}$ (β_9)	-ve
H_0VIII	$K.T_{ij}$ (β_9)	-ve

The same model may be employed to test more than one hypotheses simultaneously through the signs of the appropriate β-coefficients as described in the table below:

Empirical Testing with Partitioned Data-sets

The appropriate partitioning of data, along with the explanatory variables included and the expected signs of the parameter estimates are described in Table - 5. The various models proposed will be described now.

In case of partitioning basis being only pure cash bids (set 2), the following regression model was estimated:

$$CAW_{ij} = \beta_0 + \beta_1.G_{ij} + \beta_2.T_{ij} + \beta_3.D + \beta_4.D.T_{ij} + \epsilon_i \qquad (46)$$

H_0I may be interpreted to predict positive sign of β_3. However, a negative sign of β_3 will only imply that cash is more preferred medium of exchange in case of smaller bidders. It may not mean that cash is less preferred medium of exchange vis-a-vis securities in case of larger bidders, as implied by H_0I. H_0V will predict a positive sign for β_1.

H_0VII will predict a negative sign for β_2. The sign of β_4 is not clearly defined by any of the hypotheses and hence may be expected to be ambiguous (or insignificant). Hence the equation (46) may be estimated without inclusion of the term $D.T_{ij}$, in case β_4 actually turns out to be insignificant statistically, with the following regression model (set 3):

$$CAW_{ij} = \beta_0 + \beta_1.G_{ij} + \beta_2.T_{ij} + \beta_3.D + \epsilon_i \qquad (47)$$

In case of partitioning basis being pure cash bids by smaller bidders (set 4), the following regression model was estimated:

$$CAW_{ij} = \beta_0 + \beta_1.G_{ij} + \beta_2.T_{ij} + \epsilon_i \qquad (48)$$

H_0V will predict a positive sign for β_1. H_0VII will predict a negative sign for β_2.

In case of partitioning basis being pure cash bids by larger bidders, the following regression model (set 5) was estimated:

$$CAW_{ij} = \beta_0 + \beta_1.G_{ij} + \beta_2.T_{ij} + \epsilon_i \qquad (49)$$

H_0V will predict a positive sign for β_1. H_0VII will predict a negative sign for β_2. However, since pure cash may not always be a credible signal in case of larger bidders, the value of β_2 in case of set is likely to be less than its value in case of set 5.

H_0I requires pure cash to be the more appropriate medium of exchange if the bidder is larger. This would imply that the β-coefficient of $K.G_{ij}$ will be positive in set 1 and 2.

In case of partitioning basis being all other bids (set 6), the following regression model was estimated:

$$CAW_{ij} = \beta_0 + \beta_1.G_{ij} + \beta_2.T_{ij} + \beta_3 H_{ij} + \beta_4 D + \beta_5 D.H_{ij} + \beta_6 D.T_{ij} + \epsilon_i \quad (50)$$

H_0VI will predict a negative sign for β_1, and a positive value for β_2. The value of β_3 may be positive, while β_4 ought to be negative since stock bid is postulated by us to be more favorable to the smaller bidder. The sign of β_5 may be expected to be positive in light of H_0I, since higher percentage of cash is likely to be more favorable to the larger bidder. The sign of β_6 is not predicted by any proposition and hence may be assumed to be uncertain.

Case II: Target's CAW, Probability (success|bid) not taken into consideration

In case of target's CAWs, the overall regression model to be estimated was:

$$CAW_{ij} = \beta_0 + \beta_1.G_{ij} + \beta_2.H_{ij} + \beta_3.T_{ij} + \beta_4.D + \beta_5.K + \beta_6 K.G_{ij}$$
$$+\beta_7.D.H_{ij} + \beta_8.D.T_{ij} + \beta_9\ K.T_{ij} + \epsilon_i \qquad (51)$$

Where,

CAW_{ij} = CAW of target j in case of bid by bidder i

Rest of the symbols are the same as in equation (45).

Under the assumption that an inappropriate medium of exchange (from the bidder's viewpoint) would result in excessive transfer of value to the target at the bidder's expense, except for the coefficient of bid premium, the signs of the corresponding β-coefficients may be expected to be the opposite of those expected in case of the bidder's β-coefficients. The signs of the bid premium and percentage of cash may be expected to be the same in the two cases. High bid premium signals the high value creation in case of acquisition, to be shared mutually between the target and the bidder. Higher percentage of cash in the bid also signifies higher valuation of the target. This suggests alignment in the bidder and the target's interests in case of the bidder's data set. Table - 4 describes these models along with the signs expected in case of various partitioned data sets on the same lines as in case of the bidder's data set.

<u>Case III: Bidder's CAW: Probability taken into consideration</u>

In this case, the value of G_{ij} will be substituted by $U_{ij}.G_{ij}$ in case of all the models described under Case I, where U_{ij}

is defined as below:

$$U_{ij} = [\text{Probnorm}(G_{ij}) - 0.5]/(1 - 0.5) \quad (52)$$

Case IV: Target's CAW: Probability taken into consideration

In this case, the value of G_{ij} will be substituted by $U_{ij}.G_{ij}$, as in Case III, for the models described under Case II. The signs of the various coefficients in the models may be expected to be the same as described in Table - 5.

Multiple Bidder Contests: Optimal Bid and Bidder's Size

The optimal bid of a bidder will dominate the rest of the bids in terms of consequent CAR of the bidder. This suggests that the optimal bid would one of the bids resulting into positive CAR of the bidder. Among the set of positive CAR bids, one with the highest value will dominate the other bids as it satisfies the following two conditions: (a) highest value bid will have the highest probability of success, and (b) since usually the lower value bids will precede the highest value bid, positive CAR in case of the highest bid would imply value creation for the bidder in addition to the value generated already through the earlier bids. The relevant sample here consists of 40 multiple bidder events for the same target. Of the 40 events, 28 bidders which are larger in size to the rest of the bidders are seen to be having optimal bid higher than the smaller bidders. This proportion is significantly different from

0.5 (fraction if the ratio of the bids were a random number). The difference between the proportions of larger bidders having higher optimal bid value and smaller bidders having higher optimal bid value is also statistically significant at 5% level. Hence the empirical evidence appears to be supportive of H_0IV.

Empirical Results

The results in case of the bidder's CAWs are given in Table - 6. In the overall model (set 1, unpartitioned data), the bid premium does not appear to be a significant factor. However, it turns out to be a significant factor in case of partitioned data sets (sets 2, 3, 4 and 6), with signs as expected, and at statistically significant levels in these cases. In case of pure cash bids, increase in bid premium affects the bidder's return favorably. In case of other bids, increase in bid premium affects the bidder's return adversely.

The coefficient of percentage of cash is negative in the overall model (set 1) though not at conventionally statistically significant levels. It appears to be negative at conventionally statistically significant levels in case of the models of other bids (set 4). Apparently, higher percentage of cash in case of a bid for a riskier target (as signified by securities medium of exchange) is perceived to be unfavorable, as suggested in our research. However, the coefficient of percentage of cash in case of bidders larger than the target is positive at statistically significant level (β = 15.29, t = 1.92). Later on, in case of a probability adjusted model, the value of this coefficient is seen to be (β = 27.58, t = 4.03) in Table - 8. This value of β offsets the value of coefficient of percentage of cash (β = 27.56, t = 4.04). This indicates that higher percentage of cash in case of mixed offers is perceived unfavorably only in case where the bidder is smaller than the target. This provides support to H_0I. In case of larger bidders, higher percentage of cash helps in signaling the bidder's degree of confidence in the target's value to him. This finding is different from that reported earlier by Eckbo et al. (1990). They failed to observe a significant relationship between percentage of cash in the offer and the bidder's abnormal return in case of mixed offers.

To our surprise, the coefficient of dummy variable for the bidder larger than the target turns out to be negative (-100.03, t = -2.10) in case of pure cash bids (set 2). This suggests that pure cash medium of exchange is more favorable in case of bidders being smaller than the target, in apparent contradiction to H_0I. However, this result needs to be interpreted carefully. It does suggest that a pure cash bid yields more favorable return in case of a smaller bidder. But it may not be interpreted as suggesting that in case of a larger bidder, securities (i.e. other bids) are the more preferred medium of exchange compared to pure cash.

The better explanation for this result would be that a pure cash bid signals strongly high value of acquisition in the bidder's private information. However, the same signal provides only weak information in case of pure cash bids by larger bidder. It may be recalled from Chapter IV that a signaling equilibrium may not exist in the latter case on account of insufficient risk-aversion on the part of bidder managers in this case.

The sign of the coefficient of the dummy variable indicating larger bidder is negative (β = -560.62, t = -1.19) in the overall model (set I). This provides weak evidence of smaller bidders gaining relatively more in case of bidding events. The sign of the same coefficient alternates in case of pure cash (-100.03, t = -2.10) and other bids (-1218.95, t = 3.21). This result is also supported by the negative value of coefficient of relative size in case of larger bidder in the model of all bids (β = -43.51, t = -1.69). However, the sample of other bids consists excessively of larger bidders, and hence may not have sufficient power of resolution for the differences between larger and smaller bidders.

The sign of the coefficient of relative size of the target is negative (-27.91, t = -2.40) in case of pure cash bids and positive (517.37, t = 3.14) in case of other bids. These signs are the same as predicted by my model. It may be further seen from set 4 and set 5 (pure cash bids) that an increase in the relative size of the target affects the bidder's return more adversely in case of larger bidders (-28.92, t = -2.06) at statistically significant level compared to smaller bidder (0.31, t = 0.014). Apparently, the fact of the bidder being smaller than the target conveys the likelihood of sufficient risk-aversion on the part of the bidder. Hence increase in relative size of the target is perceived as a strong signal of the value of acquisition to the bidder. However, a larger bidder may not be perceived as sufficiently risk-averse. Hence increase in the relative size of the target may be indicative of assumption of higher risk by a bidder who is not sufficiently risk-averse, resulting in negative return to the bidder in the market's assessment.

It appears that in case of a pure cash bid by a smaller bidder, bid premium plays a very significant role as a signal (β = 0.94, t = 4.71) of the riskiness in the target and perhaps dominates the signaling feature of the relative size (i.e. the risk-bearing capacity of the bidder), resulting into a low significance level of the latter (β = 0.31, t = 0.014).

The sign of the coefficient of bid premium is positive in case of pure cash bids (β = 0.83, t = 3.13) and negative in case of other bids (β = -2.087, t = -2.65), as originally hypothesized in H_0VII and H_0VIII, respectively. As already stated, the value of this coefficient (β = 0.94, t = 4.71) is positive at statistically significant levels in case of cash bids by smaller bidders, while it is insignificantly negative (β = -0.37, t = - 0.11) in case of pure cash bids by larger bidders. This also may be explained in the light of the required condition of risk-aversion on the part of the managers for the existence of signaling equilibrium.

The model in case of other bids appears to be having a high degree of explanatory power (adj-R^2 = 0.4720, F-stat = 6.96). Perhaps, such a case would be a strong signal of the high riskiness in the target and also high aversion in the bidder, resulting in less noise in the transmission of information.

The observations in case of the bidder's returns may be supplemented and strengthened by the analysis of the target's returns, as described in Table - 7. In the overall model (set 1), the β-coefficients have the predicted signs, though only the coefficients of relative size in case of pure cash bids and bidder larger than the target are so at statistically significant levels. The coefficient of bid premium is positive at statistically significant levels in case of models relating to bids by larger bidders (models 4, 5, 9 and 11) in case of partitioned data-sets. Apparently, higher bid premium by a larger bidder is perceived to be more credible as a signal of bid synergy. However, the magnitude of this coefficient at 6.01 (t = 0.79) in case of pure cash bids is much higher compared to 1.02 (t = 1.03) in case of other bids. This suggests that based upon target's returns, pure cash bids signify less uncertainty in the valuation of the bid package, as also in case of bidder's returns. Hence increase in bid premium signifies higher valuation of the target (and thereby also higher value transfer to it) in case of pure cash bids. The value of this coefficient is higher in case of pure cash bids by larger (β = 10.55, t = 2.1, set 9) and smaller (β = 4.5, t = 0.45, set 8) bidders. This suggests that from the target's perspective, a pure cash bid is evaluated in light of the bidder's characteristics.

The coefficient of bid premium is higher (β = 16.16, t = 2.42) in case of other bids compared to pure cash bids (β = 10.55, t = 2.1) by larger bidders. In the case of the bidder's returns, coefficient for dummy for the larger bidder was negative in case of other bids. Hence it appears that for a given bid premium (indicative of the target's value to the bidder), target gets more, while the bidder gets less in case of other bids if the bidder is larger, compared to the case where the bidder is smaller. This provides a support for H_0I (i.e. cash is more appropriate medium of exchange if the bidder is larger than the target).

None of the estimated models, with the target's returns as the dependent variable, could provide a good fit (in terms of F-statistics) in case of other bids by smaller bidders. However, the coefficient of bid premium (β = 2.86, t = 0.51, set 3) in case of all the bids by smaller bidders appears to be smaller compared to the value of same coefficient (β = 4.5, t = 0.48, set 8) in case of pure cash bids. It provides a weak and indirect support to H_0I that cash is a less favorable medium of exchange for the smaller bidder for a given amount of bid premium (indicative of the target's value to the bidder). Hence pure cash bids result in excessive transfer of value to the bidder at the expense of the target.

The coefficient for the dummy indicating larger bidder (D) is not significant in any of the models at conventionally accepted levels of statistical significance. However, controlling for D does indicate differing effect upon target's returns of relative size of the target (β = -82.58, t = -2.6, set 1). This suggests that increase in relative size of the target affects the target's returns more adversely if the bidder is larger than the case where bidder is smaller. In terms of managerial risk-aversion, the fact of the target being larger than the bidder by itself serves as a sufficiently strong signal of managerial risk-aversion. However in case the bidder is larger than the target, increase in the target's size increases the likelihood of managers being risk-averse, thereby fulfillment of a pre-requisite for separating equilibrium. Hence increase in relative size allows for a stronger signal in case of larger bidders, thereby higher magnitude of the coefficient.

There is an alternative explanation possible for the differing value of the coefficient T_{ij} in case of two bidder groups. The value of the coefficient of T_{ij} is positive at a statistically significant level (β = 75.76, t = 3.19, set 2) only in case of bids by smaller bidders, more so in case of cash bids by smaller bidders (β = 83.5, t = 3.07, set 8). Due to likely existence of high degree of managerial risk aversion in this case, a cash bid would signal high valuation of the target. Larger the size of the target, stronger would be the signal, thereby resulting in positive coefficient of T_{ij}. Since t-statistics of coefficient of relative size indicates existence of a significant effect only in case of cash bids by a smaller bidder, this explanation appears to be more credible.

The coefficient of relative size in case of dummy for pure cash bids is positive at statistically significant level (β = 78.15, t = 2.01, set 1). This indicates that increase in relative size has more favorable effect on the target's returns in case of pure cash bid compared to other bid. This being opposite to the effect originally hypothesized and actually observed in case of the bidder's returns, provides indirect support to H_0 VII and H_0 VIII.

Probability Factor Inclusive Models

Inclusion of probability (as a multiplier to the bid-premium) has a clear impact upon the fit of the models (in terms of R^2 and F-statistics) in case of models of target's returns (given in Table - 9). In case of the bidder's returns, improvement in the fit of the model is clear only in case of the models of other bids and pure cash bids by smaller bidders (given in Table - 8). This suggests that the effect of inclusion of probability as a factor makes a difference in cases where the bidder is perceived to be sufficiently risk-averse. In cases where the bidder's risk-aversion is not sufficiently established, the market may not be having sufficient information to assess the likelihood of success of a bid clearly.

In case of the target's returns, improvement in the fit of the models is visible in case of all the models except for "other bids." The improvement is relatively less prominent in case of "other bids." In case of cash bids, the bid premium is the additional value being offered to the target without any ambiguity. However, in case of "other" bids, the bid-premium represents only one component of the value being transferred to the target. Hence inclusion of probability as a factor would also require hypothesizing appropriate linkages between the probability of success of the bid as well as the other relevant factors (medium of exchange being one of them).

In case of the bidder's returns, the bid premium is only a proxy for the value likely to be generated by the bidder after successful acquisition. It is plausible that this is really not a very efficient proxy (though it still may be the best plausible proxy for the same purpose). Also if the value-sharing between the bidder and the target varies a lot depending upon the case-specific bargaining aspects or other parameters (say capital structure, tax related aspects etc.), mere adjustment of the bid premium through the probability multiplier may not be an efficient technique. Perhaps there is a need to develop a model for success of a bid inclusive of factors like relative size, capital structure etc.

The results of empirical analysis undertaken so far in regard to the testable implication H_0IIIA, based upon data for the period 1970-1989, is shown in the Table - 10 below. Hence, H_0IIIA appears to be getting empirical support asymptotically as f(.) moves towards higher powers order of its argument. However, the fit of the model peaks at the power around 45 and becomes weaker thereafter. While we may not be able to say much about the validity of any particular functional form, this result may be said to be supportive of H_0IIIA due to its directional support.

Some indirect empirical support for the testable implication H_0I may be cited in the recent fate of a number of acquisitions, which are reported to be facing post-acquisition troubles. These appear to have been financed initially through cash, while the pre-acquisition assets base of the bidder was significantly smaller than that of the target. The proper medium of exchange in these cases, in light of the analysis in this paper, would have been stock or similar securities. By shifting the mix of medium of exchange from junk bonds to preferred stocks, in case of RJR Nabisco, KKR appears to be trying to restore the appropriate medium status in a post-facto sense. Another support for the contentions of this paper are provided by Cook (1987). The relevant extract from his paper is reproduced below:

> "Both methodologies showed that when an acquiring firm needed cash to finance an acquisition, if an adequate amount (0% - 25% in this study) were not generated by operations, then the target firm bondholders suffered wealth loss as a result. On the other hand, acquiring firms which generate at least 75% of their cash needs by operations tend to exhibit positive results."

It would be reasonable to equate the reaction of the bondholders as reflective of the impact of the process of acquisition upon the value of the firm. The empirical results cited above conform to the results of this paper; in case of low x, cash is not the appropriate medium of exchange. On the other hand, in case of high x (as evident in the availability of cash internally within the acquirer firm), cash indeed turns out to be the proper medium of exchange. In fact, Cook's paper finds differential impact upon the value of the firm, depending upon the range of x (vis-a-vis the quantum of cash required to finance the acquisition), as predicted by the analysis in this paper.

CHAPTER IX

OVERALL CONCLUSIONS AND OVERVIEW

In the light of available media reports, an increasing number of business sectors appear to be headed towards consolidation. The financial services industry is a prime example. Major restructuring on a scale like that of the recently completed merger of Manufacturers Hanover Banking Trust and Chemical Bank poses serious problems regarding the mechanics of post-merger ownership of the firm. Till the time the two firms merge, and even after that, doubts would persist about the synergy of the relationship and the true values of assets acquired. At times, two firms may not be willing to share business-related private information anticipating some probability of the ultimate non-materialization of acquisition talks. Such doubts may result in break-down of the acquisition process. In case of multiple-bidder setting or horizontal mergers, information provided may even go to potential competitors in the event of non-materialization of the bid. This results in a situation of absence of firm criteria for evaluating the true value of the bid from the viewpoint of either the bidder or the target.

The proposed model provides a framework in which the medium of exchange and the bid premium permit construction of the bid in a manner allowing the target the advantage of detailed scrutiny of the bid. Simultaneously, the bidder is enabled to maximize the expected value of the bid. The target has the advantage of being able to select the highest bid, above the current value of the firm. Assuming that the target management does it efficiently, the proposed model allows the bidder to determine the bid premium, mix of exchange medium and also the exchange ratio. In light of this mix, the bidder may also be able to optimize the external financing package.

I began by recognizing that a bid is essentially a proposal for investment in risky assets. The peculiarity of a bidding situation arises due to the existence of a double set of information asymmetry, reflecting the private information held by the target and bidder, respectively. Hence I adapted the multiple-signaling framework, formulated by other researchers to analyze other corporate finance phenomena involving a single source of information asymmetry. Medium of exchange and bid premium were identified as the two plausible signal components in case of bid for acquisition. Bid-premium appeared to be the extra cost of acquisition to the bidder. This allowed me to identify a unique signal from the set of feasible signaling vectors by imposing the requirement of efficient signaling equilibrium.

I also developed a framework for analyzing the probability of success of a given offer based on private information held by the target. This allowed me to formulate the overall process of bid formulation as an optimization problem for the bidder. The expected value of a bid appeared to be the logical choice as the objective function for optimization.

Overall, a bidder is likely to opt for high premium and pure cash as the medium of exchange if the target is not perceived to be risky by the bidder management. However, securities medium of exchange allows the bidder and target to share the risk arising due to the uncertainty in the target's value. A number of testable implications emerged from these results, a few of which were tested for empirical verification. Results of empirical tests offer support for my analytical results.

Table - 4

Bidder: Empirical Models and Expected Signs of Coefficients

Model set	1	2	3	4	5	6
Basis of partitioning bids bidders	All bids	Pure Cash	Pure Cash bids	Pure Cash bids by bids		Other smaller larger bidders
Explanatory variables included						
Bid premium (G_{ij})	?	+	+	+	+/?	-
Percentage of cash (H_{ij})	+					?
Relative size (T_{ij})	?	-	-	-/?	-	+
Dummy (D) $Size_{bidder} > Size_{target}$	?	+	+			-/?
Dummy (K) (pure cash)	+					
$K.G_{ij}$	+					
$D.H_{ij}$	+					+/?
$D.T_{ij}$	-		+			?
$K.T_{ij}$	-					

(i) + (-) indicates $\beta > 0$ (< 0).

(ii) ? indicates uncertainty in the sign of β .

(iii) No entry indicates that the specific variable is not included in the model.

Table - 5

Target: Empirical Models and Expected Signs of Coefficients

Model set	1	2	3	4	5
Basis of partitioning	All bids	Smaller bidders	Smaller bidders	Larger bidders	Larger bidders
Explanatory variables included					
Bid premium (G_{ij})	+	+	+	+	+
Percentage of cash (H_{ij})	+	+	+	+	+
Relative size (T_{ij})	?	?	-	-	-
Dummy (D) $Size_{bidder}$ > $Size_{target}$	?				
Dummy (K) (pure cash)	+		+		+
$K.G_{ij}$	+				
$D.H_{ij}$	-				
$D.T_{ij}$	-				
$K.T_{ij}$	+		+	+	+

Notes:

(i) + (-) indicates $\beta > 0$ (< 0).

(ii) ? indicates uncertainty in the sign of β .

(iii) No entry indicates that the specific variable is not included in the model.

Table - 5 (contd.)

Model set	6	7	8	9	10	11
Basis of partitioning	Pure cash	Pure cash	Pure cash by smaller bidders	larger bidders	Other bids	Other bids by larger bidders
Explanatory variables included						
Bid premium (G_{ij})	+	+	+	+	+	+
Percentage of cash (H_{ij})					+	+
Relative size (T_{ij})	+	+	+	-	-	-
Dummy (D) $Size_{bidder}$ > $Size_{target}$		-				
Dummy (K) (pure cash)						
$K.G_{ij}$						
$D.H_{ij}$						
$D.T_{ij}$		-				
$K.T_{ij}$						

Notes:

(i) + (-) indicates $\beta > 0$ (< 0).

(ii) ? indicates uncertainty in the sign of β .

(iii) No entry indicates that the specific variable is not included in the model.

Table - 6

Bidder: Empirical Models and Results Obtained

Model set	1	2	3	4	5	6
Basis of partitioning bids bidders	All bids	Pure Cash	Pure Cash bids	Pure Cash bids by bids		Other smaller larger bidders
Explanatory variables						
Intercept	530.5***	18.48	22.97	24.3	78.86**	1231.42***
	(3.091)	(0.60)	(-0.60)	(-0.64)	(-2.47)	(3.24)
Bid premium (G_{ij})	-1.61	0.83***	0.90***	0.94***	-0.37	-2.0871***
	(-0.915)	(3.13)	(3.71)	(4.71)	(-0.11)	(-2.65)
Percentage of cash (H_{ij})	-6.53					27.37***
	(-1.074)					(-3.98)
Relative size (T_{ij})	55.15*	-27.91**	0.0066	0.31	-28.92**	517.37***
	(1.78)	(-2.40)	(0)	(0.014)	(-2.06)	(3.14)
Dummy (D) $Size_{bidder}$ > $Size_{target}$	-560.62	-100.03**	66.14			-1218.95***
	(-1.019)	(-2.10)	(-1.4)			(-3.21)
Dummy (K) (pure cash)	53.15					
	(0.752)					
$K.G_{ij}$	2.64*					
	(1.67)					
$D.H_{ij}$	5.6					15.29*
	(0.97)					(1.92)
$D.T_{ij}$	-43.51*		-35.38			-470.27***
	(-1.69)		(-1.27)			(-2.81)
$K.T_{ij}$	-36.70					
	(-1.361)					
R^2	0.0814	0.0526	0.0576	0.0707	0.0530	0.5512
Adj. R^2	0.0447	0.0376	0.0376	0.0303	0.0396	0.4720
F-stat	2.216	3.51	2.886	1.750	3.972	6.96
Prob > F	0.0220	0.016	0.0237	0.1852	0.0210	0.0001
No. of observations	235	195	195	49	146	40

Note: Figures within brackets represent t-statistics.
* / ** / *** : significant at 10% / 5% / 1% level

Table - 7

Target: Empirical Results

Model set	1	2	3	4	5
Basis of partitioning	All bids	Smaller bidders	Smaller bidders	Larger bidders	Larger bidders
Explanatory variables					
Intercept	226.17 (1.47)	44.07 (0.17)	102.74 (0.28)	93.33 (0.98)	-1.16 (-0.01)
Bid premium (G_{ij})	0.86 (0.81)	2.96 (0.54)	2.86 (0.51)	10.98** (2.37)	11.03*** (2.38)
Percentage of cash (H_{ij})	1.42 (0.71)	4.59** (1.98)	2.48 (0.62)	1.65* (1.69)	1.356 (0.87)
Relative size (T_{ij})	1.58 (0.04)	75.76*** (3.19)	19.58 (-0.50)	-19.46 (-0.84)	-70.357 (-1.19)
Dummy (D) $Size_{bidder}$ > $Size_{target}$	-165.59 (-1.01)				
Dummy (K) (pure cash)	113.12 (0.87)		64.9 (1.15)		154.04 (1.06)
$K.G_{ij}$	4.9 (0.64)				
$D.H_{ij}$	-0.43 (-0.22)				
$D.T_{ij}$	-82.58*** (-2.6)				
$K.T_{ij}$	78.15** (2.01)		105.14** (2.27)		61.73 (0.96)
R^2	0.0510	0.0406	0.0454	0.0716	0.0791
Adj. R^2	0.0354	0.0326	0.0321	0.0567	0.0542
F-stat	3.264	5.086	3.148	4.809	3.178
Prob > F	0.0008	0.0020	0.0051	0.0032	0.0090
No. of observations	557	366	366	191	191

Note: Figures within brackets represent t-statistics.
* / ** / ***: significant at 10% / 5% / 1% level

Table - 7 (contd.)

Model set	6	7	8	9	10	11
Basis of partitioning	Pure cash	Pure cash	Pure cash by smaller bidders	Pure cash by larger bidders	Other bids	Other bids by larger bidders
Explanatory variables included						
Intercept	449.8*** (4.20)	482.76*** (4.25)	497.2*** (3.81)	294.2*** (3.01)	161.9** (2.00)	-58.8 (-0.43)
Bid premium (G_{ij})	6.01 (0.79)	5.75 (0.76)	4.5 (0.48)	10.55** (2.1)	1.02 (1.03)	16.16** (2.42)
Percentage of cash (H_{ij})					1.55 (1.45)	1.43 (0.90)
Relative size (T_{ij})	45.25** (2.31)	81.99*** (3.13)	83.5*** (3.07)	-8.38 (-0.32)	-36.55 (-1.07)	-76.91 (-1.21)
Dummy (D) $Size_{bidder} > Size_{target}$		-130.1 (-1.3)				
Dummy (K) (pure cash)						
$D.G_{ij}$						
$D.H_{ij}$						
$D.T_{ij}$		-87.9** (-2.48)				
$K.T_{ij}$						
R^2	0.0339	0.0458	0.0472	0.0520	0.0317	0.1513
Adj. R^2	0.0297	0.0375	0.0410	0.0396	0.0001	0.0920
F-stat	8.084	5.50	7.559	4.119	1.096	1.842
Prob > F	0.0004	0.0002	0.000	0.0168	0.4171	0.1601
No. of observations	465	465	309	156	92	35

Note: Figures within brackets represent t-statistics.

* / ** / ***: significant at 10% / 5% / 1% level

Table - 8

Bidder: Empirical Results with Probability Adjustment

Model set	1	2	3	4	5	6
Basis of partitioning	All bids	Pure Cash bids	Pure Cash bids	Pure Cash bids by smaller bidder	Pure Cash bids by larger bidder	Other bids
Explanatory variables						
Intercept	557.41 (1.0)	28.43 (1.15)	12.19 (0.36)	10.10 (0.30)	-47.79** (-2.07)	1247.05*** (3.30)
Bid Bid premium (G_{ij})	-1.66 (-0.93)	0.88*** (4.32)	0.88*** (4.04)	0.99*** (7.85)	-2.07 (-0.59)	-2.11*** (-2.71)
Percentage of cash (H_{ij})	-6.55 (0.993)					-27.56*** (4.04)
Relative size (T_{ij})	17.99 (0.73)	-25.47** (-2.27)	-14.11 (-0.87)	-14.40 (-0.87)	-18.66 (-1.57)	510.92*** (3.14)
Dummy (D) $Size_{bidder}$ > $Size_{target}$	-589.77 (-1.05)	-96.77** (-2.19)	-83.49* (-1.91)			-1251.58 (3.31)
Dummy (K) (pure cash)	61.56 (0.92)					
$K.G_{ij}$	2.62 (1.44)					
$D.H_{ij}$	5.7 (0.97)					27.58*** (4.03)
$D.T_{ij}$	-28.51 (-1.28)		12.76 (-0.63)			-496.16*** (-3.03)
$K.T_{ij}$	-11.12 (-0.54)					
R^2	0.0817	0.0549	0.0559	0.1406	0.0456	0.6231
Adj. R^2	0.0449	0.040	0.0359	0.1033	0.0321	0.5566
F-stat	2.223	3.678	2.797	3.764	3.389	9.370
Prob > F	0.0215	0.0132	0.0274	0.0306	0.0365	0.0001
No. of observations	235	195	195	49	146	40

Note: Figures within brackets represent t-statistics.
* / ** / *** : significant at 10% / 5% / 1% level

Table - 9

Target: Empirical Results with Probability Adjustment

Model set	1	2	3	4	5
Basis of partitioning	All bids	Smaller bidders	Smaller bidders	Larger bidders	Larger bidders
Explanatory variables					
Intercept	178.72 (1.09)	-260.62 (-0.94)	-338.63 (-0.96)		-7.29 (-0.139)
Bid premium (Gij)	1.38 (1.3)	8.34** (2.21)	8.54** (2.22)		12.00*** (2.954)
Percentage of cash (H_{ij})	1.87 (0.89)	7.05*** (2.46)	7.07* (1.73)		1.34 (0.799)
Relative size (T_{ij})	3.13 (0.09)	66.06*** (3.31)	-32.28 (-0.80)		-78.09 (-1.337)
Dummy (D) $Size_{bidder}$ > $Size_{target}$	-117.27 (-0.69)				
Dummy (K) (pure cash)	35.26 (0.36)		81.57 (0.65)		152.69 (0.988)
$K.G_{ij}$	11.19** (2.37)				
$D.H_{ij}$	-0.07 (-0.034)				
$D.T_{ij}$	-76.36** (-2.54)				
$K.T_{ij}$	71.92* (1.90)		108.9** (2.35)		68.25 (1.06)
R^2	0.0943	0.0738	0.0795		0.0872
Adj. R^2	0.0794	0.0661	0.0666		0.0625
F-stat	6.318	9.589	6.198		3.533
Prob > F	0.0001	0.0001	0.0001		0.0046
No. of observations	557	366	366		191

Note: Figures within brackets represent t-statistics.
* / ** / *** : significant at 10% / 5% / 1% level

Table - 9 (contd.)

Model set	7	8	9	10	11	12
Basis of partitioning	Pure cash	Pure cash	Pure cash by smaller bidders	larger bidders	Other bids	Other bids by larger bidders
Explanatory variables						
Intercept	402.9 *** (6.77)		400.43*** (6.04)	281.1*** (3.1)	46.13 (1.461)	-24.82 (-0.180)
Bid premium (G_{ij})	12.545*** (2.71)		12.75** (2.20)	11.84** (2.45)	1.56** (2.174)	13.62** (2.18)
Percentage of cash (H_{ij})					1.63 (1.622)	1.36 (0.85)
Relative size (T_{ij})	70.77*** (3.022)		70.46*** (2.971)	-9.75 (-0.434)	-40.07 (-1.141)	-81.04 (-1.255)
Dummy (D) $Size_{bidder}$ > $Size_{target}$	-130.18 (-1.31)					
Dummy (K) (pure cash)						
$K.G_{ij}$						
$D.H_{ij}$						
$D.T_{ij}$	-80.92** (-2.43)					
$K.T_{ij}$						
R^2	0.0918		0.0986	0.0630	0.0357	0.1262
Adj. R^2	0.839		0.0927	0.0508	0.0028	0.0416
F-stat	11.595		16.68	5.148	1.086	1.492
Prob > F	0.0001		0.00	0.0069	0.359	0.2360
No. of observations	465		309	156	92	35

Note: Figures within brackets represent t-statistics.

* / ** / *** : significant at 10% / 5% / 1% level

Table - 10

Relationship between Market Variance and Proportion of Securities Bids

Functional form of $f(1/\sigma^2)$	β_1	t-stat	F-stat	Prob >F
$(1/\sigma^2)$	32.398	0.237	0.107	0.7475
$(1/\sigma^2)^3$	$3.693*10^6$	0.670	0.448	0.5116
$(1/\sigma^2)^6$	$9.435*10^{13}$	1.125	1.266	0.2753
$(1/\sigma^2)^{11}$	$1.103*10^{26}$	1.514	2.291	0.1475
$(1/\sigma^2)^{13}$	$6.857*10^{30}$	1.587	2.518	0.1300
$(1/\sigma^2)^{20}$	$3.74*10^7$	1.697	2.879	0.1070
$(1/\sigma^2)^{30}$	$2.843*10^{11}$	1.729	2.990	0.1009
$(1/\sigma^2)^{35}$	$2.463*10^{13}$	1.733	3.003	0.1002
$(1/\sigma^2)^{40}$	$2.131*10^{15}$	1.734	3.008	0.1000
$(1/\sigma^2)^{42}$	$1.269*10^{16}$	1.735	3.009	0.0999
$(1/\sigma^2)^{45}$	$1.844*10^{17}$	1.735	3.010	0.0998
$(1/\sigma^2)^{50}$	$1.613*10^1$	1.710	2.923	0.1055
$\exp(\sigma^2)$	2.42	0.578	0.334	0.5703

APPENDIX

APPENDIX

Sign of $\partial G/\partial C$: I have from equation (21), chapter V:

$G = c.F(c) - V_b.p - p.F(c).E(Q|c)$

$\Rightarrow$

$$\frac{\partial G}{\partial C} = F(c) + c.f(c) - \frac{V_b}{V_b+Q(c)} + c.\frac{V_b}{[V_b+Q(c)]^2}.\frac{\partial Q(c)}{\partial c}$$

$$-F(c).E(Q|c).\{1/[V_b+Q(c)] - c/[V_b+Q(c)]^2 [\partial Q(c)/\partial c]\}$$

$$- \alpha.Q(c).f(c)$$

$$=F(c)+c.f(c)+\frac{p^2}{c}[V_b+F(c).E(Q|c)].\frac{\partial Q(c)}{\partial c}-\frac{V_b}{V_b+Q(c)}-F(c).\frac{E(Q|c)}{x+Q(c)}$$

$$-c.f(c).Q(c)/[V_b+Q(c)]$$

$$= c.f(c).\left[1 - \frac{Q(c)}{V_b+Q(c)}\right] + F(c)+[V_b+F(c).E(Q|c)]\left[\frac{p^2}{c}.\frac{\partial Q(c)}{\partial c}-\frac{1}{V_b+Q(c)}\right] \quad \text{(ii)}$$

However, $1 - \frac{Q(c)}{V_b+Q(c)} > 0$

And,

$$F(c)+[V_b+F(c).E(Q|c)]\left[\frac{p^2}{c}.\frac{\partial Q(c)}{\partial c}-\frac{1}{V_b+Q(c)}\right]$$

$$= \frac{[V_b+F(c).E(Q|c)]}{[V_b+Q(c)]^2}\left[c.\frac{\partial Q(c)}{\partial c} - [V_b+Q(c)]\right] + F(c)$$

$$=\frac{[V_b+F(c).E(Q|c)]}{[V_b+Q(c)]^2}\left[c.\frac{\partial Q(c)}{\partial c}-Q(c)\right] + F(c) -V_b.\frac{[V_b+F(c).E(Q|c)]}{[V_b+Q(c)]^2}$$

However, in case the product of the coefficient and the highest power of c in the power series expansion of Q(c) is at least one, which certainly ought to be the case under our assumption (i.e. $\partial q(M,\theta)/\partial M \equiv \partial Q(c)/\partial c > 1$), we will have:

$$c.\frac{\partial Q(c)}{\partial c} \geq Q(c)$$

$$\text{And } F(c) - V_b.\frac{[V_b+F(c).E(Q|c)]}{[V_b+Q(c)]^2}$$

$$= \frac{V_b}{[V_b+Q(c)]}.\left[\frac{[V_b+Q(c)]}{V_b}.F(c) - \frac{[V_b+F(c).E(Q|c)]}{[V_b+Q(c)]}\right]$$

The term within big brackets need to be analyzed carefully. F(c) is the probability of the true value of the target's assets being not more than c. $V_b+Q(c)$ is the maximum value the bidder will expect from the post -acquisition firm. $F(c).[V_b+Q(c)]/V_b$ thereby is the upper limit for the expected value of factor (percentage) by which the bidder's assets will increase due to acquisition.

$\frac{[V_b+F(c).E(Q|c)]}{[V_b+Q(c)]}$ represents the expected value of factor by which the value of the post-acquisition firm will trail the maximum value likely. For the bid to be made, the upper limit of the likely percentage increase in the bidder's existing assets value must exceed the expected percentage loss in the value of the post-acquisition firm due to information asymmetry. This is also because the base value of assets for the likely percentage increase in the value of the bidder at V_b is lower than $V_b+Q(c)$ arising from the loss likely due to information asymmetry. Hence the RHS in (ii)is positive, which implies that:

$$\frac{\partial G}{\partial c} > 0$$

Sign of $\frac{\partial P(s|st)}{\partial p}$:

I have from equation (25a):

$$Pr(\text{success}|\text{stock offer}) = P(s|st) = Pr(v \le p.[V_b+Q(v)])$$

Assume $Q(v) = m.v \qquad (m > 1)$

Then $P(s|st) = Pr\left(v \le \frac{V_b}{(1/p-m)} \right)$

$$\text{Hence} \quad \frac{\partial P(s|st)}{\partial p} = \frac{\partial}{\partial p}\left\{\int_1^{V_b/(1/p-m)} f(v)\, dv\right\}$$

$$= \frac{V_b}{p^2(1/p-m)^2}.f[V_b/(1/p-m)] > 0 \qquad \text{(i)}$$

Hence the probability of success of the securities offer will increase in the exchange ratio.

Sign of $\frac{\partial P(s|st)}{\partial V_b}$: Again from equation (25a):

$$\frac{\partial P(s|st)}{\partial V_b} = \frac{\partial p}{\partial V_b}.\frac{\partial P(s|st)}{\partial p}$$

But $p = \frac{c}{V_b + Q(c)} \Rightarrow \frac{\partial p}{\partial V_b} = \frac{-c}{V_b + Q(c)} < 0$

Hence, $\frac{\partial P(s|st)}{\partial V_b} < 0$

Hence the probability of success of the securities offer will increase in the size of the bidder.

Sign of $\frac{\partial P(s|st)}{\partial c}$: From equation (25a):

$$\frac{\partial P(s|st)}{\partial c} = \frac{\partial}{\partial c}\int_{1}^{c} f(v)\ dv = f(c) > 0$$

Hence the probability of success of the securities offer will increase in the value of the offer.

Relative Magnitude of $\frac{\partial P(s|st)}{\partial \sigma^2}$ and $\frac{\partial P(st)}{\partial \sigma^2}$:

I have from equation (25a):

$$\Pr(\text{success}|\text{stock offer}) = P(s|st) = \Pr(v \le p.[V_b+Q(v)])$$

Assume $Q(v) = m.v \qquad (m > 1)$

Then $P(s|st) = \Pr\left(v \le \frac{V_b}{(1/p-m)} \right)$

$$\text{Hence, } \frac{\partial P(s|st)}{\partial \sigma^2} = \frac{\partial p}{\partial \sigma^2} . \frac{\partial P(s|st)}{\partial p} \qquad \text{(i)}$$

$$\text{But } \frac{\partial P(s|st)}{\partial p} = \frac{\partial}{\partial p}\left\{\int_{1}^{V_b/(1/p-m)} f(v)\ dv\right\}$$

$$= \frac{V_b}{p^2(1/p-m)^2} . f[V_b/(1/p-m)]$$

In view of the relationship given by equation (18), chapter - 5, we have:

$$\frac{V_b}{(1-mp)} = c \qquad \text{(ii)}$$

From Proposition II we have:

$$\frac{\partial \alpha}{\partial \sigma^2} < 0$$

This implies that $\frac{\partial p}{\partial \sigma^2} = \frac{\partial (1-\alpha)}{\partial \sigma^2} > 0$

Hence (i) becomes:

$$\frac{\partial P(s|st)}{\partial \sigma^2} = \frac{\partial p}{\partial \sigma^2} \cdot \frac{c.f(p.c)}{p.(1-mp)} > 0 \qquad \text{(iii)}$$

It may be noted that $0 < 1\text{-}mp < 1$, otherwise the upper limit in the integral on the RHS of (i) will be negative, which is not feasible by assumption.

I have from relationship (25), chapter - V,

$$P(st) = Pr(\text{stock offer}) = Pr[c.F(c) > V_b.p + p.F(c).E(Q|c)]$$

$$= Pr\left[p < \frac{c.F(c)}{(F(c).E(Q|c)+V_b)}\right]$$

$$= Pr[v > c^*]$$

$$= 1 - Pr[v < c^*]$$

Where c^* is defined by the following relationship:

$$\frac{c^*.F(c^*)}{[F(c^*).E(Q|c^*) + V_b]} = p \qquad \text{(iv)}$$

From (iv) I may derive:

$$\frac{\partial c^*}{\partial p} = \frac{V_b + F(c^*).E(Q|c^*)}{[F(c^*) + c^*.f(c^*) - p.f(c^*).Q(c^*)]}$$

$$= \frac{c^*F(c^*)}{p.[F(c^*) + c^*.f(c^*) - p.f(c^*).Q(c^*)]}$$

Assuming $Q(c^*) = m.c^*$, we will get:

$$\frac{\partial P(st)}{\partial \sigma^2} = \frac{\partial p}{\partial \sigma^2} \cdot \frac{\partial P(s)}{\partial p}$$

$$\frac{\partial P(st)}{\partial p} = \frac{\partial}{\partial p}\left(1 - \int_1^{c^*} f(v)\, dv\right)$$

$$= (-)\frac{c^*f(c^*).F(c^*)}{p.[F(c^*) + c^*.f(c^*)(1-mp)]}$$

Hence $\frac{\partial P(st)}{\partial \sigma^2} = (-)\ \frac{\partial p}{\partial \sigma^2} \cdot \frac{c^* f(c^*)}{p} \cdot \frac{1}{[1+ \frac{c^*.f(c^*)}{F(c^*)}.(1-mp)]} < 0$ (v)

However, $[1+ c^*.f(c^*)(1-mp)]/F(c^*) > 1$. I have also shown earlier in the case of relationship (19) in chapter 5 that in equilibrium between cash and stock bids, c^* as defined by relationship (iv) would be the same as c (or as defined by (19)). Hence comparing (iii) and (v), I may infer that in term of absolute value:

$$\frac{\partial P(s|st)}{\partial \sigma^2} > \frac{\partial P(st)}{\partial \sigma^2}$$

Integrated Framework: Proof of Proposition I: The proof will be similar to that given in the case of framework based on

bidder's private information. In the integrated framework, condition (8) will become:

$$(1-\alpha_2).[\int_1^{M(2)} q(v,\theta_2).dF(v) - \int_1^{M(1)} q(v,\theta_2).dF(v)]$$
$$\geq [M(2) - M(1)] \qquad (8a)$$

(For notational convenience, I have defined the following terms as:

$M(1) = M_1^*$
$M(2) = M_2$)

The non-mimicry condition (9) may be stated as below in the integrated framework:

$$F(M(2),\alpha_2).\ \{V_b + \alpha_2.\int_1^{M(1)} q(v,\theta_1).dF(v) -$$

M(2)

$$(1-\alpha_2)\int_1 P(v,\alpha_2).dF(v) - [M(2)-M(1)] - \frac{h\sigma_t^2\alpha_2^2}{2}\}$$

$$\leq F(M(1),\alpha_1).\ \{V_b + \int_1^{M(1)} q(v,\theta_1).dF(v) - \frac{h\sigma_t^2\alpha_1^2}{2}\}$$

Or,

$$\{V_b + \alpha_2.\int_1^{M(1)} q(v,\theta_1).dF(v) -$$

$$[1-\alpha_2]\int_1^{M(2)} P(v,\alpha_2).dF(v) - [M(2)-M(1)] - \frac{h\sigma_t^2\alpha_1^2}{2}\}$$

$$\leq \frac{F(M(1),\alpha_1)}{F(M(2),\alpha_2)}.\ \{V_b + \int_1^{M(1)} q(v,\theta_1).dF(v) - \frac{h\sigma_t^2\alpha_2^2}{2}\}$$

Since $F(M(1),\alpha_1) < F(M(2),\alpha_2)$ under the assumption that bidder 2 is more efficient than bidder 1, I will also have:

$$\{V_b + \alpha_2.\int_1^{M(1)} q(v,\theta_1).dF(v) -$$

$$[1-\alpha_2]\int_1^{M(2)} P(v,\alpha_2).dF(v) - [M(2)-M(1)] - \frac{h\sigma_t^2\alpha_2^2}{2}\}$$

$$\leq \{V_b + \int_1^{M(1)} q(v,\theta_1).dF(v) - \frac{h\sigma_t^2\alpha_1^2}{2}\}$$

Or,

$$[1-\alpha_2].\{\int_1^{M(2)} P(v,\alpha_2).dF(v) - \int_1^{M(1)} q(v,\theta_1).dF(v) - [M(2)-M(1)]\}$$

$$\leq \frac{h\sigma_t^2}{2}[\alpha_2^2 - \alpha_1^2] \qquad (9a)$$

Since the bidder 2's bid is optimal, I may use relationship (5) to arrive at:

$$[1-\alpha_2].\{\int_1^{M(2)} q(v,\alpha_2).dF(v) - \int_1^{M(1)} q(v,\theta_1).dF(v) - [M(2)-M(1)]\}$$

$$\leq \frac{h\sigma_t^2}{2}[\alpha_2^2 - \alpha_1^2]$$

In view of required condition (8a) for non-mimicry, LHS in relationship (9a) will be positive, which implies that $\alpha_2 > \alpha_1$.

Q.E.D.

Integrated Framework: Proof of Proposition II: Using relationship (8a) in Appendix - V, I may state the bidder's optimization objective as:

$$\text{Max}_{\alpha,M}\ F.V$$

Where,

$$F = F([1-\alpha].[V_b + P(M,\alpha)] + M)$$

$$V = [V_b + \alpha.\int_I^M q(v,\theta).f(v)\ dv + (1-\alpha).\int_I^M P(v,\alpha).f(v)\ dv - M - \frac{h\sigma_t^2\alpha^2}{2}]$$

In equilibrium, using relationship (5), V becomes:

$$V = [V_b + \int_I^M q(v,\theta).f(v)\ dv - M - \frac{h\sigma_t^2\alpha^2}{2}] \qquad \text{(i)}$$

The bidder will make the bid only if the value of the merged firm (V) is likely to be positive. Due to limited liability consideration, V can never be negative. If the likely value of V is zero, the bidder will not have any incentive to make the bid.

The first order necessary condition for maximization of the bidder's expected utility from the bid will be:

$$\frac{\partial F}{\partial \alpha}.V + F.\frac{\partial V}{\partial \alpha} = 0 = E \text{ (to denote an identity)}$$

This gives:

$$\frac{\partial F}{\partial \alpha} = -\frac{F}{V}.\frac{\partial V}{\partial \alpha} \qquad \text{(ii)}$$

Using (i), I obtain:

$$\frac{\partial V}{\partial \alpha} = -\ h\sigma_t^2\alpha \qquad \text{(iii)}$$

I may use the implicit function rule to obtain:

$$\frac{\partial V}{\partial \sigma_t^2} = -\frac{\partial E/\partial \sigma_t^2}{\partial E/\partial \alpha} \qquad \text{(iv)}$$

Sign of $\frac{\partial E}{\partial \alpha}$:

$$\frac{\partial E}{\partial \alpha} = V.\frac{\partial}{\partial \alpha}\left[-\frac{F}{V}.\frac{\partial V}{\partial \alpha}\right] + 2.\frac{\partial F}{\partial \alpha}.\frac{\partial V}{\partial \alpha} + F.\frac{\partial^2 V}{\partial \alpha^2}$$

$$= -\ \frac{\partial F}{\partial \alpha}.\frac{\partial V}{\partial \alpha} - F.\frac{\partial^2 V}{\partial \alpha^2} - \frac{F}{V}.\left[\frac{\partial V}{\partial \alpha}\right]^2 + 2.\frac{\partial F}{\partial \alpha}.\frac{\partial V}{\partial \alpha} + F.\frac{\partial^2 V}{\partial \alpha^2}$$

$$= \frac{\partial V}{\partial \alpha}.\left[\frac{\partial F}{\partial \alpha} - \frac{F}{V}.\frac{\partial V}{\partial \alpha}\right]$$

$$= \frac{\partial V}{\partial \alpha}.\left[-2\frac{F}{V}.\frac{\partial V}{\partial \alpha}\right]$$

$$= -2\frac{F}{V}.\left[\frac{\partial V}{\partial \alpha}\right]^2 < 0 \qquad \text{(v)}$$

(Remarks: Relationship (v) also shows that the second order necessary condition for the maximization of the bidder's objective function is satisfied.)

Sign of $\frac{\partial E}{\partial \sigma_t^2}$:

$$\frac{\partial E}{\partial \sigma_t^2} = \frac{\partial F}{\partial \alpha}.\left[-\frac{h.\alpha^2}{2}\right] - F.h.\alpha$$

$$= -h.\alpha.\left[F + \frac{\alpha}{2}.\frac{\partial F}{\partial \alpha}\right]$$

$$= -h.\alpha.\left[F - \frac{F.\alpha}{2V}.\frac{\partial V}{\partial \alpha}\right]$$

$$= -h.\alpha.F\left[1 - \frac{\alpha}{2V}.\frac{\partial V}{\partial \alpha}\right]$$

$$= -h.\alpha.F\left[1 + \frac{h\sigma_t^2\alpha^2}{2V}\right] \qquad \text{(using (iii))}$$

$$< 0$$

Hence, $\frac{\partial \alpha}{\partial \sigma_t^2} = - \frac{\text{(negative term)}}{\text{(negative term)}} < 0$

Q.E.D.

Integrated Framework: Proof of Proposition III: As in the proof of Proposition II (Appendix - E), using the implicit function rule, I get:

$$\frac{\partial \alpha}{\partial h} = -\frac{\partial E/\partial h}{\partial E/\partial \alpha}$$

Sign of $\frac{\partial E}{\partial h}$:

$$\frac{\partial E}{\partial h} = \frac{\partial F}{\partial \alpha}.\frac{\partial V}{\partial h} + F.\frac{\partial^2 V}{\partial \alpha.\partial h}$$

$$= \frac{\partial F}{\partial \alpha}.\ \left(-\frac{\sigma_t^2\alpha^2}{2}\right) + F.\ (-\sigma_t^2\alpha)$$

$$= -\alpha.\sigma_t^2\left[F + \frac{\alpha}{2}.\frac{\partial F}{\partial \alpha}\right]$$

$$= -\alpha.\sigma_t^2\left[F - \frac{\alpha.F}{2V}.\frac{\partial V}{\partial \alpha}\right]$$

$$= -\alpha.\sigma_t^2\left[F + \frac{h.F.\sigma_t^2\alpha^2}{V}\right]$$

$$< 0$$

Hence, $\frac{\partial \alpha}{\partial h} = - \frac{\text{(negative term)}}{\text{(negative term)}} < 0$

Q.E.D.

Integrated Framework: Proofs of Proposition VI and VII:

As in Appendix - VI, the first order necessary condition for the maximization of the bidder's objective function will be:

$$\frac{\partial F}{\partial \alpha}.V + F.\frac{\partial V}{\partial \alpha} = 0 = E \text{ (to denote an identity)}$$

Using the implicit function rule, I will have :

$$\frac{\partial \alpha}{\partial V_b} = -\frac{\partial E/\partial V_B}{\partial E/\partial \alpha}$$

Sign of $\frac{\partial E}{\partial V_b}$:

$$\frac{\partial E}{\partial V_b} = \frac{\partial^2 F}{\partial \alpha \partial V_b}.V + \frac{\partial F}{\partial \alpha}.\underset{(=1)}{\frac{\partial V}{\partial V_b}} + \frac{\partial F}{\partial V_b}.\frac{\partial V}{\partial \alpha} + F.\underset{(=0)}{\frac{\partial^2 V}{\partial V_b \partial \alpha}}$$

$$\frac{\partial F}{\partial V_b} = (1-\alpha).f(.)$$

$$\frac{\partial^2 F}{\partial \alpha \partial V_b} = \frac{\partial}{\partial V_b}\left[-\frac{F}{V}.\frac{\partial V}{\partial \alpha}\right]$$

$$= -\frac{1}{V}.\frac{\partial F}{\partial V_b}.\frac{\partial V}{\partial \alpha} + \frac{F}{V^2}.\frac{\partial V}{\partial V_b}.\frac{\partial V}{\partial \alpha} - \frac{F}{V}.\frac{\partial^2 V}{\partial \alpha \partial V_b}$$

$$= \frac{1}{V}.\frac{\partial V}{\partial \alpha}.\left[\frac{F}{V} - \frac{\partial F}{\partial V_b}\right]$$

$$= \frac{1}{V}.\frac{\partial V}{\partial \alpha}.\left[\frac{F}{V} - (1-\alpha).f(.)\right]$$

This implies that:

$$\frac{\partial E}{\partial V_b} = \frac{\partial V}{\partial \alpha}.\left[\frac{F}{V} - (1-\alpha).f(.)\right] + \frac{\partial F}{\partial \alpha} + \left[\frac{\partial V}{\partial \alpha}.(1-\alpha).f(.)\right]$$

$$= \frac{F}{V}.\frac{\partial V}{\partial \alpha} + \frac{\partial F}{\partial \alpha} > 0$$

This implies that:

$$\frac{\partial \alpha}{\partial V_b} = - \frac{\text{(positive term)}}{\text{(negative term)}} > 0$$

Hence in the case of any medium of exchange, as the bidder's size increases, α also should increase. Alternatively, as the target's relative size increases, the percentage of cash should come down. Hence pure cash will become less optimal medium of exchange as the relative size of the target increases. And the securities medium of exchange will become more favorable to the bidder as the relative size of the target increases. This completes the proofs of Propositions VI and VII.

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