ESSAYS ON CORPORATE RISK MANAGEMENT AND STOCK OFFERS IN MERGERS

by

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Abstract

This dissertation consists of three essays in the area of corporate risk management and stock offer forms in mergers and acquisitions. In Essay One, I discuss the effect of information on corporate risk management decisions when the information is asymmetric between the insider and the market. I suggest an explanation for previous contradiction between existing theories and empirical findings, which states that fewer small firms choose to hedge. Considering two different scenarios of information revelation to the market, I find hedging cost is not the main reason preventing firms from hedging. Rather asymmetric information plays the decisive role in a firm s risk management policy. One of the empirical implications is that cash flows with high variances may discourage firms from hedging even when they face high financial distress costs.

Essay Two discusses different stock offer forms in mergers and acquisitions: fixed ratio, fixed value and collar agreement. In a theoretical model, I argue that the information revealed between merger agreement and completion can play an important role in determination of optimal forms. A collar offer is the optimal choice for a leading firm when it is uninformed of the following firm's value in the negotiation process. A collar offer increases the probability that a merger can be accepted by different types of following firms. I also find that the collar feature is more socially desirable because of its efficiency in utilizing positive synergy from mergers.

Empirical findings of the announcement effects of stock offer forms are documented in Essay Three using a sample with detailed information of collar offers. When the endogeneity problem is dealt with a two-stage probit least square model, I find the average abnormal return of target firms in collar offers is significantly higher than that in other stock offers, and the average abnormal return of acquiring firms in fixed value stock offers is higher than that in fixed ratio stock offers. I also find that the likelihood of collar offers is increasing with the relative size of target firm to acquiring firm, when the relative size is small. But it decreases when the relative size is large. The evidence supports the hypothesis that the prior objective of acquiring firms in mergers is control rights rather than value maximization.

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I dedicate this thesis to my parents and my wife.

Chapter 1

Introduction

This dissertation consists of three essays on such topics as corporate risk management and methods of payment in mergers and acquisitions.

The first essay uses a theoretical model to answer the question: why firms do not hedge. Previous literature, such as Smith and Stulz (1985), Stulz (1997), Bessembinder (1991), etc..., suggests that corporate hedging can increase firm value. However, empirical evidence shows that not all firms use risk management strategies as predicted.[1] Though costs of hedging may prevent firms from hedging, asymmetric information can play a bigger role in the decisions of corporate risk management. When managers have information that outside investors do not have, they might want to use hedging or not hedging as a signal to the market. Considering two scenarios that hedging reporting is stricter or less, I find that good firms have the incentives of using non-hedging as signals of their qualities. One implication of the model is that cash flows with high variances may discourage firms from

[1]Wharton/CIBC World Markets: "1998 Survey of Derivatives Usage by U.S. Non-financial Firms."

hedging even when they face high financial distress costs.

The second essay also uses the concept of asymmetric information to explain the existence of different stock offer forms in mergers and acquisitions. Literature such as Hansen (1987), Fishman (1989), and Eckbo, Giammarino and Heinkel (1990) has used asymmetric information between the two firms involved in a merger to analyze the choice between cash and stock offers. The fact that there are different stock offer forms such as fixed ratio, fixed value and collar agreement has been largely ignored. I extend the scope of the study of methods of payment in a theoretical model. I argue that the information revealed between merger agreement and completion can play an important role in determination of optimal stock forms. When a leading firm is uninformed of the following firm's value in the negotiation process, a collar offer is the preferred offer. The collar feature is also more socially desirable because of its efficiency in utilizing positive synergy from mergers.

The third essay looks at the empirical evidence that stock offer forms present different wealth effects for target and acquiring firms. I collect a sample consisted of detailed information of stock offers during the period of 1991 to 2000. Considering the choice of stock offer forms as an endogenous decision, I control the endogeneity problem and find that the announcement effects of stock offers are significantly different. The average abnormal return of target firms in collar offers is significantly higher than that in other stock offers, and the average abnormal return of acquiring firms in fixed value stock offers is higher than that in fixed ratio stock offers. The findings suggest that considering stock offer as a homogenous category can potentially cause problems. I also find that the likelihood of collar offers is increasing with the relative size of target firm to acquiring firm, when the relative size is

small. But it decreases when the relative size is large. The evidence supports the hypothesis that the prior objective of acquiring firms in mergers is control rights rather than value maximization.

From Chapter 2 to Chapter 4, the three essays take independent chapters respectively. I conclude the dissertation and discuss future work in Chapter 5.

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Chapter 2

Corporate Risk Management and Asymmetric Information

2.1 Introduction

Risk management has received much attention in the theory of corporate finance, and is playing an increasingly important role in corporate financial management with the rapid development of derivative securities. Many surveys show that risk management is ranked by financial executives as one of their most important objectives, and hedging is frequently used by large and widely held companies. Managers are becoming more concerned about their risk management strategies.

Theories such as Black-Scholes' option pricing model have provided insights on how to implement a firm's hedging strategies. However, we still need more insight into the mechanism of hedging on firms' behavior. Some theories have explained why corporations

need hedging and what the benefits of risk management are. These theories suggest that some companies facing large exposures to interest rates, exchange rates or commodity prices can increase their market values by using derivative securities to reduce their exposures. One fundamental direct goal of using hedging is to reduce the variability of cash flows, thus reduces various costs. According to Modigliani and Miller (1958), if hedging can increase firm value, it must do it through taxes, contracting costs, the impact on the firm's investment decision, etc... Otherwise the investors can diversify their risks through the same hedging strategies. In fact, most risk management theories focus on some aspects of relaxing the irrelevance theorem and study the effect of hedging on the firm's value or financial decisions.

From an individual investor's perspective, hedging reduces exposure to uncertainty. For example, he can use forward contract to fix a commodity price. For firms, it is essentially the same. According to Smith and Stulz (1985), firms can hedge by trading certain securities contracts or by altering real operating decisions. Therefore, hedging reduces the dependence of firm value on changes in state variables.

Hedging can reduce the volatility of taxable cash flow, which has an impact on a firm's value if the tax code is convex. Smith and Stulz (1985) state that risk management can reduce taxes if effective marginal tax rates on corporations are an increasing function of the firm's pre-tax value. Because of the convexity of the tax code in most countries, there are benefits to managing the taxable income in an optimal range. By reducing the fluctuations in taxable income, risk management can lead to lower tax payments, since it ensures that the largest possible proportion of corporate income falls in the optimal range of tax rates.

Smith and Stulz (1985), Stulz (1997), and Bessembinder (1991) discuss the impact of hedging on bankruptcy costs in firms with risky debt outstanding. Investors become concerned if the variability of cash flow increases the probability of financial distress, since the distress cost will be reflected in current firm market value. For a given a level of debt, hedging can reduce the probability that a firm will find itself in a situation where it is unable to repay that debt. In extreme cases, risk management eliminates the risk of bankruptcy totally, reducing the costs to zero and, in so doing, increases the value of the firm. In general, by shifting individual future states from default to non-default outcomes, hedging increases the proportion of future states in which equity holders are the residual claimants. Froot, Scharfstein and Stein (1993) develop this idea to show that hedging adds value to such an extent that a firm has sufficient internal funds available to take advantage of attractive investments. They argue that if capital market imperfections make externally obtained funds more expensive than those generated internally, there is a rationale for risk management. Their theory is still rooted in the understanding that risk management can reduce the variability of cash flows. It will also indirectly reduce the variability in the amount of money raised externally and variability in the amount of investment. Since the marginal return to investment usually decreases and the marginal cost of funds goes up with the amount raised externally, the reduction in the variability by hedging is very meaningful to firm value. By reducing the probability of financial distress, risk management has the potential to increase debt capacity and facilitate larger equity stakes for management. In a certain sense, risk management can be viewed as a direct substitute for equity capital. The more a firm hedges its exposure, the less equity it needs to support its business. So the use

of risk management to reduce exposure effectively increases a company's debt capacity. A firm's hedging decision should be jointly made with the corporate capital structure decision.

Gavish and Kalay (1983), Green and Talmor (1986) have formally demonstrated how the existence of risky debt generates an incentive for managers to substitute low-risk assets for high-risk assets. Campbell and Kracaw (1990) also show that the incentive to shift risk increases monotonically with the use of risky debt. They further their research by separating the risk into observable risk, which can be contractually hedged, and unobservable risk, such as operating risk, which can not be hedged using derivative instruments. By studying the impact of observable risk on asset substitution, they conclude that when two types of risks are sufficiently positively correlated manager-equityholders should benefit from hedging. This provides another explanation for hedging. Given debt in place, if hedging is unrestricted, the borrower will have an incentive to increase risk by avoiding hedging and thereby shift wealth from lender to borrower. Hence, the lender requires a contract that compels the borrower to choose a level of hedging that allows the lender to break even at least. This leads to the managerial incentive for hedging.

Stulz (1984) touches on this problem, but his focus is not on the incentive contract. Instead, he derives the optimal hedging policies under the assumption that managers maximize their expected lifetime utility, and their income from the firm is an increasing function of firm value. The manager's compensation contract is given by the shareholders without considering the agency costs. Smith and Stulz (1985) also discuss compensation contracts between managers and shareholders. Their results show that making managerial wealth a concave function of firm value bonds the firm to a hedging policy. This is also

important for a firm with debt or other fixed claims. It ensures that a firm will hedge as long as that compensation policy is followed.

Campbell and Kracaw (1990) show that the incentive to shift risk and the associated agency costs of debt increase with the use of risky debt. Thus it may be optimal to include covenants which require that borrowers hedge an observable risk in debt contracts. Bessembinder (1991) argues that independent of effects on investment, hedging increases value by improving contracting terms. In his paper, the beneficial effects of hedging are attainable only to the extent that a firm can credibly commit to maintaining the hedge over the life of the senior claim. He predicts that firms will devise methods to make such credible commitments. The most obvious is to include covenants defining a firm's hedging policies in contracts with senior claimants.

DeMarzo and Duffie (1995) investigate the role of managerial career concerns in determining corporate financial hedging policy. They find standard hedging accounting can improve a firm's future investment decisions. In addition, standard hedge accounting may also increase a manager's incentive to make an optimal initial investment decision. Under full disclosure, hedging positions have real effects primarily because they act as a signal and reveal private information known to the manager. If hedging positions are not disclosed, hedging has a more direct impact on the risks of a firm's profits and managers' wages. Thus, accounting issues are likely to have important consequences for hedging policy.

Leland (1998) considers the interaction between agency cost, capital structure and risk management. To my knowledge it is the first work that studies the joint determination of capital structure and investment risk. Using simulation, he provides some quantitative

guidance for optimizing the amount and maturity of debt and for choosing the optimal risk strategy. He finds, for realistic parameters, that agency costs of debt related to asset substitution are far less than the tax advantages of debt.

It can be very costly for owners to monitor a firm's risk management activities. Managers need to be given the right incentives for choosing the risk management policy preferred by the owner. Tufano (1996) studies the hedging behavior of 48 publicly traded North American gold mining companies. He finds that the only important systematic determinants of the 48 corporate hedging decisions are managerial ownership of shares and the nature of the managerial compensation contract. His evidence seems to suggest that hedging can alleviate an agency problem by reducing the noise in managerial compensation. It is consistent with the theory above in a certain sense. But no work has shown us how to design a managerial compensation package to make the managers use hedging to increase the firm value.

The argument that hedging can increase a firm's value is supported by some empirical findings. Nance, Smith and Smithson (1993) provide evidence that hedging increases a firm's value by reducing expected taxes, expected costs of financial distress or other agency costs.

In this chapter, we try to answer a different question. Why do not firms hedge? Though hedging costs play an important role in the answer, we argue that when there is asymmetric information between a manager and outside investors, some firms will want to hedge less or not hedge at all in order to give a signal to the market about their quality, even if hedging cost is not a concern. The revelation of signals depends on accounting

requirements. We consider two cases: i) the accounting requirements allow investors to verify the hedge ratio, and ii) investors can only verify whether or not the firm is hedging at all. We find that in the first case it is possible to have a separating equilibrium in which some firms hedge less than is necessary to eliminate all financial distress costs. In the second situation, we observe two pooling equilibria of hedging firms and non-hedging firms separated by two signals. Our results show that fewer firms will hedge as long as the variability of firm quality is high. The result obtains even for firms facing highly uncertain future cash flows. We suggest that the proportion of hedging firms is negatively related to the degree of information asymmetry. The implications from our model are consistent with some available empirical results. We also suggest more tests for future empirical study. We analyze the welfare of the whole economy in two scenarios and discuss policy implications.

In both scenarios, the cost of signaling is that good type firms are exposed to higher expected bankruptcy cost. In Ross (1977), higher leverage firms are perceived as higher value firms. In his incentive-signaling model, high debt level increases the risk that a manager receives a penalty in his compensation. However, given his compensation contingent on the firm's value, a manager signals information to the market by setting debt levels. In Ross's (1977) incentive-signaling equilibrium, expected bankruptcy cost can be thought as the signaling cost though it is actually reflected in the penalty in managers' compensations. In our model, the debt level is fixed. Risk management policies alter expected bankruptcy costs. The equilibrium in Ross (1977) no longer holds if corporate hedging decisions can also signal information of a firm's value to the market. Leverage is no longer enough to sustain the signaling equilibrium. Both leverage and risk management

policy can affect expected bankruptcy costs. Our model shows that in the presence of bankruptcy costs risk management can have the same effect as the choice of capital structure. However, the implications of our model do not rely on bankruptcy costs. The model can be extended to account for other value-increasing effects of hedging such as reduction of tax.

This paper suggests signaling can be a motive for firms not to hedge. This is realistic. The cost of changing capital structures can be very high, and adjustment to the target debt level is slow. As discussed above, risk management can provide the same signaling effect as is provided by capital structure in Ross (1977), but in a shorter time period. When the debt level is difficult to adjust because of the constraints such as debt covenants, firms may change their risk management strategies to give signals to the market. In this sense, risk management strategies are easier to implement. The existing literature has difficulty explaining why fewer small firms than larger firms choose to hedge, though small firms have more volatile cash flows. Fewer financial analysts follow small firms. Less information on small firms is available to the market. Asymmetric information can play an important role here. By telling the market: "The firm is doing so well that we do not need to hedge", firms reveal more information to the market. A motive like that is stronger for small firms. However, there have been no empirical studies that test whether firms use risk management strategies as signals. As a consequence of our modeling, we are also to suggest direction for empirical study into this issue.

We explain our model in Section 2.2. First, we design a simple example to illustrate the basic idea. After setting up the basic structure of our model, we derive some results where the hedge ratio is unverifiable and verifiable respectively. We discuss the impact of

hedging cost on this model and do the welfare analysis in Section 2.3. In section 2.4, we discuss some empirical implications. We conclude and discuss the future research in Section 2.5.

2.2 Model

2.2.1 An example

If the market is complete, in M-M's model sense, risk management cannot alter a firm's value because investors can diversify the risk themselves. However, as reviewed in Section 2.1, previous research finds that corporate risk management can increase firm value if financial distress or bankruptcy cost is considered. This is because risk management reduces the variance of future cash flow, which in turn may reduce the probability of bankruptcy or financial distress. The effects of risk management on tax shields and agency costs have also been examined. One conclusion common to these previous studies is that risk management can increase firm value. But empirical results show that though the trading in some derivatives markets is mainly for corporate purposes, the proportion of firms using risk management is not as high as expected. The proportion of firms that hedge is even lower for small firms, which is unexpected given that small firms usually have higher variances of cash flows. Different hedging costs might be one reason for this finding. Here, we explore the possibility that if risk management decisions can convey more information to the market when there exists asymmetric information between outside investors and firm managers, firms will choose no hedging or partial hedging as a signal to tell the market that they have better quality.

We use a simple one period model to illustrate the basic idea. Assume a risk-neutral world with a risk-free rate of zero. There are two firms: A and B, and one project is available for them that begins at $t = 0$ and ends at $t = 1$. Firms A and B both have identical initial value V at $t = 0$ and they have to pay off debt or a pre-determined cash payment, L, at $t = 1$. If the firms do not have enough cash for the payment, they declare bankruptcy and incur a cost: b. So if a firm does not take the project, it will face bankruptcy at the end of the period. To exclude this situation, we set the project to have a positive NPV. Thus both firms will be willing to take the project. Also, we assume there are only two states at $t = 1$ for this project, $s = 0$ and $s = 1$. In the state 0, the output will be 0; in the state 1, the firms will have a positive cash flow of X. Further, we assume the probability that firm A is in state 1 is $p + \Delta$ ($\Delta > 0$), and the probability that firm B is in state 1 is only p. Here, firm A is considered to be the good type since it has a better chance to reach the good state 1.

In order to focus on the effect of hedging, we assume non-project firm cash flow is 0, which will avoid the discussion of underinvestment problems. As in Stulz (1984), we define hedging as eliminating all the uncertainty in cash flow and also assume hedging costs are zero. So the payoff at $t = 1$ will be $(p + \Delta)X$ and pX respectively if two firms choose to hedge. Further we assume that hedging can reduce the bankruptcy cost to zero, which means $pX > L$. Thus it should be optimal for two firms to hedge their future cash flow. However, this conclusion is based on the assumption that the market has complete information on future cash flows for two firms. The manager might behave differently in the presence of information asymmetry. Suppose only the manager knows the state probability

for his firm and his purpose is to maximize the *Social welfare function* (Miller and Rock (1985)), he might behave differently. The social welfare function is:

$$WV = kV_M + (1-k)E[V] \tag{2.1}$$

where V_M is the firm's market value, which might be different from the intrinsic value $E[V]$ if the market cannot distinguish the firms' qualities. k can be thought as the weight on the firm's market value and is between 0 and 1. The social welfare function represents a balance between the interests of two groups of shareholders: those who wish to sell their shares in the market and those who wish to hold their shares for a longer time. The weight attached to present market value reflects the interests of the first group, while the weight attached to intrinsic value reflects the interests of the second group.

Let us suppose the investors in the market cannot distinguish A from B if no signal is given, but know all the other information. To focus on the risk management policy, we assume the firms can only use hedging or non-hedging as a signal. Or we can think of the case as if the firm has made other financial decisions such as capital structure and it is up to the decision of its risk management policy. It is easy to conclude that if firm A has decided to hedge and firm B knows that, firm B will always hedge. (Here firm A is the good firm.) It is always optimal for firm B to mimic firm A's risk management policy if it only considers the market value. But if its mimicking behavior brings some extra cost to its intrinsic value, firm B will have to balance the trade-off between the market value and the intrinsic value. We are interested whether there is a separating equilibrium. If there is, it must be the case that A has no hedging activity and B has.

Proposition 1 *If a separating equilibrium exists with signals of hedging or non-hedging, firms with lower expected bankruptcy costs (good firms) do not hedge.*

In this setting, firm A and B are distinguished by their risk management polices. The firm that hedges is considered to be the bad type firm B, otherwise it will be considered as the good type firm A. In the separating equilibrium, the market gets the correct signal of firms' quality and gives it the corresponding market value. It must be the case that the market value is equal to the expected intrinsic value. In order to satisfy the conditions for the existence of a separating equilibrium, we establish conditions that ensure that neither type has the incentive to mimic the other. For the good type firm A, the condition is:

$$\begin{aligned} WV_A|_{no\ hedge} &\geq kV_M|_{hedge} + (1-k)E[V_A]|_{hedge} \\ &\Longrightarrow (p+\Delta)X - (1-p-\Delta)b \geq kpX + (1-k)(p+\Delta)X \end{aligned} \tag{2.2}$$

The left hand side is the social welfare function if firm A doesn't hedge. Giving the signal of no hedging, firm A's market value is equal to its intrinsic value since a correct signal is given. The right hand is the function value if firm A hedges. The first term on the right hand side is the market value. The second part is the intrinsic value because the market thinks of firm A as a bad type if firm A hedges. Though its intrinsic value is increased under the hedging policy, as long as the increment cannot compensate the decrease in the market value, the good type firm has no incentive to give a wrong signal. The condition for firm B not to mimic A's behavior is:

$$WV_B|_{hedge} \geq kV_M|_{no\ hedge} + (1-k)E[V_B]|_{no\ hedge}$$

$$pX \geq k[(p+\Delta)X - (1-p-\Delta)b] + (1-k)[pX - (1-p)b] \tag{2.3}$$

Examining the right hand side, we observe that the bad type firm increases its market value by giving a signal of no hedging, but decreases its intrinsic value. As long as the overall effect of giving a wrong signal is negative, the bad type firm will always choose to hedge. From (2.2) and (2.3), we can see a separating equilibrium exists under the conditions:

$$\frac{k\Delta}{1-p-k\Delta}X = \underline{b} < b < \overline{b} = \frac{k\Delta}{1-p-\Delta}X \tag{2.4}$$

In the separating equilibrium, the market value of the bad type firm B is pX, which is equal to the intrinsic value since hedging strategy is adopted. The market value of the good type firm A is $(p+\Delta)X - (1-p-\Delta)b$, since given the signal the market believes a firm without hedging is the good type firm.

When the bankruptcy cost: $b \in [0,\ \underline{b}]$, there may be many equilibria. In the range of $[\overline{b},\ \infty)$, there is a pooling equilibrium in which both firms choose to hedge. The range of bankruptcy costs for the existence of separating equilibrium is:

$$\overline{b} - \underline{b} = \frac{k(1-k)\Delta^2}{(1-p-\Delta)(1-p-k\Delta)}X \tag{2.5}$$

Under some parameters, there exists the possibility that the exogenous bankruptcy cost might drop into this range. This is not a Pareto-optimal equilibrium. The good firm has to give up the benefit from hedging and use it as the signaling cost. Here, non-hedging becomes a signal by the good type firm. The non-hedging decision conveys the true quality of the firm to the market but at the same time increases the expected bankruptcy cost. The

good firm decides the trade-off between cost and benefit. When the bankruptcy cost is so small that increasing this expected cost by not hedging cannot prevent the bad firm from mimicking the good one or the increased value from hedging is insignificant, there would not be equilibrium. Another extreme case would occur if the bankruptcy cost is so high that it overwhelms the signaling effect.

The implication from (2.5) is consistent with our intuition. We find that the better the good firm is (larger Δ), the wider is the range, which leads naturally to a higher probability that the separating equilibrium may occur. We can consider p and X as the characteristics of the project. The higher they are, the wider the range is. In this example, increasing p or X is equivalent to increasing the variance of project cash flows. A more volatile project leaves more space for signaling. This implication is consistent with the survey result that fewer small firms choose to hedge than large firms, since small firms usually have more volatile cash flows. Bankruptcy cost is exogenous in this example. It includes indirect and direct costs, the sum of which is often estimated as a ratio of the firm value. So let $b = \alpha V$ (this is not restrictive since we use the initial value as the firm value here). Then the range of α is negatively related with firm value. This is also consistent with the phenomena that fewer small firms hedge than large firms, because the range of the ratio is wider.

It is necessary to discuss two extreme cases: $k = 0$ and $k = 1$. In both cases, the range of b is zero. However, when $k = 0$, firm managers focus only on the intrinsic value. In this case, all firms will hedge to eliminate the possibility of bankruptcy. There is a pooling equilibrium. When $k = 1$, no separating equilibrium exists, since firm B can mimic firm A

without cost, thereby increases its market value.

The assumption that the manager is attempting to maximize the social welfare function is essential to the conclusion. There are many arguments about this assumption. However, there are at least two reasons: 1). Firms are often issuing new shares. If the market value is lower than the true value, it is always disadvantageous for the current shareholders. 2). There is no reason to expect that the current shareholders are going to hold their shares indefinitely. In fact, it is easy to extend the example above to a case where a firm has to raise funds for the project by issuing new shares and the managers behave as maximizing the current shareholders' value.

2.2.2 The structure of the model

We include the signaling effects of risk management in a more generalized model. An important consideration is whether risk management policy is a feasible signal to the market. In other words, to what extent is it observable to investors. Thus the accounting code for corporate risk management plays an important role. The revelation of hedging positions is always reflected in footnotes of accounting reports, which is required by the FASB (Financial Accounting Standards Board). Though the accounting standards are revised gradually and more strict accounting treatments are being imposed upon corporate hedging reports, it is still arguable as to whether a firm's risk exposures are fully revealed to the market. Two situations are considered here: the first is that firms can only reveal if they hedge or not, but they cannot reveal the extent of the hedging. The other is the extreme case in which detailed hedging information such as the hedging ratio is conveyed

to the market. The first case can also be thought as a situation in which audit costs are so high that investors will not consider it worth while to determine detailed risk management policies.

The model is set in a one period context and in a risk neutral world. At time 0, each firm is offered a project, and, eventually, each firm will take the project. To maximize the social welfare of their individual firms, managers decide what risk management policy they are going to use for this project and report it to the market. Since the market only accepts hedging or no hedging as a meaningful signal, the managers only need to tell the market whether they hedge ($H = 1$) or not ($H = 0$). At time 1, the payoff from the project is realized.

Without loss of generality, we assume the offered projects are the only cash flow sources for the firms in this period. For firm i, the project has a random payoff at $t = 1$:

$$\widetilde{P}_i = R_i + \widetilde{z} \tag{2.6}$$

where R_i is a constant, and $\widetilde{z}$ is a random variable. Representing the risk that firms would like to hedge, $\widetilde{z}$ can be hedged at zero cost in the financial market. The probability density function of $\widetilde{z}$ is $f(\widetilde{z})$, and:

$$E[\widetilde{z}] = 0$$

$$0 \leq Var(\widetilde{z}) < \infty \tag{2.7}$$

Properties of $\widetilde{z}$ are known to the market. A firm's type is characterized by R_i which is only known to the manager when the project is taken. Higher R_i corresponds to a better quality firm. Managers know the distribution of their own firms' future cash flow. Outsiders know the mean of the distribution of the R_i but not individual firm's R_i.

Firms go bankrupt if

$$\widetilde{P}_i = R_i + \widetilde{z} < L. \tag{2.8}$$

L is either a pre-determined cash payment or debt payment. We can think of L as a cash flow that firms must reach to avoid going bankrupt. However, it would be interesting to endogenize L with a capital structure problem and discuss the relationship between hedging and other financial policies. We will discuss this later. Here, L is exogenous. Also, we assume

$$\Pr(\widetilde{P}_i < L) > 0. \tag{2.9}$$

for all i, which means all the firms face bankruptcy risk. This assumption is purely for convenience, and allows us to focus on the trade-off between the bankruptcy cost and the signaling effect.

If a firm goes bankrupt, the firm incurs bankruptcy costs. The bankruptcy cost, b, is the same for all the firms. In order to make sure the project is taken by all the firms, we further assume that

$$E[\widetilde{P}_i - b\Pr(\widetilde{P}_i < L)] > 0, \tag{2.10}$$

which is equivalent to

$$R_i - b\Pr(\widetilde{P}_i < L) > 0 \tag{2.11}$$

for all firms. The condition above ensures that all projects have positive NPV.

When the project is taken, managers have a better knowledge of the distribution of future cash flow, which is reflected by that they know exactly what R_i would be. Managers choose risk management policy, h, to maximize a social welfare function. The manager's problem is:

$$\max_h (WV = kV_M + (1-k)E[V]).$$

Here, V_M is the firm's market value, and $E[V]$ is the intrinsic value. We suppose all the managers place the same weight, k, on the market value.

The manager can alter the variance of future cash flow by hedging some risk. Defining h_i as a hedge ratio for firm i, then the payoff of the project is:

$$\widetilde{P}_i = R_i + (1-h_i)\widetilde{z} \tag{2.12}$$

where $0 \leq h_i \leq 1$. A positive hedge ratio reduces the variance of the cash flow. Reduction of the variance increases a firm's intrinsic value because it reduces expected bankruptcy cost. But a trade-off arises if the hedge ratio is considered as a signal of a firm's quality. A firm's market value is decided by the signal received by the market. As we have discussed in the example above, the manager has to decide the trade-off between market value and intrinsic value.

2.2.3 Scenario 1

The level of credibility that the market attaches to disclosed hedging information must be modelled. Here, we consider two extreme cases. In the first case the hedge ratio is

unverifiable but whether a firm hedges or not can be verified. This is a reasonable scenario. It is fairly easy to find out if a firm adopts a risk management policy, but the cost of verifying the exact hedge ratio is often prohibitive. Non-financial firms do not report their risk management instruments on their balance sheets. The existing evidence on corporate derivatives activity typically takes the form of categorical data — whether firms hold any derivatives or not. In the second case a hedge ratio is verifiable. This scenario would be reasonable if strict and credible accounting codes are in place. Then financial institutions would have to file more detailed reports on derivatives holdings to their supervisory agencies.

When the hedge ratio is unverifiable, the market will take the signal as:

$$H = 0, \ if \ h_i = 0;$$

$$H = 1, \ if \ 0 < h_i \leq 1. \tag{2.13}$$

Outside investors only know whether a firm hedges or not. Since there are two signals in the market and outsiders can only take their valuation upon the two signals, the market value of firms can be categorized into two groups:

$$V_{M,\,H=1} \quad and \quad V_{M,\,H=0}.$$

A firm's intrinsic value is still only known to the manager after he decides a hedge ratio, which is:

$$E[V] = R_i - b\Pr(R_i + (1 - h_i)\widetilde{z} < L). \tag{2.14}$$

Without loss of generality we normalize the initial value of the firm to be zero, and the risk-free rate to be zero.

First, we obtain:

Proposition 2 *If hedge ratios are unverifiable, firms that hedge always keep their bankruptcy risk exposure fully hedged.*

This proposition is straightforward. If a firm hedges, then $H = 1$. Changing the hedge ratio has no effect on its market value. The manager only maximizes intrinsic value, and the intrinsic value is highest when the manager uses a hedging strategy that eliminates bankruptcy costs completely. Thus, if outside investors know a firm hedges, they know the firm must have hedged away all bankruptcy risk.

Given Proposition 2, if there is a separating equilibrium, a firm signals that it is hedging will fully hedge its bankruptcy risk. The market will understand that hedging firms hedge away any possibility of future bankruptcy. However, the equilibrium is only a semi-separating equilibrium. There are only two signals to the market, which results in only two market values.

Next, we discuss the conditions for the existence of such a signaling equilibrium. Suppose the firms with different qualities are uniformly distributed between $\overline{R}$ and $\underline{R}$, where $\overline{R} > \underline{R}$. The constant component in the payoff of the project corresponds to firm quality. Also assume that $\widetilde{z}$ has a continuous, differentiable distribution. Then we have:

Proposition 3 *If and only if a firm of type R^* is indifferent to hedging or not, there exists a semi-separating equilibrium such that firms with $R_i > R^*$ choose no hedging; firms with $R_i < R^*$ choose to hedge.*

Proof: Let

$$\begin{aligned}\Delta WV &= WV|_{H=0} - WV|_{H-1} \\ &= k(V_{M,H=0} - V_{M,H=1}) + (1-k)(E[V]_{H=0} - E[V]_{H=1}) \\ &= k(V_{M,H=0} - V_{M,H=1}) - (1-k)\cdot b \cdot \Pr(R + \tilde{z} < L)\end{aligned}$$

We have:

$\frac{d(\Delta WV)}{dR} = (1-k)\cdot b \cdot f(L-R) > 0$

Since $\Delta WV|_{R=R^*} = 0$, we prove it is sufficient. It is straightforward to show that the necessary condition holds. In the proof of proposition 3, we find

$$\frac{d(\Delta WV)^2}{d^2R} < 0.$$

The cost associated with signaling is negatively related to the firm type, which is consistent with the Spence condition.

In this signaling equilibrium, signals only convey limited information to the market. Good firms can only tell the market at least how good it is, but cannot give the exact information of its quality to the market. In this semi-separating equilibrium, firms of different qualities are still pooled with the same market value. Accepting that outsiders are rational, the market value should be the average intrinsic value of the group with the same signal. We have:

$$V_{M,H} = E\{E[V]|_H\}, \tag{2.15}$$

which is a function of R^*. Substitute (2.15) into:

$$kV_{M,H=0}(R^*) + (1-k)E[V(R^*)]_{H=0} = kV_{M,H=1}(R^*) + (1-k)E[V(R^*)]_{H=1}. \quad (2.16)$$

By solving (2.16) to obtain the solution R^*, we establish the semi-separating equilibrium. The existence of a feasible solution depends on the parameters of the economy. We will use an example to show the relationship.

In the example, we set $\widetilde{z}$ uniformly distributed between $[-a, a]$. We have:

$$R^* = \frac{L + a - \frac{a}{b}k(\overline{R} - \underline{R}) - \frac{1}{2}k\overline{R}}{1 - \frac{k}{2}}. \quad (2.17)$$

For there to be a quasi-separating equilibrium, we must have:

$$\underline{R} < R^* < \overline{R}. \quad (2.18)$$

We show the social welfare function on Figure 2.1, assuming that (2.18) is satisfied, .

Firms with quality above R^* do not hedge. The line C-D shows the welfare function value of firms that do not hedge, while the line A-E shows the value of hedging firms. Notice that the solid part B-C is above the dotted line B-E, which shows that in this range firms have no incentive to choose hedging. The opposite result is obtained from line A-B and line D-B. The function is quasi-convex.

We are most interested in the proportion of firms that report hedging in this economy, since many empirical surveys provide evidence that fewer small firms use risk

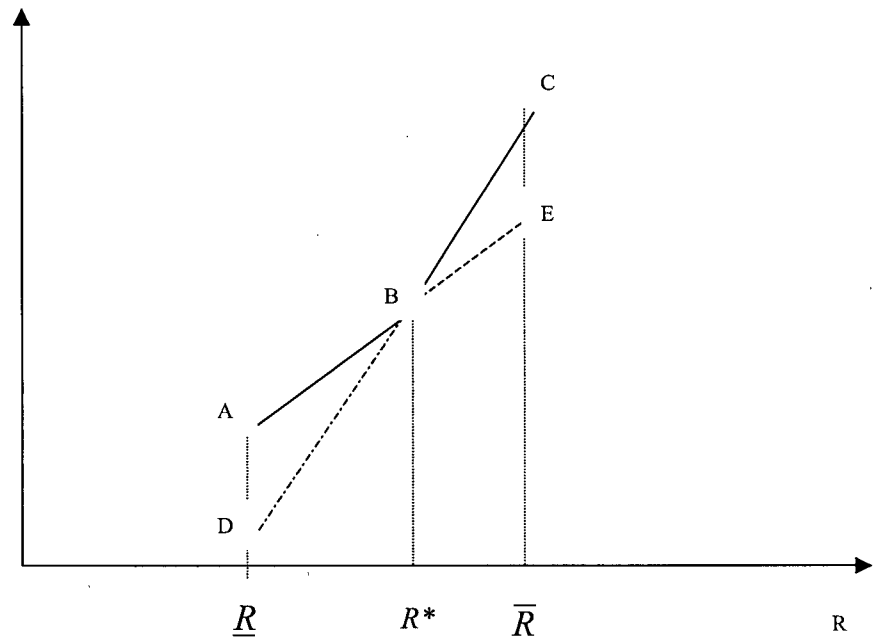

Figure 2.1: Illustration: social welfare function in scenario 1

management than predicted by existing models. The proportion of hedging firms in this economy is given as:

$$p = \frac{R^* - \underline{R}}{\overline{R} - \underline{R}} = \frac{L + a - \underline{R}}{(1 - k/2)S} - (\frac{1}{2} + \frac{a}{b})\frac{k}{1 - k/2} \tag{2.19}$$

where $S = \overline{R} - \underline{R}$.

Based on a comparative static analysis, this result has several implications:

a). The number of firms that hedge increases with L or b. These two factors are associated with bankruptcy risk. A high level of pre-determined cash payment exposes firms to a high probability of bankruptcy, and a high bankruptcy cost increases a firm's signaling cost. If there is no asymmetric information between managers and outside investors, all firms will hedge the bankruptcy risk, and so changes to bankruptcy costs cannot alter a firm's decision. But when firms have to consider the trade-off between the signaling effect and the effect on intrinsic value, a change in bankruptcy cost alters the equilibrium. We also have $\frac{\partial^2 p}{\partial b^2} < 0$. The change of the proportion is negatively related to the change of the bankruptcy cost. Higher than expected bankruptcy costs cause more firms to hedge, but the signaling effect is still there.

b). As $S = \overline{R} - \underline{R}$ increases, p decreases. Fewer firms hedge in an economy in which the quality variance is large. In other words, when there are more good quality firms, fewer firms hedge. It is the result of the signaling effect dominating the risk-reduction effect.

c). When managers put larger weight on the market value in making their hedging decisions, the proportion of hedging firms decreases. We have $\frac{\partial p}{\partial k} < 0$ and $\frac{\partial^2 p}{\partial k^2} < 0$. When

firms need to raise external funds, managers are more concerned with market value and so fewer will hedge. This result differs from the result found in Froot, et al (1991) in which they suppose hedging decreases funding costs by relying more on internal funds, but there is no effect on external funding. Our results imply that hedging might increase external funding costs. The equilibrium is a result of a trade-off between a firm's intrinsic value and possible future funding costs. One empirical implication would be that firms that are more likely to raise external funds in the near future would be less likely to hedge.

d). The effect of project variance is ambiguous. The parameter a acts as a proxy for project variance. We obtain:

$$\frac{\partial p}{\partial a} = (\frac{1}{S} - \frac{k}{b}) \cdot \frac{1}{1 - k/2}.$$

When the variability of firm quality is high, $\frac{\partial p}{\partial a} < 0$, which implies that riskier projects result in fewer hedging firms. This contradicts previous literature, but is consistent with empirical evidence that fewer small firms hedge than larger firms. Small firms are usually not so well followed by analysts in the market. Less information about their quality is available, which results in the perception of a small firm's greater quality divergence. According to our result, though small firms always have higher volatility of cash flow, only a small proportion will hedge. If the quality divergence is insignificant, the benefit from signaling does not exceed the cost of decreasing intrinsic value, especially when the bankruptcy risk is higher with a riskier project.

2.2.4 Scenario 2

In the section above, we assume that the information to the market can only differentiate between hedging or non-hedging firms. The equilibrium does not perfectly reveal a firm's type. However, if the manager can credibly provide a more detailed signal, he can reveal more information about type to the market. Based on the information equilibrium by Riley (1975), we explore the possibility of a separating equilibrium when hedge ratios are verifiable by the outsiders.

As before, h is a continuous variable. However, outside investors now receive a signal that reveals exactly how much a firm is going to hedge. Investors can then make their judgments about a firm's quality that determine the firm's market value. Let $R_M(h)$ be the perceived quality of firm i given the hedge ratio h. We assume $R_M(h)$ is differentiable in h between a reasonable range. If the signal is fully revealing, we have

$$R_M(h) = R_i. \tag{2.20}$$

which is equivalent to saying that the market value is equal to the intrinsic value. Here, we do not know the exact function form of $R_M(h)$ yet, so we write the market value and the intrinsic value as

$$V_M = V_M(R_M(h), h);$$

$$E[V] = E[V(R_i, h)].$$

Suppose V_M is infinitely differentiable in R_M, and $E[V]$ is infinitely differentiable in h. We have the objective function:

$$\max_h (WV = kV_M(R_M(h), h) + (1-k)E[V(R_i, h)]).$$

We solve the problem in a similar way to Heinkel (1982). The first order condition is:

$$k(\frac{\partial V_M}{\partial h} + \frac{\partial V_M}{\partial R_M} \cdot \frac{\partial R_M}{\partial h}) + (1-k)\frac{dE[V]}{dh} = 0. \tag{2.21}$$

Suppose the second order condition is satisfied.

$$\frac{\partial^2 WV}{\partial h^2} < 0 \tag{2.22}$$

If a boundary condition is given, we can solve the first order condition as a differential equation to get the function of $R_M(h)$.

We use the same setting as in the example of scenario 1, except that the manager can credibly reveal his hedge ratio, h. This assumption is closely related to the accounting requirement for risk management disclosure. Stricter accounting requirements in accounting make this kind of signal more feasible. We leave the discussion of this for later. In the example, we assume that the manager of firm i can use risk management to obtain a uniform distribution $[R_i-(1-h_i)a, R_i+(1-h_i)a]$ of project cash flow. A distinct difference between the two scenarios is the concept of full hedging. If the hedge ratio is unverifiable, the market can assume firms choose a hedge ratio of 1 as long as firms choose to hedge. The market values of all hedging firms are the same. But in this setting, firms choose h_i such that $R_i - (1-h_i)a \geq L$. We assume that this constraint is binding. Hence firms choose h_i to eliminate bankruptcy risk, but do not hedge any further.

In this setting, the firm's intrinsic value is

$$E[V] = R - \frac{L + (1-h)a - R}{2(1-h)a}b \tag{2.23}$$

Suppose the second order condition is satisfied. Substituting equation (2.20) into the first order condition, equation (2.21), and using equation (2.23), yields

$$\frac{\partial V_M}{\partial R_M} \cdot \frac{dR_M}{dh} = -\frac{dE[V]}{dh} \tag{2.24}$$

or

$$k\frac{dR_M}{dh}[2(1-h)a+b](1-h) = (R-L)b. \tag{2.25}$$

The ordinary differential Equation (2.25) has the solution

$$k\ln(R_M - L) = -\ln\frac{2a(1-h)}{2a(1-h)+b} + C_0. \tag{2.26}$$

C_0 is a constant that is dependent on a boundary condition. The worst firm $\underline{R}$ wants to eliminate bankruptcy, so we have the boundary condition

$$R_M(1 - \frac{\underline{R}-L}{a}) = \underline{R}.$$

Solving for C_0 yields

$$R_M = L + (\underline{R}-L)[\frac{a(1-h)(2\underline{R}-2L+b)}{(2a(1-h)+b)(\underline{R}-L)}]^{\frac{1}{k}}. \tag{2.27}$$

Inverting (2.27) and using equation (2.20), we have the function $h(R)$.

$$h(R) = 1 - \frac{(R-L)^k(\underline{R}-L)^{1-k}}{(\underline{R}-L)^{1-k}[(\underline{R}-L)^k - (R-L)^k] + b/2} \cdot \frac{b}{2a}. \tag{2.28}$$

The relation between quality and hedge ratio is nonlinear. When a firm's quality is high enough, we might even have a negative hedge ratio. In this situation, managers are willing to expose their firms to additional bankruptcy risk to signal their quality. This

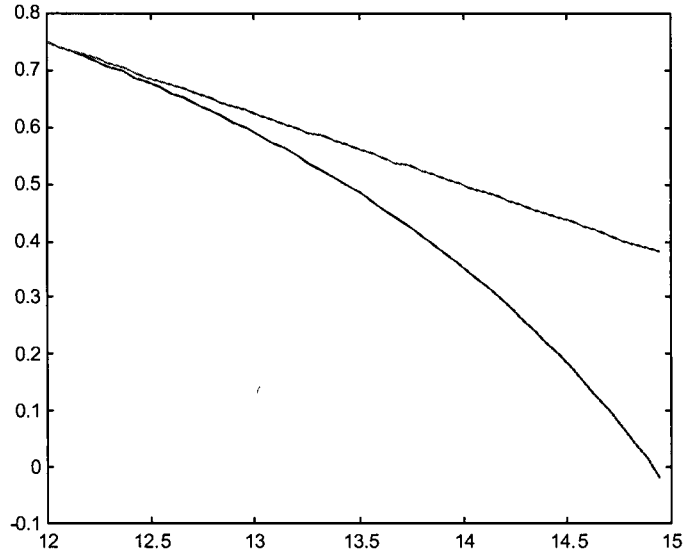

Figure 2.2: The relation between the hedge ratio and a firm's quality in a separating equilibrium when hedge ratio is completely verifiable.

phenomenon is reported in some empirical studies. Here, we provide a possible explanation for a manager's decision to increase rather than reduce risk exposure.

Given the second order condition, (2.22), a signaling equilibrium will not exist for all parameter combinations. In Figure 2.2, we plot the hedge ratio as a function of firm quality for some feasible parameters[1].

The straight line is a plot of the minimum hedge ratio required for firms of different qualities to fully eliminate bankruptcy risk. The equilibrium curve will always lie under the straight line. Otherwise the signaling mechanism breaks down because firms do not face any signaling cost. In the area under the straight line, firms do not eliminate all the expected bankruptcy cost by hedging. Instead they choose to retain some bankruptcy risk as the

[1]We choose parameters $\underline{R} = 12$, $a = 8$, $b = 5$, $L = 10$, and $k = 0.6$.

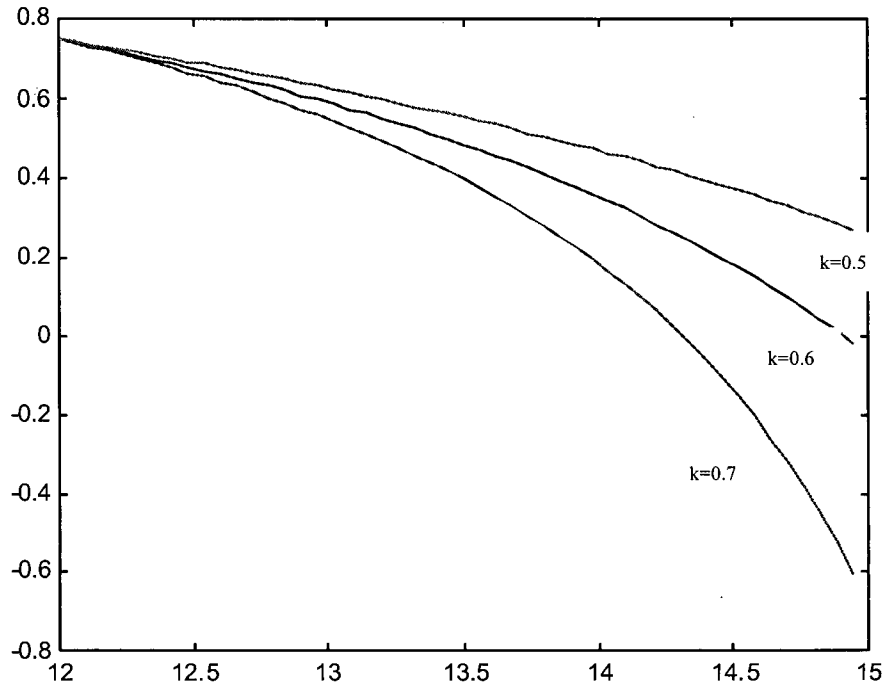

Figure 2.3: The effect of different weights in the social welfare function on the signaling function, $h(R)$. $\underline{R}$= 12, $a = 8, b = 5, L = 10$,and $k = 0.5, 0.6, 0.7$

cost for signaling in this equilibrium. The function is concave in the figure above, which shows good quality firms need more bankruptcy risk exposure in an increasing way. This is reasonable because good firms have a higher expected cash flow and can bear a higher cost for signaling. For some parameters, good firms might even have a negative hedge ratio. Managers choose to increase the uncertainty of the future cash flow. The idea is straightforward: "our firm is so good that we can handle higher risk". Unlike the case when hedge ratios are unverifiable, here quality and hedge ratio have a one-to-one relation. It is a fully separating equilibrium. The exact quality is conveyed to the market by hedge ratio. In some sense, each firm takes its own signaling cost.

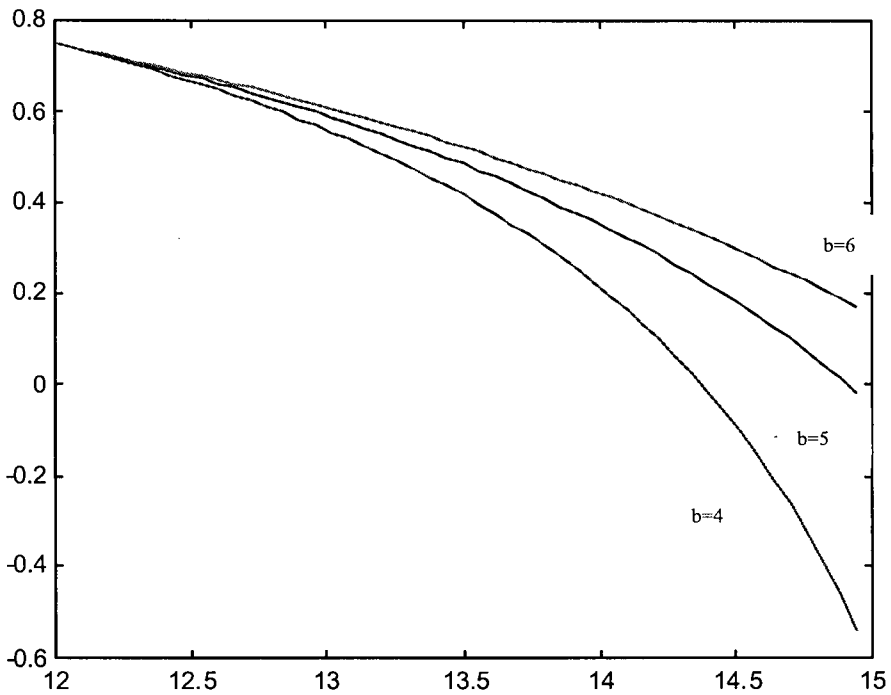

Figure 2.4: The effect of different bankruptcy costs on the signaling function, $h(R)$. $\underline{R}$= $12, a = 8, k = 0.6, L = 10$,and $b = 4, 5, 6$.

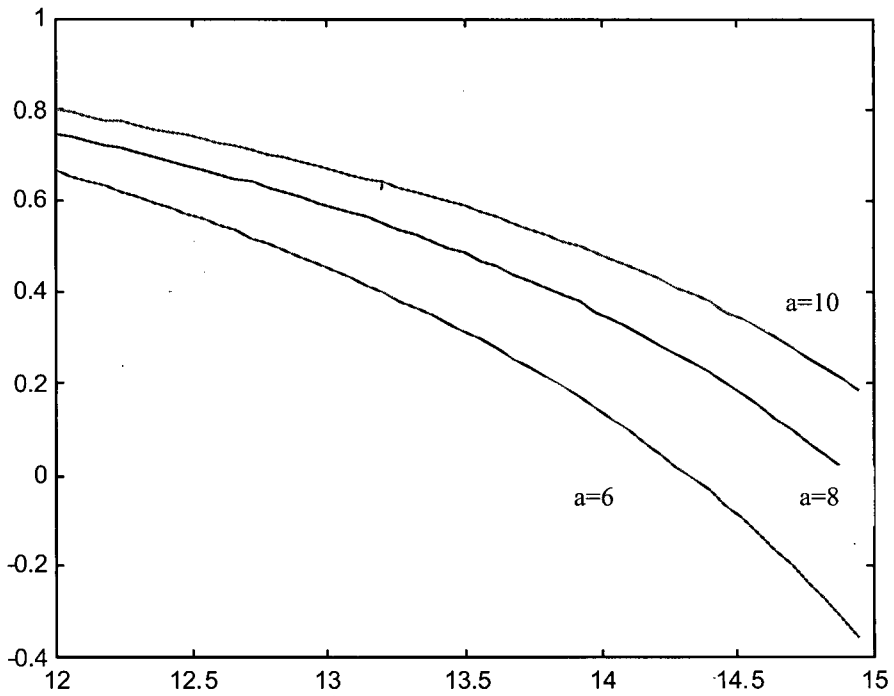

Figure 2.5: The effect of project variance on the signaling function, $h(R)$. $\underline{R}= 12, b = 5, k = 0.6, L = 10$,and $a = 6, 8, 10$.

In Figure 2.3 to Figure 2.5, we check the effect of different parameters on the signaling function, $h(R)$. The implications are consistent with those observed for scenario one. When the social welfare function has more weight on market value, firms choose to hedge less, though, in the signaling mechanism, market value is equal to intrinsic value. The signaling function is more concave for higher k. The hedging function is more concave with lower bankruptcy cost, since firms choose to hedge more when they are facing a high bankruptcy cost. From Figure 2.5, we observe that lower cash flow variance increases the concavity of the signaling function.

2.3 Discussion

We address two issues in the discussion section: hedging cost and welfare analysis.

2.3.1 Hedging cost

We have assumed that the hedging cost is zero. The assumption of no hedging cost implies that credit risk is not priced into financial instruments used for hedging. We can think of this as a competitive market in which the providers of hedging instruments face no bankruptcy risk at all. However, risk management packages are sometimes customized by large institutions in a non-competitive environment because only they have the access to firms that face bankruptcy costs. They then obtain monopoly profits by adding extra charges for providing customized instruments. When hedge ratios are unverifiable, these institutions cannot distinguish between different quality firms that hedge. Suppose they charge hedging firms a constant cost, c. A direct result that would be that fewer firms

would want to hedge because of higher hedging costs. The hedging provider is a monopolist whose objective function is

$$\max_{c}(\widehat{R} - \underline{R}) \cdot c. \tag{2.29}$$

Here $\widehat{R}$ represents the quality of the marginal firm that is indifferent between hedging or not hedging with hedging cost c. Notice that $\widehat{R}$ is also determined by c. The hedge provider knows the reaction function of firms and chooses c. Solving the above problem yields

$$\widehat{R}^* = \frac{R^* + \underline{R}}{2},$$

where $\widehat{R}^*$ is the quality of the firm that is indifferent to hedging when c^* is the optimal solution of (2.29), and R^* is the quality of the firm that is indifferent between hedging or non-hedging when there is no hedging cost. The proportion of firms that hedge is reduced to

$$p' = \frac{\widehat{R}^* - \underline{R}}{\overline{R} - \underline{R}} = \frac{1}{2}p.$$

Introducing exogenous costs discourages firms from hedging. However, the implications of the comparative static analysis do not change. The range of bad firms narrows; on the other hand, the pooling group of better firms becomes larger.

2.3.2 Welfare analysis

We have discussed the effect of asymmetric information in two economies. The two economies differ in their risk management reporting requirements. One has stricter reporting requirements than the other. Alternatively, the difference might reflect a difference in auditing costs between the economies, with auditing costs being prohibitive in one case

and negligible in the other case. Here, we analyze welfare in the two economies and discuss policy implications.

We define economic welfare as the intrinsic value created in the economy. We choose the benchmark to be the economy in which there is no asymmetric information. In this case (with no hedging costs) every firm will hedge away its bankruptcy risk. The total welfare of this economy is

$$\frac{\overline{R}^2 - \underline{R}^2}{2}. \tag{2.30}$$

In the economy of scenario one, better firms will not hedge. This decreases the welfare of the economy. Total economic welfare is

$$\frac{\overline{R}^2 - \underline{R}^2}{2} + \frac{b}{2a}(\overline{R} - R^*)(\frac{\overline{R} - L - a}{2} + \frac{R^* - L - a}{2}). \tag{2.31}$$

The second term is always negative. When the quality divergence in the economy is large, the economic welfare loss due to signaling is higher.

The welfare of the economy in scenario two is:

$$\frac{\overline{R}^2 - \underline{R}^2}{2} - \frac{b}{2a}\int_{\underline{R}}^{\overline{R}} \frac{L - R + (1-h)a}{(1-h)} dR, \tag{2.32}$$

where h is given as a function of R in equation (2.28).

Which scenario has higher welfare? Or, what risk management reporting requirement better encourages the long term value-increasing in an economy? The answer depends on the characteristics of the economies. We provide numerical simulations of different economies in Table 2.1.[2]

[2]Here we set the parameters of the economies as $\underline{R} = 12, a = 8$, $b = 5$, $L = 10$, and $k = 0.5$. The welfare in the table has been scaled by the welfare in the benchmark economy.

Table 2.1. Relative welfare analysis with quality variance

$\overline{R}$	$(\overline{R}-\underline{R})/\underline{R}$	Welfare of Scen. 1	Welfare of Scen. 2
15.25	27.1%	0.9884	0.9790
15.50	29.2%	0.9781	0.9764
15.75	31.3%	0.9689	0.9738
16.00	33.3%	0.9603	0.9711
16.25	35.4%	0.9526	0.9683
16.50	37.5%	0.9454	0.9655
16.75	39.6%	0.9388	0.9627

When quality variance is not large, the scenario with less strict reporting requirements has a higher total value than the scenario with stricter risk management reporting requirements. This reverses when the quality variance gets bigger. In the first scenario, there is a group of firms that fully hedge away their bankruptcy risks. In the second scenario, no firm uses full hedging strategies, but each firm hedges a fraction of the bankruptcy risk. As we discussed in the previous section, low quality variance causes more firms to fully hedge in the first scenario, which is why welfare in the first scenario is higher than in the second scenario when the quality variance is small.

Table 2.2 lists numerical results for different values of k.

Table 2.2. Relative welfare analysis with different k.

k	Welfare of Scen. 1	Welfare of Scen. 2
0.40	0.9816	0.9999
0.45	0.9721	0.9852
0.50	0.9603	0.9711
0.55	0.9460	0.9575
0.60	0.9286	0.9444

Consistent with our intuition, when managers are more concerned with market value, they are less likely to hedge (or to hedge less). Therefore, the welfare of the economy decreases in k. From the results in the table, we find that the welfare in Scenario 2 is always

higher than in Scenario 1. This result holds for almost all parameter combinations that we tried. Intuitively, a partial reduction in hedging bears a lower cost than no hedging at all. In an economy in which market value diverges from the true value, stricter risk management reporting requirements are preferred.

Our welfare analysis does not support the notion that stricter risk management reporting is always socially better than less strict reporting. The policy making of risk management reporting requirements should consider quality variance in the market. Stricter requirements are more suitable for markets in which the degree of information asymmetry regarding firm quality is significant.

2.4 Empirical Implications

We suggest an explanation for why firms do not hedge optimally when they face bankruptcy risk. We identify the trade-off between two effects of hedging. The first effect of hedging is an increase in intrinsic value due to reduced expected bankruptcy cost. The other effect arises because hedging acts as a signal of firm quality when there is information asymmetry between managers and outside investors. We examine the signaling equilibrium under different accounting requirements, since under the present accounting standards, investors cannot pinpoint the degree of hedging in formal statements. This model has some empirical implications, some of which have been observed in previous empirical studies. We suggest some new tests to verify whether risk management policy can reveal information to the market.

It is difficult to verify the motivations of managers who adopt risk management

policies. The essential prerequisite of our model is based on the belief that hedging can eliminate or decrease bankruptcy costs. So whether managers realize that or whether some risk management policies are designed for this purpose is the premier question. Altman (1984) measured bankruptcy costs and concluded that bankruptcy costs are not trivial. On average, bankruptcy costs range from 11% to 17% of a firm's value up to three years prior to bankruptcy. Up until now, empirical results have been mixed with firms hedging in response to expected financial distress costs. Graham and Rogers (2000) studied the derivative holdings of firms facing interest rate and/or currency risk. Their results indicate firms hedge in response to higher financial distress costs. The evidence in Haushalter (2000) shows that the extent of hedging is related to financial costs. Tufano (1996) examined the corporate risk management activity in the North American gold mining industry. He finds little support for bankruptcy cost models. Mian (1996) finds that the evidence is inconsistent with financial distress cost models.

In our model, we assume a manager's objective is a social welfare function. This is justifiable when managers have to balance the requirements of two groups of shareholders: one that is going to sell stocks in the near term, and one that intends to hold. Different weights are imposed on the market value and on the intrinsic value according to the welfare of the two groups respectively. The weights may vary because of the financial situations of firms. For example, when firms are going to issue new shares to raise funds, managers would prefer a high market value. The weight attached to market value will be higher before firms have seasoned issues. In this situation, our model predicts that firms would hedge less because they want to give a more accurate signal of their quality to lower their costs before

new equity issues. Froot, Scharfstein, and Stein (1993) studied the relationship between hedging and the cost of raising funds. However, they focused on internally generated funds and suggested that "firms will want to hedge less, the more closely correlated are their cash flows with future investment opportunities". This requires that the empirical test of our model be able to separate the effects of signaling and generating more internal funds. The risk management policy in Froot, etc. (1993) should be static since "future investment opportunities" describe all possible future funding requirements, but our model predicts a change in a firm's risk management decision when an investment opportunity is to be undertaken.

Asymmetric information is at the core of our model. This implies that the more severe the uncertainty of the information, the more effective signaling will be. When the range of firm quality is large, the model indicates that fewer firms will hedge. An implication is that small firms have a lower hedging proportion than large firms do. Usually small firms are not as closely or widely followed by analysts and less information is available to investors in the market. This phenomenon has been reported in many empirical papers. For example, Nance, Smith and Smithson (1993), Mian (1996), Geczy, Minto and Schrand (1997), and Graham and Rogers (2000) used accounting data; Culp and Miller (1995) conducted a survey of 1999 companies and got responses from 530 firms. One clear finding that emerged from that survey was that large companies make greater use of derivatives than smaller firms. This phenomenon has also been explained by the idea of economies of scale. But there is one further implication of our model that has not been tested before. This result can be used to separate the cost effect and the signaling effect. We find that a more volatile

project may lead to less hedging when the variability in firm quality is high.

On a cross-sectional basis, hedging activities are predicted to be greater at firms that are going to have a lower return. We predict that there is a negative relation between the hedge ratio and a firm's quality when hedge ratio is easy to verify. Even if the ratio is unverifiable, we may still have this negative relation on average. This is a direct testable implication that can be used to determine whether signaling is a consideration of companies when they make risk management decisions.

Also, in our model, there are always firms that hedge less than the optimal amount. This implies that incomplete hedging is common in the market. Studies have discovered this phenomenon in many markets. Empirical studies also show that many firms buy derivatives that expose them to additional risk. Hentschel and Kothari (1999) use data from financial statements of 425 large US corporations. They find that many firms manage their exposures with large derivative positions and some reduce risks with derivatives, while others increase risks. We predict this can happen when firms are of sufficiently high quality that they must increase risk to provide an accurate signal to the market. In future empirical tests, we would be interested to see if there exists a strong relation between firm quality and a negative hedge ratio.

2.5 Conclusion

Previous theories provide many explanations for why firms hedge. Our work examines the risk management problem from a different perspective. Much of the empirical

evidence indicates that firms do not always implement a risk management policy. We explore a possible explanation for this phenomenon based on the signaling effect of a risk management policy. In the presence of bankruptcy risk, firms choose whether or not to hedge to convince the market that they are of a certain type. Good firms choose not to hedge, thereby voluntarily incurring greater bankruptcy costs.

We discuss two cases, one in which a hedge ratio can be verified by the market, and one in which the market only knows whether or not a firm hedges. If the hedge ratio is unverifiable, we cannot have a complete separating equilibrium. But the choice of whether to hedge or not to hedge acts as a signal that divides firms into two groups distinguished by a quality. In the case that a hedge ratio is verifiable, we obtain a separating equilibrium with different type firms choosing different hedge ratios. In this latter case, the hedge ratio in the signaling equilibrium is always smaller than the necessary ratio to cover all bankruptcy risk.

Our model has some results that are consistent with empirical observations. We find that if projects have high cash flow variance then fewer firms might hedge. This contradicts implications of previous theories. We identify additional implications for future empirical tests. Since we focus solely on bankruptcy risk, some assumptions in the model are not general. But our model can be easily extended to deal with the effects of a convex tax code on risk management. We only consider linear financial instruments in hedging in this model, non-linear ones such as options can be easily included if we suppose firms use options to eliminate the asymmetrical risks.

An interesting extension of our model would be to assume that the level of financial

distress is endogenous. We fix the debt level in this model. By relaxing this assumption, our model could potentially be employed to study the relationship between capital structure and risk management policy.

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Chapter 3

Collars and Stock Offers in Mergers and Acquisitions

3.1 Introduction

Cases of mergers and acquisitions fill the newspaper headlines almost everyday. The record of the biggest deal is constantly being rewritten. The merger of Exxon and Mobil was big - $81.5 billion - when it was announced in 1998, only to be outdone by the merger of MCI WorldCom and Sprint - $116 billion - in 1999. In 2000, both of those deals were surpassed by the biggest deal so far: the merger of American Online and Time Warner, a union valued at $165 billion. The drama and economic impact always place mergers in the center of the market's attention. Mergers and acquisitions have become central public and corporate policy issues.

The reason one firm may choose to merge with another firm can be very specific.

Researchers have looked at the motives behind mergers and acquisitions from micro and macro perspectives. From the macro perspective, the focus is on aggregate merger activity. In the U.S., historically, there were five so-called merger waves, during which merger activities were clustered. The first wave occurred around the turn of the last century. Stigler (1950) describes it as being "mergers for monopoly" in contrast with the later "mergers for oligopoly" wave during the 1920s. The third wave is the conglomerate mergers of the late 1960s. Unlike those in the previous merger waves, a typical 1960s merger brought together two firms from completely different industries. There was a peak of merger activity in the mid 1980s followed by the most recent wave in the late 1990s. In Figure 3.1, we can see the volume and the aggregate value of transactions in mergers from 1979 to 2003[1]. On the macro level, antitrust laws and regulations are the major factors explaining merger activity. Macroeconomic factors may justify the aggregate merger activities, but can not explain the involvement of specific firms. From the micro perspective, previous studies have offered many theories of merger activities. One of them is the improvement of efficiency, which possibly results in positive synergies. A second major area of merger theories involves undervaluation that can be due to inefficient management or market mispricing. Information signaling, agency problems, and tax savings can also be the motives of mergers and acquisitions.

Regardless of particular motives, in merger proxy statements issued to the shareholders, detailed documents filed with SEC, or news in Reuters, the method of payment in a merger is always an important component of the merger deal. The method of payment

[1]Data Source: SDC Platinium

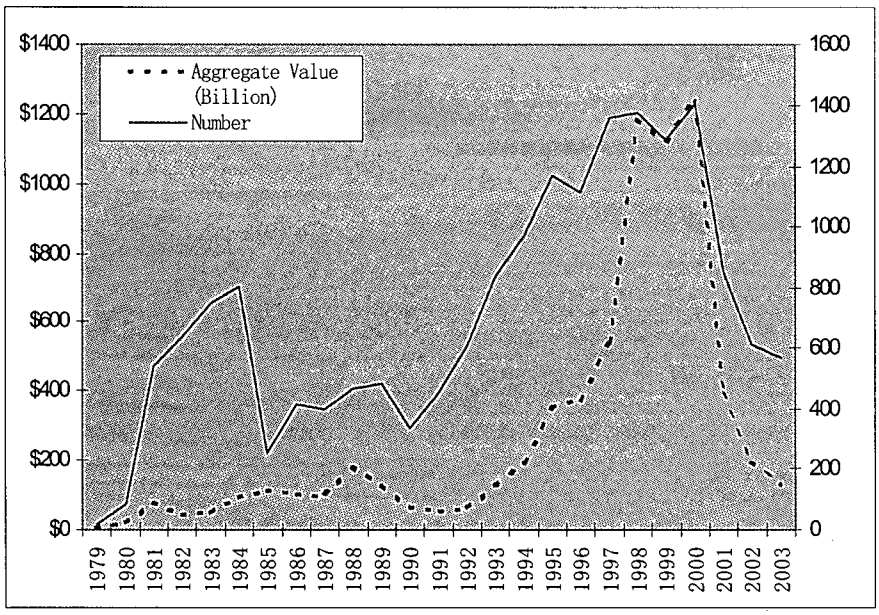

Figure 3.1: Historical Merger Activity

used in a merger may influence the returns to the stockholders of both bidder and target firms. Every merger is unique with respect to the timing, the value involved, the motive, the strategy, and the process. However, methods of payment used in mergers and acquisitions fall into two categories: cash and stock. Cash as a method of payment has the advantage of being simple and is easy to implement. However, the large values of some transactions sometimes constrain cash from being the sole method of payment. Firms may either lack free cash or have difficulty raising cash with low costs. Stock offers sometimes include a cash component, and other times do not. Besides more complicated accounting treatments with stock exchange, the form of a stock offer can be very complicated.

3.1.1 Stock Offers in Mergers and Acquisitions

Being more complicated than a cash offer, a stock offer can take different forms in merger agreements. The common forms are fixed ratio stock offers, fixed value stock offers, and collar offers. The most common form is the fixed ratio stock offer (FR stock offer), in which one firm offers a fixed number of its shares for each share of the other firm, say, 2.5:1.

Another form, the fixed value stock offer (FV stock offer), provides one firm with a fixed dollar amount of stock. The number of shares exchanged in the merger will depend on the two firms' stock prices per share just prior to the merger's closing. For example, a fixed value stock offer may state that the shareholders of firm A receive $50 worth of firm B's stock for each share of firm A exchanged in the merger. The exact number of shares to be exchanged is decided by dividing the $50 by firm B's average closing price for some trading days prior to the closing.

Sometimes fixed ratio stock offers or fixed value stock offers are contingent on a *collar* feature. The collar feature specifies the price range of one firm (usually firm B in a fixed value offer). If the firm's price is outside of this range before closing, the merger will be called off. Usually collar provision is not seen with either fixed ratio offers or fixed value offers alone. More complicated stock offers involve fixed value, fixed ratio and collar feature, and is a combination of them all.

The following scenario is a typical example. In June 1997, Allmerica Financial Corp. (AFC) entered into an acquisition agreement with Allmerica Property & Casualty Companies, Inc., a Delaware corporation (APY). I quote the following from the AFC's filing

with SEC on June 16, 1997.

> " If an APY stockholder elects to receive merger consideration in all stock, such holder will receive, for each share of APY Common Stock, .85714 (the "Stock Exchange Ratio") of a share of AFC Common Stock (the "Stock Consideration"); provided, however, that (1) in the event the Average Stock Price is less than $36, the Stock Exchange Ratio shall be equal to $32 divided by the Average Stock Price and (2) that in the event the Average Stock Price is greater than $41, the Stock Exchange Ratio shall be equal to $34 divided by the Average Stock Price."

In this case, the average stock price is the average of the closing market prices of AFC stock for the ten consecutive trading days ending on the fifth trading day prior to the effective time. In this stock exchange, when the average price of AFC stock is between $36 and $41, the stock exchange appears to be a fixed ratio stock offer with a ratio, 0.85714:1. When the average price falls outside this range, the offer is a fixed value offer. The two offers are combined by a collar. To avoid confusion, I will call this combination form of stock offer a collar stock offer or collar offer from this point forward.

In Figure 3.2, I plot the APY shareholder's payoff contingent on the average stock price of the AFC in this collar offer. When the AFC's average stock price is between $36 and $41, the offer is similar to a FR stock offer with an exchange ratio 0.85714:1. However, if the AFC' average stock price is lower than $36 or higher than $41, the offer turns out to be the same as a FV stock offer with a fixed value $32 or $34 respectively. The APY shareholders' return in this merger agreement is affected by the AFC's stock price. The uncertainty of the AFC's stock price prior to the merger completion causes the uncertainty of the payoff to the APY shareholders.

This collar offer can be viewed from the exchange ratio perspective in Figure 3.3.

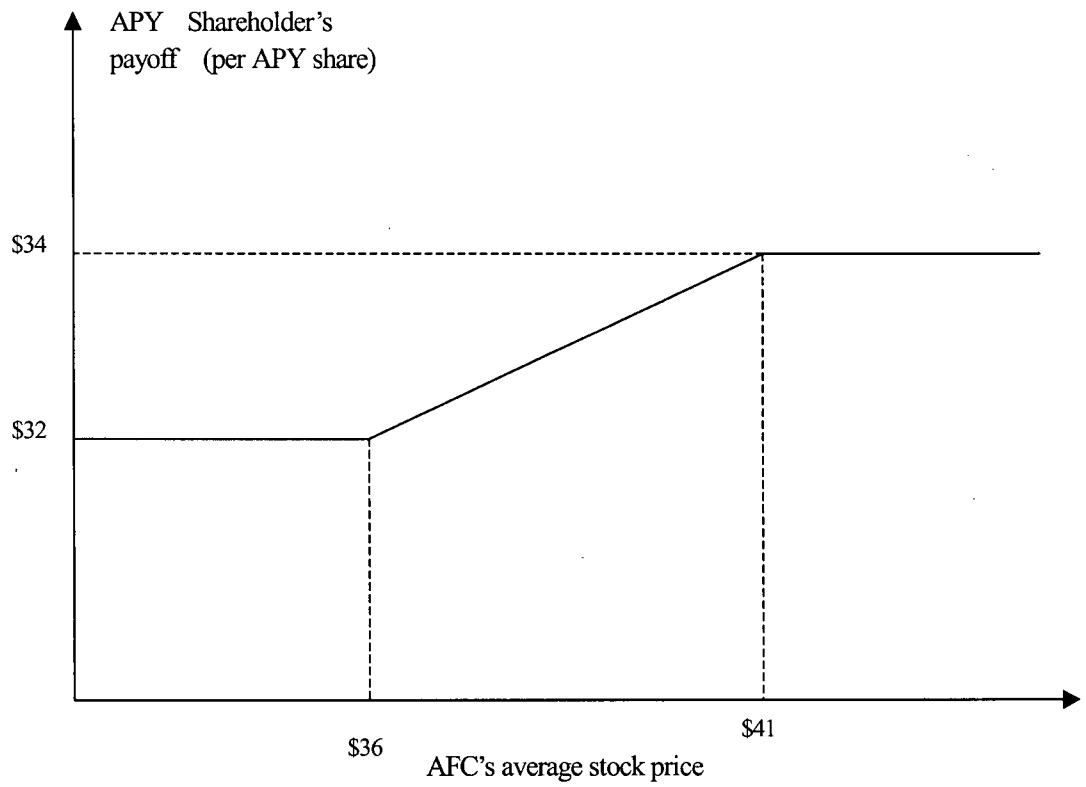

Figure 3.2: The APY-AFC example (APY's shareholder's payoff)

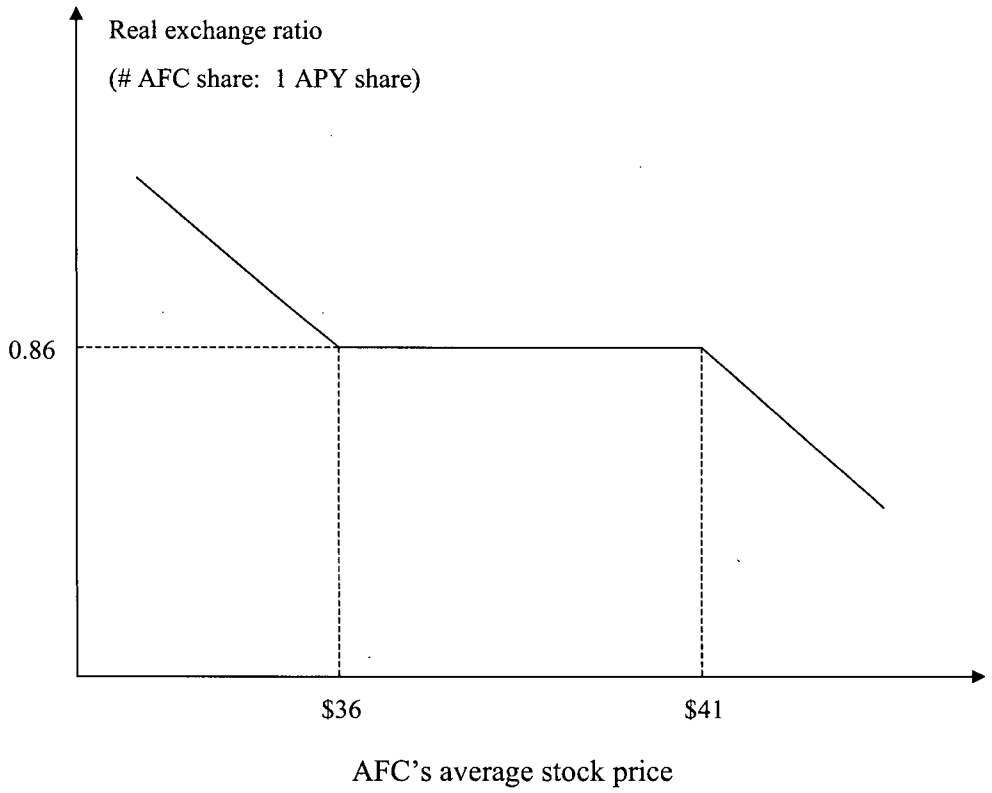

Figure 3.3: The APY-AFC example. (The exchange ratio)

If the AFC's average stock price is in the \$36-\$41 range, the exchange ratio is fixed at 0.86:1, so that the APY's shareholder can exchange one share of the APY stock for 0.86 share of the AFC stock after the merger. According to the formula described in the merger agreement, the APY's shareholders can get more AFC shares when AFC's average stock price is below \$36, while they get fewer AFC shares when the price is above \$41. Thus the ownership percentage of the APY's shareholders in the merged firm depends on the AFC's average stock price, and it is not certain when the merger is announced.

There are other forms of stock offers, such as step-wise collar offers, which can be

thought of as a combination of collar offers with different boundaries. This essay focuses only on FR stock offers, FV stock offers, and collar offers, since they represent most of stock offers made in mergers, and are the basic components of the more complicated stock offer forms.

3.1.2 Theories of Methods of Payment

In the area of research that focuses on the wealth effects associated with the method of payment in mergers and acquisitions, literature such as Hansen (1987), Fishman (1989), and Eckbo, Giammarino and Heinkel (1990) has provided insightful analysis. Equilibrium for the choice of method of payment is developed under asymmetric information in these models. Though the choice is between cash and stock offers in these models, the difference of stock offer forms is largely ignored. The stock offer considered in the previous theoretical literature is usually a fixed ratio stock offer.

Hansen (1987) models the transaction process of a merger as a two-agent bargaining game under asymmetric information. He argues that if a target firm knows its value better than the bidder, the bidder usually prefers to offer stock, which has desirable contingent-pricing characteristics, rather than cash. A target firm's payoff in the game depends on its own value in a stock offer, while the payoff in a cash offer does not. When asymmetric information exists on both sides, the target firm uses the method of payment and the amount of any stock offer as signals of the acquiring firm's value.

Fishman (1989) considers a model where bidders' offers bring forth potential competition and asymmetric information exists. The difference between a cash offer and a

security offer is that a security's value depends on the profitability of the acquisition, while the value of cash does not. Therefore, a properly structured security offer can induce the target to make an efficient decision, when the target has the better information on the profitability of an acquisition. In equilibrium, securities are offered by lower valuing bidders and cash by higher valuing bidders. The advantage of a cash offer is that it serves to preempt potential competition by signaling a high valuation.

In Eckbo, Giammarino and Heinkel (1990), a model of a separating equilibrium is developed when two-sided asymmetric information is considered. They allow a mix of cash and stock as the method of payment in their model, which is commonly observed in reality. In the equilibrium, the value of the bidder firm is revealed by the mixture of cash and stock used as payment for the target. The revealed value is increasing and convex in the amount of cash used in the offer.

The question why there exist different stock offers has not been answered, since the previous theoretical literature only offers explanations for the choice between a cash offer and a stock offer. In fact, literature such as Hansen (1987) and Eckbo, Giammarino and Heinkel (1990) treats stock offers as simple fixed ratio stock offers. In their models, a stock offer is considered to provide a fraction of the post-merger firm shares to be held by the target shareholders. Though they all model the transaction process under two-sided asymmetric information, the fraction determined in a stock offer is independent of asymmetric information. However, this is only a characteristic of fixed ratio stock offer. The APY-AFC example above shows that a fixed value stock offer or a collar offer violates this assumption. The real fraction is uncertain when the merger is announced, and is determined

later.

Another underlying assumption shared by the literature mentioned above is that there exists asymmetric information on both sides of a merger: the bidder (or the acquiring firm) and the target (or the required firm). Both sides have their own private information either on their own values or the potential merger profitability. However, one implied assumption in these models is that the market knows exactly which firm is the bidder and which firm is the target. The transaction process is public information. The information is asymmetric regarding the two sides' valuations, but not about the roles played by the two sides in the transaction. This structural assumption is surely valid when hostile takeovers or tender offers are considered, which occurred very often in the 1980's. In the 1990's, most mergers are friendly in nature. The transaction is usually done by negotiation rather than public bidding in the market. The original meaning of bidder-the one who bids in the public market-becomes ambiguous and weaker, because not many recent mergers are hostile takeovers. The present assignment of "a bidder" to either side involved in a merger is based more on the after-effect of a merger than the action of either side: a bidder is usually the firm that owns more than 50% of the merged firm.

3.1.3 Motivations for and Contributions of this Essay

The method of payment in mergers is an interesting and important topic, because it has significant shareholder wealth effects of two firms involved. While the difference between a stock offer and a cash offer has been well addressed, the difference among stock offers has not been fully studied. This chapter develops a theoretical model under asymmetric

information to accommodate the rationality of the existence of different stock offer forms.

Existing theories have not distinguished different wealth effects associated with different stock offers, which leads to an inconsistency when empirical implications are tested. Though fixed value stock offers and collar offers represent a significant proportion of stock offers in the 1990s, they are treated inconsistently when the wealth effects associated with methods of payment are studied. Often, for example in Travlos (1987) and Martin (1996), fixed value stock offers and collar offers are treated the same as fixed ratio stock offers, so the difference between stock offers is ignored. Even if the difference is noted, it is difficult to categorize stock offers when existing theory can only provide implications about cash offers versus stock offers. Some empirical studies, such as Baker and Savasoghu (2002), simply consider fixed value stock offers as being equivalent to cash offers. A better understanding of stock offer forms is necessary to better specify empirical tests for wealth effects in mergers and acquisitions. This chapter focuses on the forms of stock offers in mergers and acquisitions, and provides theoretical explanations and empirical implications.

This chapter examines the forms of stock offers in a framework similar to Hansen (1987). However, I depart first by considering the significance of the period of time elapsed between merger agreement and completion. Stock exchange usually takes a long time to complete because of regulatory and legal requirements. The period between reaching an agreement and merger completion is normally four to five months. It is not unusual for some stock offer mergers to take a year to complete. For example, in the banking sector, the average time for completion of a proposed merger between banks exceeds seven months. The economic significance of this period is reflected in the information revelation process.

Between agreement and completion, firms involved in the merger attract more attention from the market. The market reacts to new information and can better evaluate the value of both firms and the merger. At the same time, the two firms also get to know each other better because the initial merger agreement gives them fuller access to each other's information, which could be previously private. Extended time between announcement and completion allows for uncertainty to be resolved prior to closing. This makes fixed ratio offers and fixed value offers different in terms of final ownership percentage of the newly merged firm. Hansen (1987) and Eckbo, Giammarino and Heinkel (1990) assume a stock offer provides a determined fraction of the merged firm to one firm. In a fixed ratio stock offer, the fraction is determined by the exchange ratio in the agreement when a merger is announced. However, in a fixed value stock offer or a collar offer, the fraction will not be determined until the merger is completed. Assuming that time passes, and information is revealed, the time period between merger agreement and completion invalidates the assumption in Hansen (1987) and Eckbo, Giammarino and Heinkel (1990) that a fixed ratio stock offer and a fixed value stock offer are the same.

I also depart by considering a private negotiation process in the merger rather than a public transaction process which clearly identifies a bidder and a target. Even though previous models assume asymmetric information, it is always clear which side is the bidder and which side is the target. The complete revelation of the roles played by the two firms in a merger process certainly drives the models' results, and is appropriate when this information is indeed revealed to the market such as in hostile takeovers. However, fixed value stock offers and collar offers gained the popularity in the 1990s, when most mergers

were friendly. In a friendly merger, it is difficult for the public to know all the information of the negotiation process. It is almost impossible to say whether one firm gives a bid price or the other firm asks for a price. The term "bidder" employed in friendly mergers usually refers to the after-merger effect of the process: a "bidder" is identified by who gains control of the merged firm. In this chapter, I do not explicitly model a bidder and a target, thus avoid arbitrarily imposing a control constraint on the game as implied by previous literature.

In reality, the meaning of "bidder" is mixed. For example, suppose IBM is going to acquire a small technology firm, XYZ Inc., using a stock offer. It is common to call IBM the bidder, because XYZ Inc. will disappear after the merger and the combined firm's name is IBM. Also, IBM is much larger than XYZ Inc. However, it is possible that in the negotiation process, XYZ Inc. might be the first mover. It might be the case that IBM shows an interest in this small firm and asks for the price that XYZ Inc. can accept. So the scenario might look like XYZ Inc. gives an offer to IBM: "Our offer is that two shares of IBM's stock be given for one share of our stock. Do you accept it?" The term "bidder" does not necessarily mean "first mover".

The objective of this essay is to theoretically explain the reason for the existence of collar offers and the difference between fixed ratio offers, fixed value offers and collar offers. In a merger, when the offerer is uncertain of the offer receiver's value, a collar offer gives the offerer a higher expected gain from the merger. Though fixed value stock offers are not different from fixed ratio stock offers in terms of the offerer's value maximization, the offer receiver in a fixed value stock offer has a higher expected value than in a fixed

ratio stock offer.

In my model, I assume the first mover (i.e., the offerer) takes all the rent or has all the bargaining power, though each side has the right to terminate the agreement before the completion. I call the first mover the leading firm or the leader, and the other firm the following firm or the follower. In the merger process, the leading firm decides that an optimal bargaining strategy is to make a first-and-final offer. When the leading firm offers a fixed ratio stock offer and the following firm has private information on its own value, there will be an adverse selection problem. Before the completion, neither side can alter the ownership percentage in the new firm. Only following firms of low values accept the offer. The leading firm will also walk away when the following firm's value is too low. If this occurs, the potential synergy from merging is forgone. Fixed value offers create different incentives. In a fixed value stock offer, the leading firm will get a fixed dollar amount of stock in the completion. The ownership percentage will depend on the follower's market price upon the completion. The followers with higher values will own more in the new firm, which makes followers with higher values accept the agreement in the first place. However, the synergy from low value following firms, who reject the merger, is forgone here. Neither form of stock offer can dominate the other in terms of maximizing the leading firm's expected wealth. However, I find a mixed offer with a *collar* feature is ex ante preferred by the leading firm and also ex post mutually beneficial. The collar offer makes the offer acceptable in more states and more efficiently extracts the synergy from mergers. My model extends the scope of the wealth effect of the medium of exchange in mergers and acquisitions.

There have been a few empirical studies looking at stock offers. Houston and

Ryngaert (1997) use conditional stock offers in bank mergers to test for evidence of adverse selection. Their study concerns the relation between bidder abnormal announcement returns and bid elasticity. The authors argue that if adverse selection influences the choice of method of payment (i.e. overvalued bidders choose to offer stock to target shareholders) then the bidder's abnormal announcement return should be significantly higher in bids that are the most cash-like (low elasticity) than in stock-like (high elasticity) bids. My model gives similar implications. However, my explanation is the information effect of offer forms on the acquiring firm. My model also provides more implications on the target firm's side. Officer (2003) finds that the inclusion of a collar significantly reduces the probability of contract revisions and increases the likelihood that a merger is successfully completed. This is consistent with my model because a collar offer is acceptable in more states. Fuller (2000) finds relative size and ownership are two factors in the likelihood of collar offers.

The rest of the paper is organized as follows. Section 3.2 introduces the model. I compare fixed value offers and fixed ratio offers, and derive an optimal collar offer under asymmetric information. In Section 3.3, I discuss the impact of other effects on collar offers. The empirical implications are discussed in Section 3.4. Section 3.5 concludes the paper.

3.2 Model

In this section, I develop a model that considers the significance of information revelation between a merger announcement and its completion. When a leading firm is uncertain of a following firm's value, a collar offer is preferred because of the higher expected gain compared to other offer forms. A collar offer is also more socially desirable, since it

is more likely to be accepted by a following firm, thus more efficiently utilizing economic resources. This conclusion is drawn assuming one-sided asymmetric information and the advantage of a collar offer is mainly driven by assuming private information is held by the following firm.

3.2.1 Model setup and general assumptions

In this paper, I restrict my attention to a case where the medium of merger and acquisition is by stock exchange. In a stock exchange agreement, it is not easy to define the acquiring firm and the target firm. I would like to think that one firm initializes the agreement and the other firm accepts it or refuses it. I refer to the firm that initializes the agreement as the leading firm and the firm that receives the offer as the following firm.

Basic setup The following firm's asset value is denoted as x, which is defined over $[\underline{x}, \overline{x}]$ with distribution $F(x)$. The leading firm's asset value is y defined over $[\underline{y}, \overline{y}]$ with distribution $G(y)$. I model the possible synergy created from the merger process in the same fashion as Hansen (1987). If two firms merge, the newly created firm's asset value would be: $y + w(x, y)$. Capital X and Y are used to indicate following firm and leading firm respectively.

So we can think $w(x, y) - x$ as the synergy in the view of the leading firm. In a first best world, any merger between these two firms should go through, regardless of firm types involved, if the synergy is positive ($w(x, y) \geq x$). Or, in the view of social welfare, every merger with positive synergy going through utilizes all the economic resources and creates more value for the economy. Here, we do not constrain the synergy to be positive.

$w(x,y)$ can be less than x.

For the moment, I assume that all firms are equity-financed, and $G(y), F(x)$ and $w(x,y)$ are common knowledge. I also assume $\frac{\partial[w(x,y)-x]}{\partial x} > 0$. This assumption implies that higher value following firms can create more synergy in mergers. My modeling of synergy is a little different from Hansen (1987)'s. In my model, the synergy does not only depend on the following firm's value, but is a function of the leading firm's value.

Time line This is a two-date model. At $t = 0$, the leading firm offers a merger proposal to the following firm. If the following firm accepts the offer at $t = 0$, the merger agreement would be announced. Otherwise, no merger news would be revealed to the market. However, the merger agreement only comes to be effective at $t = 1$. At $t = 1$, both the leading and the following firms can decide if they want to carry on with the merger agreement. Only when both of them want to complete the merger will it take place. If either firm decides to walk away from the agreement at $t = 1$, the merger is called off. After the merger takes place, a new firm is created.

So at $t = 0$, the leading firm decides the form of offer and the following firm decides to accept it or not. At $t = 1$, they both must decide whether or not to let the merger go through.

The leading firm and the following firm know their own values throughout the period between $t = 0$ and $t = 1$, and they observe each other's value at $t = 1$. However, at $t = 0$, I assume there is only one firm who knows the other firm's value aside from its own value, and the other firm only knows its own value. I call the one firm who knows

both firms' values as the informed firm, and the other as the uninformed firm. I also label this situation as asymmetric information on the uninformed firm's side. I use the period between $t = 0$ and $t = 1$ to capture the effect of the information revelation process on the merger decision. At $t = 0$, if there is asymmetric information on one side, only one firm's value is known to the market. However, at $t = 1$, the true value of the two firms will be fully revealed to the market. The assumption can be weakened. I can also model that the true value of a firm may not be fully revealed but the market gets more ideas of the true type by receiving more information during this period, which would be an information updating process. Here, I make this assumption in order to focus on the difference of two information sets at two dates without complicating the analysis. The assumption is realistic in that, usually, firms in a merger processes attract more attention, which generates more information regarding their prospects.

This model allows both firms to walk away from the merger agreement at $t = 1$ without incurring any cost. One direct result is that negative synergy mergers can never take place, because this implies that at least one firm receives a negative gain from the merger and this would be rejected. This assumption can be relaxed by assuming that costs are incurred when the firms enter the agreement at $t = 0$ and when they decide to walk away at $t = 1$. Then, some negative synergy mergers can go through. However, it will not alter the main results of this paper about different stock offers. I will discuss the model with deadweight costs after showing the main results.

Offer forms The stock exchange merger agreement can take two basic forms, which gives the leading firm three options:

- Fixed ratio offer λ. The leading firm can propose a fixed ratio offer, in which it specifies the ownership percentage, λ, of the following firm in the new firm.
- Fixed value offer S_X. The leading firm can offer a fixed value offer to the following firm, which states upon the completion of the merger that the following firm will be given shares of stock worth a fixed dollar amount, S_X.
- Fixed value offer S_Y. The leading firm can give a fixed value offer, which states the leading firm will be given shares of stock worth a fixed dollar amount, S_Y, in the new firm if they both agree to merge.

The difference between the second and the third option is which firm receives shares of stock worth a fixed dollar amount. The subscript X (Y) of S indicates that following firm (leading firm) receives stock worth a fixed dollar amount. To summarize the options the leading firm has, I specify the values of the leading firm and the following firm when the merger is completed. Here the forms of the offers are denoted by λ, S_X, and S_Y respectively.

Offer Type	Value of the leading firm (V_Y)	Value of the following firm (V_X)
λ	$(1-\lambda)[y+w(x,y)]$	$\lambda[y+w(x,y)]$
S_X	$y+w(x,y)-S_X$	S_X
S_Y	S_Y	$y+w(x,y)-S_Y$

One difference between fixing the ratio and fixing the value is the determination of ownership percentages for the two firms. In a fixed ratio stock exchange, the ownership

percentage is fixed at $t = 0$ for both firms and is known to the market. But in a fixed value offer, the ownership percentage cannot be decided at $t = 0$ with certainty because the new firm's value is still unclear to the market. At $t = 1$, if the merger occurs, the ownership percentage for the following firm would be: $\lambda' = \frac{y+w(x)-S_Y}{y+w(x)}$ if the leading firm chooses the third option. Notice that λ and λ' are determined at different dates: λ or S_Y is specified at $t = 0$, while λ' is only known or decided when the two firms decide to merge at $t = 1$ in a merger agreement with fixed value offer.

In the model, a fixed value offer is similar to a cash offer because a fixed dollar amount is specified in the offer. In reality, however, a cash offer may guarantee a certain cash value at $t = 0$, but the true value of a fixed value offer is affected by other factors, such as liquidity. For example, in fixed value offer S_X, at $t = 1$, the following firm gets some stock, say n shares, with a value S_X. It might be very difficult to sell n shares without changing the share price when n is a large number. Only when the market value is equal to the true value of the share at all times, does a fixed value offer give the same value as a cash offer. In this chapter, I will not discuss why the leading firm uses a stock exchange rather than cash. We can surmise that the investors have a long-term investment horizon and are more concerned with ongoing values. By refraining from the discussion of cash offers, we can better focus on the main goal of this paper, which is to explain the use of collar offers.

I will discuss these basic forms under different information environments in the following section.

3.2.2 Stock offers

Leading firm is informed.

As defined earlier, the leading firm being informed means that at $t = 0$, the leading firm knows the value of the following firm, but the following firm has no information regarding the leader's value except the distribution $G(y)$. Each firm always knows its own value.

Knowing the following firm's true value x, the leading firm will choose the optimal offer as a fixed value offer S_X with

$$S_X = x, \tag{3.1}$$

when $w(x, y) > x$ (the synergy is positive). The following firm will accept the offer and the merger can go through. After the merger, the leading firm will get $y + w(x, y) - S_X$, which is higher than y. However, if the synergy is negative, the leading firm has no incentive to make the merger happen in the first place.

If the leading firm wants the merger to go through, it will not use λ or S_Y because of the Lemons problem. The following firm has no information regarding y. If the offer is fixed value S_Y or fixed ratio λ, the value after the merger for the following firm would be also contingent on the value of the leading firm, or y, as shown in the summary table above. The following firm will make its decision on its inference of the leading firm's value, which creates a Lemons problem. Even though there may exist a signaling equilibrium in which the leading firm offers more λ or less S_Y, either of the signals is still costly compared to the offer S_X for the informed leading firm. Thus an informed leading firm always uses the fixed

value offer S_X . In this information environment, a collar offer has no reason to exist.

When the leading firm is informed, that firm is like a bidder if we specify the roles of the two firms in common merger terminology, because commonly a merger agreement says that the bidder gives stock worth a fixed dollar amount to the target. Analysis suggests that if a bidder is informed of the target's value and has all the bargaining power, the stock offer will look like a fixed value offer.

This case also illustrates how to analyze our model. Referring to the IBM and XYZ example, we can our analysis does not try to identify IBM as the bidder or target. I analyze offer forms under a certain information environment while assuming one firm has the first mover advantage. Here, if IBM has a clear idea of XYZ Inc.'s value and IBM has the dominate bargaining power in the process, it will offer a fixed value stock offer to XYZ Inc. There is no grounds for the existence of a collar offer in this case.

Leading firm is uninformed.

In this case the leading firm does not know the following firm's value but the following firm knows the exact value of the leading firm. Each firms knows its own value. So the following firm knows y and its own value x, while the leading firm has no exact information of x but the knowledge of the distribution $F(x)$, and its own value y. The leading firm decides the form of the offer.

Fixed-ratio offer λ In this form of stock exchange, the leading firm gives an offer to the target firm, which specifies the exchange ratio of the two firms' stocks in the merger process.

Essentially this offer determines the ownership percentage for the two firms in the newly merged firm. For example, the leading firm may offer to exchange one share of its own stock for two shares of the following firm's. Implicitly it contracts $\lambda = 1/3$ if the numbers of outstanding shares are the same. So, I assume the stock offer is specified by λ directly. A fixed ratio offer λ is a first-and-final offer. Given the acceptance of this offer is at $t = 0$, there is no obligation for the following firm to accept the offer at $t = 1$. At $t = 1$, both the leading firm and the following firm can walk away from the merger agreement.

Given λ, only the firms with type $x \leq x^*_\lambda$ [2]will accept the offer and let the merger go through. Here x^*_λ satisfies[3]:

$$\lambda[y + w(x^*_\lambda, y)] = x^*_\lambda. \tag{3.2}$$

In fact, because the following firm knows y as well as x, it already knows whether it will let the merger go through or not at $t = 0$. Those following firms that do not intend to let the merger go through at $t = 0$ are indifferent to accepting the offer or not at $t = 0$. Although it will not change our analysis, I assume that only the following firms that know they will merge with the leading firm choose to accept the merger offer at $t = 0$. This is consistent with assuming that there are other deadweight costs paid during the period between $t = 0$ and $t = 1$ for the following firm when the following firm accepts the offer at $t = 0$, even if the cost is very small.

The leading firm cannot distinguish the types of the following firms. But when it

[2]The subcript letter λ, S_X or S_Y of x indicates the type of following firm in a fixed ratio stock offer, a fixed value offer S_Y or a fixed value offer S_X respectively. The superscript or subscript $*$ on x denotes upper or lower level of x respectively if applicable.

[3]Here we make the same assumption as in Hansen (1987): $\frac{\partial w}{\partial x} < \frac{y+w(x,y)}{x}$, which implies that any $x \leq x^*_\lambda$ will also accept the offer. This assumption is not necessary for all propositions to follow, but it makes the analysis easier.

gives an offer with λ specified, the leading firm knows that at $t = 1$ the merger will take place only if the following firm's value is less than x^*_λ. Given λ, the following firm with type x^*_λ breaks even in the merger process. The following firm with a type lower than x^*_λ receives positive premium in the merger. The premium they will obtain is:

$$\lambda[y + w(x, y)] - x. \tag{3.3}$$

The premium can also be written as: $[w(x, y) - x] - [(1 - \lambda)w(x, y) - \lambda y]$. The first term can be thought as the total synergy of the merger. The second term is determined by the offer, which can be thought as the part of the synergy going to the leading firm. Notice that if x is small enough, the first term could be negative implying a negative synergy; and the second term could be negative, which implies the leading firm would receive no part of synergy at all, but needs to give up some of its own value to the following firm. In Hansen (1987), the leading firm's loss here is considered to be the cost. In my model, the same behavior would be considered irrational. Being rational, the leading firm knows it will not exercise the agreement at $t = 1$ if the value of the following firm is smaller than a certain value $x_{\lambda*}$, because the value of the following firm will be revealed at that time. Here $x_{\lambda*}$ satisfies:

$$(1 - \lambda)[y + w(x_{\lambda*}, y)] = y \tag{3.4}$$

It is not difficult to verify that $w(x_{\lambda*}) \geq x_{\lambda*}$, because the leading firm receives zero gain and the following firm receives positive gain here. Because of information being revealed, negative synergy merger cannot happen.

At $t = 1$, the leading firm has the option not to carry on with the merger agreement if the type of the following firm, when revealed, is too low. Knowing that and considering

the deadweight cost, only the following firms with types between $[x_{\lambda *}, x^*_\lambda]$ will accept the merger agreement at $t = 0$.

Because of asymmetric information at $t = 0$, the leading firm does not know the exact type of the following firm accepting the agreement, and its expected wealth with the offer λ would be:

$$E[W \mid \lambda] = \int_{x_{\lambda *}}^{x^*_\lambda} (1-\lambda)[y + w(x,y)]dF(x) + \{1 - [F(x^*_\lambda) - F(x_{\lambda *})]\} \cdot y. \tag{3.5}$$

$F(x^*) - F(x_*)$ is the probability that the merger occurs. $1-\lambda$ is the leading firm's ownership percentage in the new firm. The expected wealth has two components. The first term is the probability of a merger multiplied by the conditional value in the new firm. The second term is the value conditional on no merger. For the moment, I simply assume $x_{\lambda *}$ is not supported by the distribution $F(x)$, or $x_* < \underline{x}$, for simplicity. Later I will include this consideration.

The leading firm will choose the optimal exchange ratio λ to maximize its gain. In other words, we can also think the leading firm is choosing x^*_λ since λ and x^*_λ have a one-to-one correspondence:

$$\max_{x^*_\lambda} \int_{\underline{x}}^{x^*_\lambda} (1-\lambda)[y + w(x,y)]dF(x) + [1 - F(x^*_\lambda)]y \tag{3.6}$$

Subject to:

$$\lambda = \frac{x^*_\lambda}{y + w(x^*_\lambda, y)}. \tag{3.7}$$

To obtain an interior optimum, the appropriate first and second order conditions have to be satisfied. Given x^*_λ and λ^* as the optimal, the expected wealth of the leading firm in

this offer is:

$$W_\lambda^* = (1-\lambda^*)\int_{\underline{x}}^{x_\lambda^*}[y+w(x,y)]dF(x) + [1-F(x_\lambda^*)]y. \tag{3.8}$$

Here

$$\lambda^* = \frac{x_\lambda^*}{y+w(x_\lambda^*,y)}.$$

The first term in Equation (3.8) is the expected wealth when the merger agreement is accepted. The second term is the multiplication of the acquiring firm's value and the probability that no merger occurs. If the leading firm offers a higher λ, the probability that the merger agreement is accepted is greater. However, it also means the leading firm has to share more synergy with the following firm. The optimal λ^* is the result of a trade-off between two effects.

If we think of the type of the following firm as the state variable, the leading firm will walk away when it finds out the state is lower than $x_{\lambda *}$. In addition the following firm will not accept the offer if the state is higher than x_λ^*. A merger only occurs when the state is between $x_{\lambda *}$ and x_λ^*. The potential synergy outside of this range cannot be exploited.

Fixed value offer S_X The leading firm can also offer a fixed value offer of S_X to the following firm. The natural response of the following firm is to accept the offer if $x \leq S_X$. But the following firm also realizes that if later at $t=1$, the leading firm is in the position of negative gain from the merger, the leading firm will walk away. This case may happen when the synergy is less than the premium the leading firm pays. Similar to the case of fixed ratio offer λ, the states in which the merger could happen are from $x_{S_X *}$ to S_X. Here

x_{S_X*} is given by

$$w(x_{S_X*}, y) = S_X \tag{3.9}$$

The right hand side is how much the leading firm pays, and the left hand side is how much the leading firm gets.

Under this offer, the highest type of following firms , $x = S_X \equiv x^*_{S_X}$, who accepts the merger agreement, receives zero premium, while the lowest type x_{S_X*} receives premium $S_X - x_{S_X*}$. If we can write the inverse function of $w(x, y)$ as $w^{-1}()$, then the leading firm needs to decide the optimal S_X such that the expected wealth is maximized.

$$W^*_{S_X} = \max_{S_X} \int_{w^{-1}(S_X)}^{S_X} [y + w(x, y) - S_X] dF(x) + y[1 - F(S_X) + F(w^{-1}(S_X, y))] \tag{3.10}$$

Here, it is also easy to verify that $w(x_{S_X*}, y) \geq x_{S_X*}$, which says that negative synergy mergers never go through. In fact, in the setup of our model, all the information is revealed at $t = 1$, and firms can make final decisions at that moment. Both firms need to receive a non-negative gain to stay in the merger no matter what offer form is given. For this reason, I will focus on positive synergy mergers in subsequent sections.

In a fixed value offer S_X, the leading firm walks away when it finds out the following firm's value is lower than x_{S_X*}, and the following firm will not accept the merger offer if its value is higher than $x^*_{S_X}$. Similar to the fixed ratio offer λ, the potential synergy outside of the range $[x_{S_X*}, x^*_{S_X}]$ cannot be exploited by the fixed value offer S_X.

The difference between fixed ratio offer λ and fixed value offer S_X is given in Proposition 4.

Proposition 4 *If the leading firm is uninformed as defined above, then for every fixed value S_X that is acceptable to the leading firm, there exists a fixed ratio offer λ that is preferred.*

Proposition 4 is similar to the first proposition in Hansen (1987), which implies that if the uninformed leading firm's choices are limited to only a fixed ratio offer λ and a fixed value offer S_X, the leading firm will always choose a fixed ratio offer.

Fixed value offer S_Y Instead of promising a fixed value to the following firm, at $t = 0$, the leading firm can offer an agreement that provides itself with some shares of stock worth a certain fixed value S_Y at $t = 1$ in the new firm. When the merger is announced at $t = 0$, neither the leading firm nor the market knows the exact ownership percentages in the firm. However, the following firm knows the exact proportion it can have in the new firm because its type is known to itself.

At $t = 1$, all the information about the firms' type is revealed to the market. The market knows the new firm's value is $y + w(x, y)$. So when the merger happens, the leading firm will own $\frac{S_Y}{y+w(x,y)}$ of the new firm, and the following firm will own the proportion, $\frac{y+w(x,y)-S_Y}{y+w(x,y)}$, of the new firm. Intuitively this offer guarantees that the ownership percentage for the following firm is positively related to its true value.

Because the following firm knows the exact ownership percentage at $t = 0$, the incentive constraint would be:

$$\frac{y + w(x, y) - S_Y}{y + w(x, y)}[y + w(x, y)] = y + w(x, y) - S_Y \geq x \tag{3.11}$$

Given the offer S_Y, the premium the following firm can receive is:

$$[y + w(x, y) - S_Y] - x,$$

which is increasing with the following firm's type.

Suppose the offer S_Y is chosen such that for type $x^*_{S_Y}$ firm, the following firm $x^*_{S_Y}$ receives no premium from the merger. So:

$$S_Y = y + w(x^*_{S_Y}, y) - x^*_{S_Y}. \tag{3.12}$$

Different from the fixed ratio offer, we find that any type $x \geq x^*_{S_Y}$ will accept the offer. The following firm with $x^*_{S_Y}$, which is the lowest state of merger, receives zero premium; while the higher value following firms receive higher premiums. The positive correlation between the premium and the firm's type ensures the firms with better types can have higher positive premiums. This is the opposite situation compared with the case of fixed ratio offer λ and fixed value offer S_Y.

For the leading firm, fixed value offer S_Y also makes sure that it can get S_Y in the new firm, which is always larger than y. The new value created in the merger is allocated to the two firms such that the leading firm gets a fixed amount and the following firm takes the rest.

For the leading firm, to decide the optimal S_Y in the agreement is equivalent to decide the lowest type $x^*_{S_Y}$ firm that will agree to merge. The leading firm will choose this type by maximizing its expected wealth.

$$\begin{aligned} W^*_{S_Y} &= \max \int_{x^*_{S_Y}}^{\overline{x}} S_Y \; dF(x) + F(x^*_{S_Y})\; y \\ s.t.\; x^*_{S_Y} &= y + w(x^*_{S_Y}, y) - S_Y \end{aligned} \tag{3.13}$$

After simplification, the leading firm has an optimization problem as:

$$W^*_{S_Y} = \max_{x^*_{S_Y}}\{\ y + [w(x^*_{S_Y}, y) - x^*_{S_Y}][1 - F(x^*_{S_Y})]\} \tag{3.14}$$

$1 - F(x^*_{S_Y})$ is the probability that a merger occurs. $w(x^*_{S_Y}, y) - x^*_{S_Y}$ is the allocation of the newly created value to the leading firm. A higher gain from the merger will decrease the probability that the merger will occur. The leading firm decides the trade-off between the gain and the chance of merger success.

We have several observations: (1). If a merger happens, the leading firm only gains a fixed value: $w(x^*_{S_Y}, y) - x^*_{S_Y}$ that is increasing with $x^*_{S_Y}$. (2). The probability that a merger happens is decreasing with $x^*_{S_Y}$. (3). The selection of $x^*_{S_Y}$ is independent of the leading firm's value. (4). The expected gain for the leading firm is always positive no matter what type of following firm the leading firm chooses.

Fixed ratio and fixed value offers are different in the forms which are specified by λ and S_Y. I am going to compare them in more detail and analyze the relation between them.

First, it is straightforward to have the following proposition:

Proposition 5 *If the leading firm is uninformed as defined above, we have the following:*

(a). In an optimal fixed ratio stock offer λ, the expected gain of the merger for the leading firm is decreasing with its value y.[4]

(b). In an optimal fixed value stock offer S_Y, or S_X, the expected gain of the merger for the leading firm is independent of its value y.

[4]Even if we consider $x_* > \underline{x}$.

In a fixed value stock offer S_Y, two firms reach the agreement that only deals with the newly created value. The leading firm gets something fixed and the following firm gets the rest, or the opposite. In the fixed value offer S_Y, by fixing its new holdings in the new firm in a dollar amount, the leading firm ignores its value in setting the terms of the agreement. It is different for the fixed ratio offer λ. By specifying the ownership percentage explicitly, the leading firm brings its own value to the table.

Secondly, in Proposition 4, I show that a fixed ratio offer λ is preferred over a fixed value offer S_X by the leading firm. The preference between a fixed ratio offer λ and a fixed value offer S_Y depends on $w(x, y), G(x)$, and y. There is no strict dominance in terms of expected gain for the leading firm.

Third, another difference between fixed value offer S_Y and fixed ratio offer λ is the states in which a merger can happen. A merger happens in states $[x^*_{S_Y}, \overline{x}]$ in a fixed value offer S_Y. Fixed value offer S_Y encourages following firms with high values to accept a merger agreement. Any following firm with a value lower than $x^*_{S_Y}$ will walk away from the offer. The leading firm never walks away from this deal. A merger happens in states $[x_{\lambda *}, x^*_\lambda]$ in a fixed ratio offer λ. Better following firms do not accept the offer, while the leading firm walks away when it finds out that the following firm's value is too low. Either offer discourages some types of following firms to participate in a merger agreement. Therefore, neither offer is optimal if the social objective is to maximize expected synergy.

Collar offer Though the fixed value offer S_X is dominated by the fixed ratio offer, the other two forms cannot dominate each other since the optimal decision depends on

$w(x,y), G(x)$, and y. However, the leading firm can make a collar offer, which dominates both offers and has a characteristic of a "floor" and a "cap".

The fixed ratio offer λ is preferred to the fixed value offer S_X because of its contingent-pricing effect. However, because of the adverse selection problem caused by one-sided asymmetric information, only following firms that have lower values than the following firm that receives zero premium will accept the offer. If we consider the following firm's value as the state variable, a fixed ratio offer gives up the potential economic gains in the high states. I model mergers as an opportunity to utilize economic resources and increase the efficiency of the whole economy. While a fixed ratio offer λ is upside constrained, a fixed value offer S_Y is downside constrained. The leading firm fixes its gain in each state that the merger goes through, but the states that the merger can happen are high-value states. Though lower value following firms can still improve the efficiency of economic resource usage, fixed value offers S_Y will fail in the lower states because the following firm's constraints cannot be satisfied.

Figure 3.4 illustrates this point. The X axis stands for the state that is from $\underline{x}$ to $\overline{x}$. The vertical axis is the net gain of the leading firm. The leading firm may use a fixed value offer S_Y and decide the optimal S_Y. From the discussion above, we know there is a corresponding $x^*_{S_Y}$ such that the merger would happen in states higher than $x^*_{S_Y}$.[5] In the states lower than x^*_S, following firms walk away. A merger happens in states $[x^*_S, \overline{x}]$ on the X axis. The line MN is the gain of the leading firm in each state that the merger happens, which is a constant, $S_Y - y$. So the area $MN\overline{x}x^*_S$ is the total expected gain for the leading

[5]To simplify the notation, the subscript Y is dropped in fixed value offer S_Y from this point forward.

firm.

The curve $Ax_{\lambda *}$ is the gain in each state for a fixed ratio offer λ. Similarly we know the area between $Ax_{\lambda *}$ and the X axis is the total expected gain. As I discussed before, the leading firm will walk away from the agreement at $t = 1$ when the state is below $x_{\lambda *}$. Following firms will walk away from the merger if the state is higher than x^*_λ. A merger happens only when the state belongs to $[x_{\lambda *}, x^*_\lambda]$.

Apparently, both fixed ratio offers and fixed value S_Y offers have some states with no economic gain. One direct improvement is that the leading firm gives a fixed offer λ and at the same time offers a fixed value offer S' such that x^*_λ is the corresponding critical state. Here, the following firm with value x^*_λ receives a zero premium from the fixed value offer S'. The height of the AD line is $S' - y$. Then the total expected gain for the leading firm will be the area between curve $x_{\lambda *}AD$ and the X axis. Total expected gain of the leading firm is increased by the area $AD\overline{x}x^*_\lambda$. Now, from the state x^*_λ to the state $\overline{x}$, the leading firm's gain is capped at S'. The rest synergy goes to the following firm, which means that high value following firms will not walk away from the merger.

As a second improvement, at the same time, the leading firm offers a fixed value offer S'' such that $\underline{x}$ is the critical value. A floor is placed on the leading firm at $w(\underline{x}, y) - \underline{x}$. With this guarantee, the leading firm will not walk away when the state is low. The fixed offer S'' eliminates the area under the X axis and increases the expected gain for the leading firm.

I discuss this idea in detail. The leading firm can suggest a merger proposal, in which two prices P^+, P_+ are specified such that if the following firm's price at $t = 1$ is

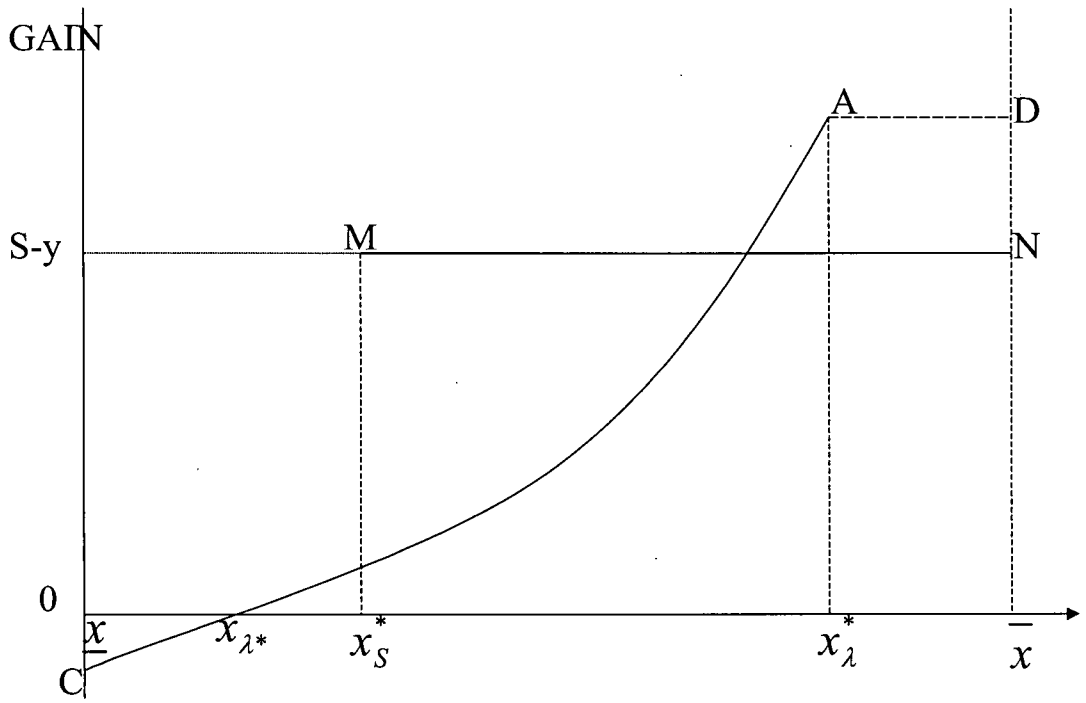

Figure 3.4: Illustration: FV offer, FR offer and collar offer

higher than P^+, fixed value offer S is used with S^+. If the following firm's price at $t = 1$ is lower than P^+ but higher than P_+, it will be a fixed ratio offer with λ. When the target firm's price is lower than P_+, a fixed value offer S is proposed with S_+. To summarize, the offer is:

$$\text{fixed value offer } S^+ \qquad \text{if } P > P^+$$

$$\text{fixed ratio offer } \lambda \qquad \text{if } P_+ \leq P \leq P^+$$

$$\text{fixed value offer } S_+ \qquad \text{if } P < P_+$$

I call this offer a collar offer.

I assume at $t = 1$ the asymmetric information is resolved such that the market knows the following firm's type as does the leading firm. The market will price the following firm considering its type and the offer form. At the same time, the offer form should be consistent with the pricing mechanism and support the market price.

In equilibrium, the specifications of a collar offer are determined by two sets of equations. The first set is

$$S^+ = y + w(x^+, y) - x^+ \tag{3.15}$$

$$\lambda = \frac{x^+}{y + w(x^+, y).} \tag{3.16}$$

$$S_+ = y + w(x_-, y) - x_- \tag{3.17}$$

$$S_+ = (1 - \lambda)[y + w(x_+, y)] \tag{3.18}$$

This set determines S^+, S_+ and λ in a collar offer.

I treat the values of the following firm as state variables. In fact, *the only decision the leading firm has to make at* $t = 0$ *is to choose* x^+ *and* x_-. I will show why this is so after going through the following analysis.

To simulate the decision of the leading firm, let us first suppose x^+ and x_- have been chosen. I will explain how x^+ and x_- are chosen later.

Equation (3.15) gives S^+. As discussed above, at $t = 1$, if the realized state is from x^+ to $\overline{x}$, the leading firm will get stock worth a dollar amount S^+. When the following firm is a high value firm, the leading firm sets a cap on its gain from the merger. Thus the following firm gets $y + w(x, y) - S^+$ and the leading firm has S^+ when $x \in (x^+, \overline{x}]$.

At the same time, equation (3.16) solves λ. The following firm x^+ receives zero premium. Thus following firms with values lower than x^+ are willing to accept the merger agreement. Leaving the leading firm with $(1 - \lambda)[y + w(x, y)]$, the following firm gets the rest of the new firm: $\lambda[y + w(x, y)]$. As discussed earlier, the fixed ratio offer λ discourages the leading firm from letting the merger go through when the following firm's value is very low. Here, in a collar offer, the leading firm will not walk away because it sets the minimal value it can obtain from the merger: S_+. S_+ is given in equation (3.17). It is decided by choosing x_-. The leading firm fixes the minimal gain it can obtain from the merger, which is the synergy when the following firm is the lowest value firm.

Equation (3.18) determines the critical state, x_+, in which the leading firm receives the same value from S_+ and the fixed ratio offer λ. Notice x_+ is actually determined by x^+ and x_-. When $x > x_+$, $(1 - \lambda)[y + w(x_+, y)] > S_+$. The leading firm is better off to let the

following firm have a fixed percentage of the new firm when $x \in [x_+, x^+]$. So in this range, the offer looks like a fixed ratio offer λ. In the states, $[x_-, x_+]$, the leading firm takes S_+ out of the new firm and leaves the rest to the following firm. For the following firm with type from $[x_-, \overline{x}]$, its constraint is always satisfied.

The expected wealth for the leading firm in a collar offer is:

$$E[W \mid m] = \int_{x_-}^{x_+} S_+ dF(x) + (1-\lambda) \int_{x_+}^{x^+} [y + w(x,y)] dF(x) + \int_{x^+}^{\overline{x}} S^+ dF(x) \tag{3.19}$$

Or explicitly I can write it as:

$$\begin{aligned} E[W \mid m] = & \int_{x_-}^{x_+} [y + w(x_-, y) - x_-] dF(x) + \\ & (1-\lambda) \int_{x_+}^{x^+} [y + w(x,y)] dF(x) \\ & + \int_{x^+}^{\overline{x}} [y + w(x^+, y) - x^+] dF(x) \end{aligned} \tag{3.20}$$

Here I use m to denote the offer form as a collar offer (or mixed offer). As in the discussion of the first set of equations, we know S^+, λ, S_+, and x_+ are all determined by the choice of x^+ and x_-. To maximize its expected wealth from the merger, the leading firm only needs to choose the optimal x^+ and x_- in (3.19) or (3.20). In fact, the problem can be written as:

$$W_m^* = \max_{x_-} \{ \max_{x^+} E[W \mid m, x_-] \} \tag{3.21}$$

We can think that the leading firm first chooses the lowest type of following firm that it wants to merge with, then decides collar specifications.

The expected wealth of the leading firm has three terms. The first term, which covers the range $[x_-, x_+]$, is the expected wealth from the fixed value offer S_+. The second

term is the leading firm's ownership percentage multiplied by the expected new firm's value in the range $[x_+, x^+]$, which is specified by the collar feature. For the following firm with type $[x^+, \overline{x}]$, a fixed value offer S^+ is given. The third term is the expected wealth for the leading firm if the fixed value offer S^+ is actually effective.

The following proposition claims that a collar offer is optimal for the leading firm.

Proposition 6 *If the leading firm is uninformed as defined:*

(1). For an optimal fixed ratio stock offer λ, there exists a collar offer that is preferred by the leading firm;

(2). For an optimal fixed value stock offer S_Y, there exists a collar offer that is preferred by the leading firm.

Proof: The basic idea is the same as the curve $Cx_{\lambda *}AD$ in Figure 3.4. It is easy to see that with an optimal fixed ratio offer, let $x^+ = x^*_\lambda$ and fix $x_- = x_{\lambda *}$, the collar stock offer always has a higher expected wealth. For an optimal fixed value offer, let $x^+ = x^*_S$ and choose x_- such that $w(x_-) = x_-$, the collar stock offer also has a higher expected wealth than the fixed value offer.

The proposition implies a collar stock offer dominates the other forms. We can think the expected gain for the leading firm is determined by the multiplication of two components. The first is the probability that the merger happens, which can also be thought of as the coverage of the states that a merger happens. The other expected gain is the net gain conditional on the state in which a merger happens. A collar stock offer guarantees more types of following firms will agree to merge[6] and the net gain in each state is larger

[6]Since this is not the focus of this paper, proof is omitted here.

than zero except the state x^+ and x_-, which have zero net gain. However, a fixed ratio offer or a fixed value stock offer normally cover less states, which leaves zero gain in the states uncovered. The proof of Proposition 3 actually uses this idea and confirms that the overall multiplication effect in a collar stock offer dominates the other two offers, though the net gain in each state for collar offers may not dominates the net gain in other offers. Intuitively, in a merger, the leading firm wants to set the incentive or the merger agreement in such a way such that more types of following firm are willing to merge with it.

The dominance of the collar offer occurs because of the information update between $t = 0$ and $t = 1$. We can also think the leading firm's expected wealth as:

$$E[\rho \cdot \Omega \mid \text{offer}] \cdot \Pr[\text{offer accepted}] + y \cdot \Pr[\text{offer unaccepted}]$$

Here ρ is the ownership percentage of the leading firm in the new firm and Ω is the new firm's value in the states in which a merger take places. In the fixed ratio offer, ρ has no correlation with Ω. Ω increases in high states. The leading firm would want to cover high states in the merger agreement. However, because ρ is specified at $t = 0$, low value following firms realize if they accept the offer, their ownership in the new firm will be independent of their type. This means that more lower value following firms are willing to merge. But for a fixed value offer, ρ will depend on the updated information about the following firm's value, which creates a correlation between ρ and the new firm's value. When I assume full information is revealed at $t = 1$, negative correlation between ρ and Ω is implied. Now the ownership percentage of the following firm in the new firm, $1 - \rho$, increases with its type, which encourages high type following firms to merge. In the view of following firms, the disappearance of asymmetric information encourages high value following firms to merge,

and the premium increases with higher values. Good following firms like information to be fully revealed, because only then can they use their good quality as an advantage.

The fixed value offer S_Y encourages high value following firms to merge. However, low value following firms can also increase the value of the economy by creating synergy in mergers. But in a fixed ratio stock offer, its nature of not using information advantage discourages high value following firms from entering into the merger. A collar stock offer partially overcomes these problems by combining the advantages of two offers and offsetting their weaknesses. So it is not only optimal for the leading firm, but also more desirable to the whole economy.

The leading firm cannot write the collar offer directly contingent on the underlying states of the following firm, since at the effective date the state variable is not a marketable claim. A second set of equations is needed to determine the price range, P^+ and P_+, in the collar offer. The price range of the collar is given by:

$$P^+ = x^+ \tag{3.22}$$

$$P_+ = y + w(x_+, y) - S_+ \tag{3.23}$$

The following firm with value x^+ receives no premium in the merger process. The market price at $t = 1$ is its original value, which is equation (3.22). What the following firm with value x_+ will receive is given in equation (3.23). We can verify that the market valuation function of the following firm at $t = 1$ is continuous. The market valuation of the following firm is the sum of its original value and the premium received from the merger.

If we write the whole function as $P(x)$, $P(x)$ is continuous in x and we will always have $P(x') > P(x)$ if $x' > x$. In the collar offer, the following firm with higher type will always receive higher value in the new firm.

Similar to Proposition 5, we have:

Proposition 7 *If the leading firm is uninformed about the following firm's value as defined in Section 3.2, the leading firm's net gain from the optimal collar offer decreases with its true value.*

Given the specifications of a collar offer, I also find the following characteristics of collar offers:

Lemma 8 *x_+ is increasing with x^+, and the difference between x_+ and x^+ is also increasing with x^+.*

Corollary 9 *P_+ is increasing with P^+, and the bounds of collar are wider when the collar upper boundary, P^+, is higher.*

The proof of Lemma 8 is straightforward. Lemma 8 is true for any fixed ratio offer, which is not necessarily the optimal. One direct result from Lemma 1 is Corollary 9, which states that the range for the part of fixed ratio offer is larger when the cap of the collar is high because x_+ and x^+ move in the same direction but at different speeds.

Unless the optimal collar stock offer has x_m^* outside of $\underline{x}$ and $\overline{x}$, the optimal stock offer has a feature of *collar*, which specifies the lower boundary price (floor) and the upper

boundary price (cap) of the trading range. Between this range, the agreement is in the form of a fixed ratio offer. The lower boundary is decided by the upper boundary that the leading firm chooses. Implied by Corollary 1, the range is larger when the cap is higher.

It is not necessary to have all the specifications I list above to form an optimal stock offer. Depending on the optimal decision, collar offers can take different forms:

(1) If $x^+ \geq \overline{x}$ and $x_+ \leq \underline{x}$, the offer looks just like a fixed ratio offer. The leading firm only needs to specify λ.

(2) If $x^+ \leq \underline{x}$, it will be a fixed value offer.

(3) If $x^+ \in (\underline{x}, \overline{x})$ and $x_+ < \underline{x}$, the leading firm only needs to specify λ and S^+ without specifying P^+, P_+. The offer will appear to give the following firm two choices, which can be indeed observed in the market.

(4) Otherwise, it looks like an offer with collars.

All of these forms can be found in merger proxy statements. The problem is whether they are the result of optimal collar stock offers or not, which needs further empirical analysis.

In Section 3.2, I have discussed different forms of stock offer in two information environments. I focused on the situation where the leading firm knows only its own value, and makes the offer to the following firm, who knows both firms' values. A collar offer is preferred to other forms, since it provides higher expected gain for the leading firm.

Now, if we look at the example of IBM and XYZ again, we can obtain some information from the merger agreement. For example, if there is an agreement of collar offer between IBM and XYZ Inc., it is more likely that XYZ Inc. is uncertain of IBM's real value and is in an advantage position of negotiation process. However, if the agreement is a fixed value stock offer, besides this possibility, there exists another possibility that IBM has all the bargaining power and has all the information of XYZ Inc.'s value.

3.3 Discussions

3.3.1 Negative synergy and costs

In previous sections, negative synergy is largely ignored because both the leading firm and the following firm can walk away from the merger agreement without any cost at $t = 1$. If a merger creates negative synergy, at least one firm's payoff from the merger will be negative. Thus it would never accept such an offer. Based on the assumption of zero cost, the conclusion that collar offers are preferred by the uninformed leading firm is reached. Would collar offers be still preferred when costs are considered?

In a merger process, costs such as research input, legal fees, and accounting fees are inevitable. There are also some intangible costs such as reputation and information. For example, the accounting information and business strategies of a firm in a merger process might become more vulnerable to competitors or the other firm in the merger. To simplify the analysis, two types of costs are considered in the following discussion: the first type of cost, a deadweight cost, occurs between the merger announcement and completion; the second type of cost, a termination cost, is purely incurred when a firm enters the agreement

and decides to walk away later. The information environment that the leading firm is uninformed and the following firm is informed will be discussed here again.

The following firm is informed of the leading firm's value y. The deadweight cost on the following firm will change its incentive constraint: its gain from the merger has to be higher than the cost rather than zero. If the leading firm faces no cost and the deadweight cost is the same for different following firms, then the leading firm's strategy will be unchanged. The leading firm needs to offer a higher percentage to the following firm. However, the relationship between fixed ratio offers and collar offers remains the same. The leading firm can always find a better collar offer given any fixed ratio offer. The same conclusion can be reached when fixed value offers and collar offers are compared. The intuition is straightforward. The cost on the following firm can be thought of as a friction in the economy, which is the same to different offer forms and does not change the fact that collar offers attract a broader range of following firms. At the same time, the cost cannot be higher than the highest possible synergy. Otherwise none of the three offer forms will be feasible. Facing the termination cost, the following firm's incentive constraint does not change. The results in the previous section prevail.

It is more interesting to consider the cost on the leading firm's side, since the leading firm is uninformed and makes the first move. For this moment, we ignore the cost on following firms. If the leading firm has to take deadweight costs, there is only one addition consideration added to its strategy. The leading firm will not only choose the offer form that gives the highest payoff among three offer forms, but also compare the highest payoff to the cost. Only if the highest payoff exceeds the cost, will the leading firm make

the first move. However, this type of cost on the leading firm has no effect on the difference among the three offer forms. As discussed before, collar offers are more likely to be socially desirable. This cost does not change the result. Still, no merger with negative synergy can take place. At $t = 1$, the deadweight cost is already in place, any negative synergy only decreases one or both firms' payoff.

However, the termination cost on the leading firm might change our results, because the chance that a merger goes through is different among offer forms. The expected cost would be different when the termination cost is considered for the leading firm. Collar offers are more likely to go through than the other two offer forms, which decreases the probability that the termination cost occurs. Overall, collar offers are still preferred by the leading firm and the result is enforced when the termination cost exists. In the view of the whole economy, the termination cost on the leading firm will cause some mergers with negative synergies to go through. The inefficiency is because of the information asymmetry at $t = 0$. The termination cost only occurs at $t = 1$ if the leading firm decides to walk away. The collar offer as other offer forms cannot prevent some mergers with negative synergy from going through, but it still encourages high value following firms to go with the mergers and utilizes those potential economy resources. In this sense, the collar offer is still more likely to be socially desirable.

The reason that negative synergy combined with costs do not change the main results we have is because of the assumption that there exists a positive relationship between the synergy and the following firm's value. We have assumed $\frac{\partial[w(x,y)-x]}{\partial x} > 0$ or $\frac{\partial w(x,y)}{\partial x} > 1$. If this assumption is relaxed, collar offers may not be the preferred form for the leading

firm. For example, if a high value following firm creates negative synergy while a low value firm creates positive synergy, a fixed ratio stock offer will be preferred. However, it is more realistic to expect a firm with high quality assets to have more potential. Or we can think it is easier for a leading firm to create higher synergy when it obtains higher quality assets from the following firm.

3.3.2 Another form of collar offer

In the model, I assume that the true values of the leading and the following firms are constant through the periods. The uncertainty involved in the initial agreement is unknown new information regarding the future values. The period between the initial agreement and the effective date gives both firms and the market some time to alleviate the uncertainty problem. In reality, the firms in M&A attract more research and attention from the market, which helps to resolve the uncertainty. However, the same period may create another effect that actually brings more uncertainties into the M&A process. The market is changing. The underlying values of two firms may also change during this period, which also needs to be considered when the leading firm gives the offer. I call the first effect as the information updating effect and the second as the value changing effect.

Intuitively in the information updating process, a fixed value offer S_Y can take advantage of the information by luring higher value following firms into accepting the merger agreement, while a fixed ratio offer can keep the lower value following firms in the merger. However, in the long run, if the underlying asset of the following firm is changing in a way that a present good-type firm is more likely to be a bad-type firm in the future, the second

effect may dominate the first effect. In this case we will have a different form of collar offer.

For example, I still assume the leading firm knows only its own value, and the following firm knows not only its value but also the leading firm's value. I also assume the conditional distribution of the following value at $t = 1$ is:

$$H\ (v \mid x).$$

Here x is the value of the following firm at $t = 0$. v is the value of the following firm at $t = 1$. H as a distribution formula is common knowledge. Suppose $H(v \mid x_1)$ is first-order stochastically dominated by $H(v \mid x_2)$ when $x_1 > x_2$. The present good following firm has a higher probability to go bad at $t = 1$ than the present bad following firm. This is like a mean reverting process.

I use a fixed value offer S_Y as an illustration. Given a fixed value offer S_Y, the following firm x^* has:

$$y + \int w(v, y) dH(v \mid x^*) - S_Y = \int v dH(v \mid x^*).$$

We may have:

$$y + \int w(v, y) dH(v \mid x) - S_Y \geqq \int v dH(v \mid x)$$

when $x \leq x^*$ under some parameters. In this situation, the following firm with a value lower than x^* accepts the offer, which is the opposite of the situation in the first effect. And if the following firm is given a fixed ratio offer, higher value following firms are more willing to accept the offer. (Here high values refer to the value at $t = 0$.) Following similar analysis, as in Section 3.2, we can arrive at a collar offer with a fixed value offer between upper and

lower boundaries and two fixed ratio offers outside of the collar range. I call this form of collar offer a fixed value (FV) collar offer and the form in Section 3.2 a fixed ratio (FR) collar offer. A FV collar offer has a fixed value feature between collar boundaries, while a FR collar offer has a fixed ratio feature between the cap and the floor of a collar.

Overall, if the value changing effect dominates the information updating process, we still have collar offer as a preferred offer form even though the exact form may be different: FV collar or FR collar.

3.4 Empirical Implications

The model in this essay proposes that a collar offer is an optimal stock offer form for a leading firm to maximize its net gain given its uncertainty about the following firm's value. The model does not specify a bidder or a target to avoid the confusion of different meanings implied by those terms. Therefore, the first step to draw empirical implications from the model is to match the commonly used terms, bidder and target, to the terms used in previous sections.

In the model, a collar offer is characterized by S^+, P^+, λ, P_+, and S_+. As in Section 2, P^+ and P_+ are the following firm's prices, and S^+ or S_+ goes to the leading firm under certain conditions. If the APY-AFC example in Section 1 is adopted, simply matching S^+, P^+, λ, P_+, and S_+ to the offer terms in the merger agreement shows that P_+ and P^+ are equivalent to \$36 and \$41 respectively. At the same time, S^+ and S_+ are similar to the roles of \$34 and \$32 respectively. λ is implied by .85714. These imply that the target firm,

APY, in the example takes the role of a leading firm of the model, because P_+ and P^+ are written on AFC's price. So the target firm takes the role of a leading firm and the bidder firm plays the role of a following firm. When a target firm has more bargaining power and is concerned about the uncertainty of a bidder firm's value, there exists a probability that a collar offer could be chosen.

Given the match between a leading firm (a following firm) and a target (a bidder), an immediate implication of the model is that no collar should be used in hostile tender offers. In tender offers, a firm that openly bids in the market usually intends to gain the control of another firm. The first firm is called the bidder because of its action and its intention. The other firm is called the target. The bidder firm bids directly for the shares owned by shareholders. There is no negotiation and the bidder has all the bargaining power. There is no base for the existence of collar offers. As reported in Officer (2003) and in the next chapter of this dissertation, there exists no collar offer in tend offers since the first appearance of collar offer in 1991.

This observation that a target firm is more likely to take the role of a leading firm is not surprising. Based on event studies, empirical evidence indicates that excess returns to shareholders of target firms are significantly positive after merger announcements. The average excess return is 20%-25% and increases over the last decade. While excess returns to shareholders of bidder firms are only around 1%. Though it is not clear why excess returns to shareholders of target firms are significantly higher than bidder firms, it implies that target firms might have more bargaining power to maximize their payoffs from a merger.

Collar offers provide target firms with an optimal form to offer proper incentives

for bidder firms to engage in mergers, such that target firms' net gain could be maximized. When a merger agreement is announced, the market reaction to the news would incorporate the information of method of payment. The market should more favor target firms with collar offers than target firms with fixed value or fixed ratio offers, since collar offers bring higher expected gain to target firms. However, this implication considers the possibility that target firms are prevented from adopting the optimal form for themselves. If there is no such constraint that prevents target firms from using collar offers, fixed value or fixed ratio offers ought to be special forms of collar offers. Then the market should treat collar offers, fixed ratio and fixed value stock offers the same. It is impossible that all the assumptions in the model will be satisfied in empirical environment. The assumption that target firms have all the bargaining power is surely not always true. Thus it is unlikely to think fixed value or fixed ratio stock offers observed are always the special form of collar offers. However, collar offers always imply dominating bargaining power of target firms and higher net gains. Excess returns to shareholders of target firms should be higher in mergers with collar offers than with fixed ratio or fixed value stock offers. There should be no difference between excess returns with fixed value offers and with fixed ratio offers.

If fixed value offers or fixed ratio offers observed in the market are not the special form of collar offers, the information of bidder firms' values could be inferred from offer forms. On average, higher value bidder firms are more likely to engage in fixed value stock offers and lower value bidder firms are more likely to engage in fixed ratio stock offers. Collar offers do not provide much information about bidder firms' values, because collar offers are designed to encourage different types of bidder firms to carry on with merger

agreements. Even though some fixed value and fixed ratio stock offers observed in the market are probably special forms of collar offers, on average it is still expected to see different announcement effects on the side of bidder firms. Suppose the market price of a bidder firm is the average price given the uncertainty of the bidder firm's true value before a merger announcement. A merger announcement with fixed value stock offers makes the market infer that the bidder firm involved has a true value higher than the average; a merger announcement with fixed ratio stock offers is more likely to let the market think that the bidder firm's true value is lower than the average. The model implies different announcement effects for bidder firms: excess returns to shareholders of bidder firms are higher in fixed value offers than in fixed ratio offers; excess returns to shareholders of bidder firms in collar offers are more likely to be in the middle.

The model provides some empirical implications that extend the scope of studies of method of payments. The effect on target firms will be called wealth effect, and the effect on bidder firms will be called information effect. Though it is not the goal of this essay, the study of stock offers might provide us with a way to look into the incentives for bidder and target firms to involve in a merger. If the wealth effect and the information effect associated with stock offer forms do exist in empirical results, the reason why target firms are not able or perhaps not willing to use collar offers might give us additional information about the incentives besides value maximization.

3.5 Conclusion and Future Work

This paper provides a theoretical analysis of stock exchange in mergers and acquisitions. I find that a collar offer is the preferred form of stock exchange when the following firm has private information of its own value. A fixed ratio offer discourages high value following firms from accepting an offer because high value following firms cannot get a portion of the synergy. Collar offers dominate fixed ratio offers setting a maximal gain for the leading firm and leaving the rest of the synergy to the following firm. A fixed value offer S will not be accepted when the synergy of the merger is small though still positive. A collar offer dominates it by promising lower value following firms a proportion of the synergy regardless of its value. In this world, any unsuccessful merger, which has potential positive synergy, is inefficient because it forgoes potential synergy in the economy. A collar offer is a more efficient channel to increase the welfare of the leading firm as well as social welfare, since collar offers encourage more following firms to accept and allow mergers to go through.

From another perspective, my model justifies the positive wealth effects brought by regulations. In fact regulations in mergers and acquisitions play an important role in the choice of optimal strategies. Regulations create a time gap between the merger agreement and completion, in which asymmetric information is more likely to be resolved. It makes it possible that collar offers can take advantage of the information revelation process and result in better strategies not only for the leading firm, but is also ex post beneficial to the whole economy.

This paper does not explore the effect of more complicated bargaining processes on the determination of stock offer forms. The model is analyzed under the assumption that one firm has all the bargaining power and makes a take-it-or-leave-it offer. One way to incorporate different bargaining scenarios is to assume the following firm's incentive constraint is above a certain level rather than only zero. That the following firm is guaranteed to have payoffs above a pre-determined value can be thought as a reduced form of bargaining. In this setting, the level can be determined as a result of different bargaining powers. For example, if it could be assumed that the leading firm has only 80% of the bargaining power in the negotiation process, in equilibrium the level will be the value accepted by the leading firm to make 20% of the expected synergy go to the following firm. This is like a two-step negotiation. After determining the base level, the following firm still faces a take-it-or-leave-it offer. If this is the case, the main results will not change. More complicated bargaining scenarios such as renegotiation need the consideration of two-sided asymmetric information. Also, in the future work, it would be interesting to study the effect of other contractual terms such as break-up fee on stock offer forms.

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Chapter 4

Stock Offers in Mergers and Acquisitions: Empirical Evidence

4.1 Introduction

Merger outcomes may be influenced by agency problems (Jensen and Meckling (1976)) and manager preferences for private benefits of control (Grossman and Hart (1986), Hart and Moore (1990)), or "power" (Rajan and Zingales (1998)). The existing empirical evidence has not been able to clearly distinguish among the different motives of mergers. By examining different stock offer forms, I provide empirical evidence suggesting that acquiring firms trade value for control rights in stock mergers. The acquirer (more likely the acquiring firm's manager) obtains control of the newly merged firm. In compensation of losing control, the target firm is given more power in deciding offer forms to maximize its expected gain from the merger.

The empirical analysis is based on the study of stock offers. The difference between stock offers and cash offers has been well addressed,[1] while the existence of various stock offers is largely ignored in previous literature. The stock offer is usually considered as a single category compared to the cash offer. However, fixed ratio (FR) stock offers, fixed value (FV) stock offers and collar offers not only have different payment arrangements, but also represent different ownership structures.

The structural variation embedded in stock offers naturally raises the first question in this paper: are there differences among various stock offers? A short answer would be yes, given the empirical findings in this chapter. Analyzing a detailed dataset consisting of 780 mergers using stock offers between 1991 and 2000, I find that target firms' average announcement abnormal return is the highest in collar offers. For example, the difference between the average abnormal return of target firms in collar offers and that in FR stock offers is 5.79% during the three-day period around merger announcements. The acquirer's announcement abnormal return in fixed ratio stock offers is significantly lower than that in fixed value stock offers or in collar offers. The findings are robust when such factors as the relative size of target to acquirer, the systematic risk (and the unique risk) of target and acquirer, and the industry difference are controlled. More importantly, I find that the endogeneity problem, which arises because the choice of stock offers is an endogenous decision, cannot be ignored. A two-stage probit least squares model is used to account for this concern.

In Chapter 3 of this dissertation, I argue that firms should always choose collar

[1] In Hansen (1987), Fishman (1989), and Eckbo, Giammarino and Heinkel (1990)

offers to maximize their payoffs from mergers.[2] However, empirical evidence shows that collar offers are not frequently chosen. The announcement effects also show that the market reacts differently to collar offers and other stock offers. It appears that firms' behavior is not consistent with the objective of value maximization, which would favor the use of collar offers, and I argue that this is due to firms' desire for control rights. The announcement effects for both the target and acquirer can be jointly explained by the hypothesis that the prior objective of the acquirer is control rights instead of value maximization. I extend the discussion in the latter sections.

Stock offers lead to varying ownership structures. "Empire building" acquirers prefer larger targets, which might enable larger target firms to use collar offers to obtain higher payoffs. However, the empirical evidence in this chapter shows that a collar offer is less likely to be used when the target firm's size is large relative to the acquiring firm. The empirical findings also show that the likelihood of choosing a collar offer over a FR offer increases when the relative size of target to acquirer is small, and decreases when it is large. One possible explanation is the control rights issue. When the control rights of acquiring firms are not threatened, larger target firms are more likely to choose collar offers. However, when their control rights are threatened, even though the acquirer abnormal return in FR offers is significantly lower than in other stock offers, acquirers choose to fix the future ownership percentage. The results support that value maximization is not always the first objective of acquiring firms in mergers. Control rights are more likely to be the major concern of acquiring firms. The choice of different stock offers provides a good setting to

[2]FV stock offers or FR stock offers can be the special form of collar offers.

explore the incentives in mergers from a new perspective.

The rest of this chapter is organized as follows. Section 4.2 reviews related literature and summarizes the contributions of this chapter. In Section 4.3, the empirical findings of the announcement effects of stock offers are presented. I propose a hypothesis of the prior objective of acquiring firms in Section 4.4. Section 4.5 shows that value maximization may not be the prior objective of acquirers in mergers. Section 4.6 concludes this chapter.

4.2 Motivations and Contributions

4.2.1 Motivations

Though fixed value stock offers and collar offers represent a significant proportion of stock offers in the 1990s, they are treated inconsistently when the wealth effects associated with methods of payment are studied. Often fixed value stock offers and collar offers are treated the same as fixed ratio stock offers, such that the difference existing among stock offers is ignored. Chapter 3 develops a model that explains that forms of stock offers are different because of their implications of future payoffs and ownership structures. Though Chapter 4 is not a direct test of the model in Chapter 3, it is motivated to seek whether or not there is empirical evidence that the market reaction to different forms of stock offers consists of different wealth effects for target and acquiring firms. As reviewed in Chapter 3, existing theories have not distinguished different wealth effects associated with different stock offers. One motivation of this chapter is to examine whether the theoretical differences among different forms of stock offers may indicate inadequate empirical comparisons across different methods of payment.

Stock offer forms represent different combinations of future ownership structures and payoffs. In a fixed ratio stock offer, the future ownership percentage after merger completion is fixed and determined at the announcement day, while the payoff value depends on the acquiring firm's future stock price. In a fixed value stock offer, the value of the transaction is fixed, while the ownership percentage will depend on the acquiring firm's future stock price. In a collar offer, both the payoff and the ownership percentage rely on the acquiring firm's future stock price right before the merger completion. So, stock offer forms may be a good forum in which to examine the trade-off of value and control rights for firms in mergers. This chapter is also motivated to explore the trade-off.

4.2.2 Related literature

In the area of research that focuses on the wealth effects associated with the method of payment in mergers and acquisitions, literature such as Hansen (1987), Fishman (1989), Eckbo, Giammarino and Heinkel (1990), and Berkovitch and Narayanan (1990) has provided insightful analysis. Unlike cash, stock offers involved in mergers and acquisitions are usually more complicated, and can take such forms as fixed value stock offers, fixed ratio stock offers and collar offers. The choice between these has not been well studied with a few exceptions such as Houston and Ryngaert (1997), Fuller (2000) and Officer (2003).

Our focus is different from the previous literature. Houston and Ryngaert (1997) use conditional stock offers in bank mergers to test for evidence of adverse selection. Their study concerns the relation between bidder abnormal announcement returns and bid elasticity. The authors argue that if adverse selection influences the choice of method of payment

(i.e. overvalued bidders choose to offer stock to target shareholders) then the bidder's abnormal announcement return should be significantly higher in bids that are the most cash-like (low elasticity) than in stock-like (high elasticity) bids. Their study does not look at announcement effects of stock offer forms on the target firm's side. Officer (2003) finds that the inclusion of a collar significantly reduces the probability of contract revisions and increases the likelihood that a merger is successfully completed. Fuller's (2000) study is the closest to ours. She also examines announcement effects of different stock offer forms. However, she does not consider that the choice of stock offers as an endogenous decision. We find the ignorance of the endogeneity problem can cause potential problems regarding the wealth effects associated with methods of payments. We find some different results from hers.

4.2.3 Contributions

One contribution of this chapter is that it provides empirical evidence that the market does not treat all stock offers the same. This is reflected in the significant difference in announcement effects for target and acquiring firms. In this empirical study, the information of 780 stock mergers between 1991 and 2000 is collected. The stock mergers are categorized as fixed ratio (FR) stock offers, fixed value (FV) stock offers and collar offers according to the descriptions of the merger agreements. I find that collar offers are associated with higher abnormal returns for target firms. The target announcement abnormal return in FV stock offers is also significantly higher than in FR stock offers. I also look at the effect on the acquirer side. I find the average abnormal return of acquiring firms from FV stock offers (and from collar offers) is significant higher than that from FR stock

offer. The empirical results show that the wealth effects associated with stock offers are not necessarily the same across different forms for target firms and acquiring firms.

More importantly, our empirical results account for the endogeneity problem. The endogeneity problem is usually overlooked in previous model estimations. Typically the method of payment is treated as exogenous, and is captured as dummy variables along with other independent variables in cross-sectional analysis. However, the two firms' choice of a form of stock offer is an endogenous decision, which is affected by factors including their expectation of the market reaction. I find that not accounting for the endogeneity problem causes inconsistency. The difference between the target announcement abnormal return in collar offers and that in FR stock offers disappears when stock offers are considered as exogenous decisions. I use two-stage probit least squares model to incorporate endogeneity in the empirical test.

The other contribution of this chapter is that, by looking at stock offers, I find that the prior objective of acquiring firms in mergers is not value maximization, but more likely maintaining control rights. To some extent, FV stock offers have a similar payoff arrangement as cash offers. There also exists similarity between the mixture offers of cash and stock in Eckbo, Giammarino and Heinkel (1990) and collar offers in this chapter. In Hansen (1987), Fishman (1989), and Eckbo, Giammarino and Heinkel (1990), they all have empirical implications that the bidder abnormal return should be higher in a cash offer.[3] We find similar empirical support for the bidder abnormal return. But the implications for the target abnormal return in Hansen (1987) and Fishman (1989) are ambiguous. Eckbo,

[3]In Eckbo, Giammarino and Heinkel (1990), the bidder abnormal return in mixture offers is sandwiched between that in cash offers and in stock offers.

Giammarino and Heinkel (1990) suggest that the target abnormal return is independent of the medium of exchange. They all implicitly assume that the two firms are maximizing their payoffs from the merger. However, as suggested by Shleifer and Vishny (1988), value maximization may not be the objective of mergers. There are other objectives such as control rights.

I find that the announcement effects for both the target and the acquirer can be jointly explained by the acquirer's objective of control rights. When the prior objective of the acquirer is control rights, it is willing to sacrifice shareholders' value. The market interprets that a FR stock offer allows the acquirer to lock in future control rights in the agreement. By doing that, the acquirer's manager may sacrifice shareholders' value. At the same time, the target firm's flexibility to maximize payoffs is also limited by a FR stock offer. The market will anticipate that the target firm may not be able to achieve the same payoff as with another offer form. So, the market reacts less favorably to both the target and the acquirer in FR stock offers.

To formally test whether the prior objective of acquiring firms is value maximization or control rights, I develop a hypothesis that links the likelihood of a collar offer to the relative size of target to acquirer. When larger target firms are involved, acquirers place more importance on keeping control. If the acquirer's objective is value maximization, the likelihood of choosing a collar offer is independent of the relative size of target to acquirer. Otherwise, there may exist a relationship between relative size and the distribution of forms of stock offers. "Empire building" acquirers' preference allows larger target firms to have a better bargaining position in the negotiation, so that the likelihood of collar offers should in-

crease with relative target size. However, this positive relationship must satisfy a condition that the larger target size and the choice of stock offer form cannot threaten the acquirer's control rights. The structure of collar offers may place some threats to the acquirer's control rights because of the uncertainty of future ownership structure contained in collar offers. So, we expect that the positive relationship will turn negative when relative target size gets fairly large. I find a concave relationship between relative size and the likelihood of collar offers from the sample. The evidence supports that the prior objective of acquiring firms in mergers is not value maximization, but more likely control rights.

4.3 Announcement Effects of Stock Offers

In this section, I present the empirical findings of announcement effects of different stock offer forms. The data is introduced first. The univariate analysis provides preliminary evidence that the average abnormal return of target firms in collar offers is significantly higher than in other stock offers. In the cross-sectional analysis, when the endogeneity problem is controlled, the empirical evidence suggests that there are significant wealth effects associated with stock offer forms for targets and acquirers.

4.3.1 Data

A sample of mergers announced between 1991 and 2000 is collected from the Securities Data Corporation's (SDC) Merger and Acquisitions database. To be included in the sample, it is required that:

1. the value of the transaction is more than $10 million;

2. the target is a U.S. firm;

3. the acquirer objective is for a controlling (at least 51 percent) interest in the target;

4. the acquirer is not making a tender offer;[4]

5. the merger is successful (i.e., not pending or not rejected by shareholders);

6. the transaction involves a stock offer;

7. both acquirers and targets have enough data on the CRSP and Compustat databases to compute meaningful statistics.

The final sample includes 780 bids, of which 194 (24.9%) feature collar terms. I trace the news releases of merger announcements via Lexis/Nexis News Wires to confirm the collar features. In many cases, the news provides enough information of the collar structure. When the information in the news release is not enough, I searched the Edgar database for the official merger announcement in the SEC filings. In most of cases, the first news appearance of a merger in Lexis/Nexis is on the same day as the merger announcement.

Table 4.1 summarizes the sample distribution across years, the values of transactions, and the length of pre-closing periods within each year. I divided the sample into two categories: (i) stock offers with no collar and (ii) collar offers, where merger agreements describe the collar features. Stock offers with no collar are further divided into fixed value stock offers and fixed ratio stock offers. Some collar offers can be clearly categorized into fixed value collar offer or fixed ratio collar offer[5] given collar descriptions. If a collar offer

[4]Officer (2002) reports virtually no tender offers recorded on SDC include collar provision. Our findings confirm it.

[5]We define a fixed value collar offer as a collar offer that has clear upper and lower boundaries and specifies the fixed value to exchange between two boundaries. A fixed ratio offer is a collar offer that has

cannot be decided between fixed value or fixed ratio collar offer, it is categorized as other collar offers.

As indicated in Table 4.1, a pure stock offer is the most popular method of payment in our sample. Of the total 780 mergers in the final sample, 586 (75.1%) mergers use stock offers with no collar features. A FR stock offer is more often used than a FV stock offer: 480 and 106 respectively. 24.9% of stock offers have collar provisions in the merger agreements. There is no apparent cluster of particular offers in years except that stock offers are increasingly used from 1997 to 1999, which may relate to the booming stock market around that period. I show the distribution of the collar sample in Panel B of Table 4.1. The first collar offer recorded in SDC is in 1991.[6] Since then, the use of collar offers has been gradually increasing. There is no cluster of collar offers in a particular year. From 1991 to 2000, we have 194 mergers with collar offers in our sample.

Panel C lists the value of transactions and the length of pre-closing period in the same categories as Panel A. I define the length of a pre-closing period as the days between the date of merger announcement and the effective date. The value of transactions is provided by SDC for each merger.[7] In the sample, the average value of transactions is $1521.7 million. However, the distribution of the value of transactions is extremely skewed with a median of only $202.2 million. It is driven by some mega-mergers included in the sample such as the merger of Time Warner Inc. and AOL in 2000. There exist significant differences between FV stock offers and FR stock offers. The median value of transactions in FV stock offers

clear upper and lower boundaries and specifies the fixed ratio to exchange between two boundaries.

[6]The collar offer recorded in 1991 is not included in the final sample.

[7]The value of transactions is usually calculated using the market prices of the last trading day before merger announcements. So the value of transactions is not the realized value but expected value given by SDC.

is only half of the one in FR stock offers. The average value of transactions in collar offers is lower than in stock offers with no collar, while the median is almost the same. Collar offers have the longest pre-closing period, and FV stock offers have the shortest pre-closing period. The difference between median days is usually four weeks. Panel D reports the value of transactions and the length of pre-closing periods for the collar sample. The median of value of transactions in mergers with collar offers is similar to the median of total samples. There is no significant difference across sub-categories of collar offers.

4.3.2 Univariate analysis

The announcement effect is captured by the announcement day abnormal return. Using market model event methodology, I estimate the abnormal stock returns for the acquirer and the target based on daily return data. Market model parameters are estimated over day -200 to day -21 using continuously compounded firm and CRSP equally-weighted market returns, where day 0 is the announcement date of the merger. The daily abnormal stock return, calculated for each firm i, is then averaged for the N firms to obtain the average abnormal returns:

$$AR_t = \frac{1}{N}\sum AR_{it} = \frac{1}{N}\sum(R_{it} - \widehat{\alpha}_i - \widehat{\beta}_i R_{mt}) \tag{4.1}$$

Here R_{it} is the continuously compounded return of firm i on day t, R_{mt} is the CRSP equally-weighted market return on day t, $\widehat{\alpha}_i$ is the estimated alpha of firm i in the market model, $\widehat{\beta}_i$ is the estimated beta of firm i in the market model, AR_{it} is the abnormal return of firm i on day t, and AR_t is the average abnormal return on day t. We also calculate the average cumulative abnormal return: CAR_3 (from day -1 and day 1), CAR_5 (from day -2 to day

2), and CAR_7 (from day -3 to day 3). The CARs and AR_0, the announcement day average abnormal return, for acquirer and target are reported in Table 4.2.

I divide the stock offers into several sub-samples: stock offers without collar features, collar offers, fixed ratio stock offers, fixed value stock offers, fixed ratio collar offers, and fixed value collar offers. The means of abnormal returns and cumulative abnormal returns of sub-samples for bidders and targets are compared to zero using a two-tailed t-test . The means between sub-samples are also compared using a one-tailed t-test.

I reported the AR_0 and the CARs for targets and compared the means in Table 4.2. The targets' abnormal returns are significantly positive in each category. The simple comparison clearly shows that the average abnormal return for targets in collar offers is significantly higher than that in FV and FR stock offers. At the announcement day, the average target abnormal return in collar offers is higher than that in other stock offers by 1.45%. The difference is even more significant when the CAR_7s are compared. During the 7 days around the announcement, the cumulative abnormal return of the target firms in collar offers is 2.35% higher than that in other stock offers. When I examine sub-categories: FR and FV stock offers to FR and FV collar offers, the results sustain in most cases. If we increase the significance to the 15% level, all the results are significant. The market reaction to collar offers is more favorable than to other stock offers.

There is no significant difference between the abnormal returns of targets in FV stock offers and in FR stock offers. At the announcement day, the difference is only 0.33%.

The difference between the cumulative abnormal returns becomes -0.62% during the 7 days around the announcement. Neither is significant.

In Table 4.2, the AR_0 and $CARs$ for acquirers in FR stock offers are all negative and significant at the 1% level. For example, the announcement day abnormal return for acquirers in FR stock offers is -2.25%, which is significant at the 1% level. The results for acquirers in fixed value stock offers are not decisive. The AR_0 for acquirers in FV stock offers is negative and significant at the 1% level, while the CAR_5 is not significant.

Table 4.2 also shows that the AR_0 and the $CARs$ for acquirers in FR stock offers are significantly smaller than in FV stock offers at the 1% level. For example, at the announcement day, the average abnormal return of the acquiring firms in FR stock offers is lower than in FV stock offers by 1.39%. In fact, the average abnormal return of the acquiring firms is -0.86% in FV stock offers, -0.988% in collar offers and -2.25% in FR stock offers.

The same comparison is done between the AR_0 and the $CARs$ for acquirers in FR collar offers and FV collar offers. The differences of the AR_0 and the $CARs$ for acquirers in FR and FV collar offers are not significant. To further examine the announcement effect, I also compare the AR_0 and the $CARs$ for acquirers in FR stock offers to FR and FV collar offers, and for acquirers in FV stock offers to FR and FV collar offers. We find the means for acquirers in FR stock offers are significantly smaller than the means for acquirers in either collar offer. However, it is not the same for FV stock offers. Only the CAR_3 for acquirers in FV stock offers is significantly larger than in FV collar offers.

The report of abnormal returns for the target and the acquiring firms and the simple comparison of means show that the market does not treat different stock offer forms the same. The market reaction to target firms in collar offers are more positive than to those in other stock offers. Acquiring firms in FR stock offers receive lower negative abnormal return than in FV stock offers or in collar offers.

4.3.3 Cross-sectional analysis

From the examination of abnormal returns, I find the market reacts differently when different methods of payment are used. A better way to show results more convincingly is to add control factors and do a cross-sectional analysis. However, before we are able to conduct a cross-section analysis, we have to be careful with the selection of factors. In the following analysis, I will define the variables used. Then I will argue that the endogeneity problem is a relevant concern. I will show that an OLS analysis gives different results from using simultaneous equations to do the cross-sectional analysis.

Definition of variables:

The variables used in the analysis are defined as:

LOGACQ (LOGTAR): the natural logarithm of an acquiring firm's (target firm's) market value four weeks prior to merger announcement.

RSIZE: the market value of a target firm divided by market value of an acquiring firm.

INDUSTRY: an industry dummy variable. (=0, if the first three digits of SIC codes of two firms are the same; =1, otherwise).

ACQVAR (TARVAR): the standard deviation of an acquiring firm's (target firm's) stock daily returns in the market model estimation period.

ACQBETA (TARBETA): the acquiring firm's (target firm's) beta in the market model, which is the proxy for the acquiring firm's (target firm's) market risk.

ACQURISK (TARURISK): the standard deviation of residuals of the market model in the estimation period for the acquiring firm (target firm), which is the proxy for the acquirer's (target's) unique risk.

YEAR: equals 0 if the merger is announced between 1997 and 2000, and 0 otherwise.

Endogeneity problem and simultaneous equations:

Most previous studies on wealth effects of the method of payments treat offer forms as exogenously given and typically treat them as dummy variables along with other independent variables such as relative size, industry dummy and year dummy. (e.g. Travlos (1987), Chang (1998)) One exception is Eckbo, Maksimovic and Williams (1990) though their intent was consistent estimation in event studies. They conclude when an event is voluntary and investors are rational, standard OLS and GLS estimators are inconsistent. They use event studies in horizontal mergers as an example and show a truncated regression model can do a better job. Acharya (1993) uses a latent variable model to deal with an endogenous event. However, in their models the effect that decision makers are also rational is missed.

In fact, offer forms in stock exchanges are endogenous choices rather than exoge-

nous decisions. The decision of the stock offer form is probably affected by factors such as information asymmetry, the relative size of the two firms, the uncertainty of firms' values, etc. The choice is also affected by the two firms' expectations of the market's reaction to their choice. Investors and the two firms are all rational. The market's reaction should sustain the two firms' expectation in equilibrium. For the purpose of my study, I think two simultaneous regression equations are more appropriate to deal with endogeneity in my model. The pair of simultaneous equations is written as:

$$\begin{aligned} y_1^* &= \gamma_1 y_2^* + \beta_1' X_1 + \epsilon_1 \\ y_2^* &= \gamma_2 y_1^* + \beta_2' X_2 + \epsilon_2 \end{aligned}$$

Here X_1 and X_2 are two vectors of exogenous variables. y_1^* and y_2^* are continuous latent random variables. This is a standard pair of simultaneous equations. In my study, I think the observations of two latent variables are y_1 and y_2. I assume:

$$\begin{aligned} y_1 &= y_1^* \\ y_2 &= 1 \text{ if } y_2^* > 0 \\ y_2 &= 0 \text{ otherwise} \end{aligned}$$

Thus y_1 can be thought as the announcement effect or the abnormal return in this study. y_2 is the dummy variable or choice variable of offer forms. In fact, Eckbo, Maksimovic and Williams (1990) and Acharya (1993) deal with a special case of the simultaneous equations above. Their approach implies γ_2 is zero, which implies that the decision of offer forms does not consider the market reaction. However, the concern of the announcement effect should enter into the choice of the offer form in certain ways.

The estimation of simultaneous equations uses a standard two-stage process as in Heckman (1978). In the first stage, only exogenous variables are used to fit two equations. The first equation is estimated via OLS and the second equation is estimated via a probit model. In the second stage, the original endogenous variables on right hand side of equations are replaced by respective estimated variables from the first stage. Then OLS and probit model are used again. The final step of the procedure is the correction of standard errors.

γ_1 is the key coefficient. If the market does infer different information from stock offer forms, γ_1 should be significant. In the first equation of the pair, the control variables include LOGACQ (LOGTAR) and YEAR. In the second equation, the control variables include RSIZE, INDUSTRY, ACQBETA, ACQURISK, TARBETA, and TARURISK. Previous empirical research suggests there exists higher uncertainty when the target and the acquiring firms are in different industries. I use the variable INDUSTRY to capture this factor.

Results of cross-sectional analysis:

The results of simultaneous equations are reported in Table 4.3.[8] For comparison, we also report regression results via OLS using the dummy choice variable, RSIZE, INDUSTRY, and YEAR as independent variables. I compare five pairs of choices: FV stock offer and collar offer, FR stock offer and collar offer, stock offer and collar offer, FV and FR stock offer, and FV and FR collar offer in Panel A to E respectively.

In the first part of Panel A, the standard OLS estimation gives very different results

[8]Only the results using the three-day cumulative abnormal returns are reported in Table 4.3. The results are similiar when other measures of the abnormal returns are used.

compared to the simultaneous equations. In the standard OLS estimation, the choice of FR stock offer or collar offer has no different announcement effect. There is no significant difference in the target firm's abnormal returns. However, in the simultaneous equations, I_DUM is significantly positive, which means that the target firm's abnormal return is higher in collar offers than in FR stock offers. In the univariate analysis, the difference is 1.81% on average. Here, the difference is increased to 5.79%. In the second equation with DUM as the dependent variable, RSIZE and INDUSTRY are significant factors. The significantly positive coefficient of the variable INDUSTRY suggests that a collar offer is more likely to be used when there exists asymmetric information between the two firms. The negative sign of RSIZE shows that a collar offer is less likely to be chosen over a FR stock offer when the relative size of the target to the acquiring firm is large. As for the acquirer's abnormal return in the second part of Panel A, the result also shows ACQRET is significantly higher in collar offers than in FR stock offers, which is similar to the result obtained from the univariate analysis. It is interesting to see INDUSTRY factor is no longer significant. The acquiring firms are less concerned with the uncertainty between the two firms.

In Panel B, almost no coefficient is significant. A FV stock offer looks very similar to collar offers. The target abnormal return in FV stock offers is not significantly different from that in collar offers. This result is different from the univariate analysis. FV stock offers are perceived very similar to collar offers. This finding is confirmed in Panel D. The target firm's abnormal return is higher in FV stock offers than in FR stock offers by almost 10%. However, at the same time, the acquirer's abnormal return is also higher by 5%.

In Panel C, when I compare stock offers to collar offers, I find that the abnormal return of the target in collar offers is significantly higher than in other stock offers. From the results above, it is more likely driven by FR stock offers. As in Panel E, there is no significant difference between the target firm's abnormal return in FV collar offers and that in FR collar offers. There is also no evidence of significant difference between the acquirer's abnormal returns in FV collar offers and in FR collar offers.

After considering endogeneity problem, the test shows that target firms in collar offers receive more positive response from the market than other stock offers. FV stock offers are very similar to collar offers in terms of the target abnormal return and the acquirer abnormal return. The acquirer's abnormal returns in both FV stock offers and collar offers are significantly higher than in FR stock offers. Overall, different stock offer forms present significantly different announcement effects in the market. Overlooking the different implication of stock offer structures could cause potential problems.

4.3.4 Discussion

The wealth effects associated with stock offer forms extend the scope of previous studies of methods of payment. Previous literature has explored this issue in the context of cash versus stock offers. Eckbo, Giammarino, and Heinkel (1989), Huang and Walkling (1987), Travlos (1987), and Wansley, Lane, and Yang (1983) all report significantly higher bidder and target returns from cash offers than from stock offers. If we ignore the ownership structure in FV stock offers, FV stock offers are very similar to cash offers in terms of the contractual feature of payments. Indeed, the announcement effects show that the acquirer

abnormal return from FV stock offers or collar offers is significantly higher than that from FR stock offers. In the models of Hansen (1987), Fishman (1989), and Eckbo, Giammarino and Heinkel (1990), the bidders intend to use cash offers when they have more favorable private information. This explains why the stock prices of bidders react more favorably to cash than to stock or other securities. Collar offers have a more complicated structure than the mixture offers of cash and stock in Eckbo, Giammarino and Heinkel (1990). But to some extent, collar offers provide similar balance between certainty and uncertainty of payoffs. The acquirer abnormal return from collar offers is significantly higher than that from FR stock offers, and is lower than that from FV stock offers.

However, the theories mentioned above cannot explain why the target's stock price reacts in the same fashion as the bidders. In Eckbo, Giammarino and Heinkel (1990), the announcement effect on the target's stock price is independent of the method of payments. In Hansen (1987) and Fishman (1989), the implications are ambiguous. We find the announcement effects on the target's and acquirer's stock prices can be jointly explained by the theory that the acquirer's objective is not value maximization, but maintaining control rights.

The theoretical work on methods of payment relies on the implicit assumption that two firms maximize value. However, if the market understands that the acquirer's prior objective is to obtain control rights, the market will not react favorably to FR stock offers. Because the market expects that the acquiring firm has a stronger incentive to fix the control rights by making a FR stock offers. By doing that, the acquirer (more likely the manager) trades off shareholders' value for the benefit of control. At the same time,

the target firm is constrained from using other stock offers but FR stock offers. This limits its flexibility of maximizing the payoff from the merger. The problem can be consistently explained from the target's point of view. The target firm will lose control rights of the new firm. In compensation of that, the acquirer lets the target obtain higher payoffs from the merger. When the target firm knows that the acquiring firm has private information about the new firm's future, it prefers FV stock offers or collar offers to eliminate (or partially eliminate) the uncertainty. When the acquiring firm uses FR stock offers to fix its control rights in the new firm, conditional on a FR stock offer, the target maximizes it payoff but the uncertainty about the acquirer's value cannot be resolved. Thus, the market react less favorably to the target firm in FR stock offers.

The announcement effects found in this section are consistent with the explanation that the prior objective of the acquiring firm may not be value maximization. The acquirer trades value for control rights. To formally test this explanation, I develop a hypothesis in the next section.

4.4 Value maximization versus control rights

The empirical findings show that target firms in collar offers have a higher average announcement abnormal return than in other stock offers. Then why are collar offers not always used by target firms? It might be because target firms are constrained by their relative bargaining positions in mergers or by the incentives of acquiring firms.

The determinants of relative bargaining positions and the objectives of firms in merger negotiations are many. Firms in stronger bargaining positions may become the

acquirer in an acquisition (e.g. Stulz (1988)); however, conditional on being an acquirer, outcomes such as payoffs from the merger vary by incentives to negotiate the synergy allocation. "Empire building" acquirers prefer larger targets since manager compensation may be determined by firm size as suggested by Morck, Shleifer and Vishny (1990), or because they gain more power, prestige, and standing in the business community (Avery, Chevalier, and Schaefer (1998)). These acquirer preferences give a larger target firm greater bargaining power. When the acquirer's objective is not value maximization but more power and control, there may be a positive correlation between the target firm's size and its relative bargaining position in the merger negotiation.

It is easy to think that IBM has more bargaining power than a small technology firm. However, it is not always that case. The implicit assumption of the example is that IBM has the incentive to maximize its payoff. However, Shleifer and Vishny (1988) states that "In choosing the acquisition targets the (bidder) manager is guided by a number of objectives other than value maximization". In a merger, the target firm will most likely lose the control of the new firm, which is the reason why it is called the target. Between control rights and payoffs, the target firm's objective is value maximization. The acquiring firm's objective is more complicated. To take the role of the acquirer, one of the acquiring firm's objective may be control rights. At the same time, value maximization could also be an objective. Even managers interested only in entrenching themselves will enter into synergistic mergers since this would increase their own value to shareholders. The structure of stock offers, which have different combinations of merger payoffs and control rights, provides an opportunity to explore the prior objective of acquirers.

To explore what is the prior objective, a hypothesis is formed as:

H(a). If the prior objective of the acquiring firm is control rights, the probability of a collar offer is increasing with the relative size of the target to the acquiring firm when the relative size is small; the probability of a collar offer is decreasing with the relative size when the relative size is large.

Suppose the acquiring firm's prior objective is to obtain control of the new firm. When the target relative size is large, the uncertainty of control rights embedded in a collar offer threatens the acquiring firm. When the target relative size is large, the possibility that the target firm could have higher ownership percentage and threaten the acquiring firm's dominate control of the new firm is higher. The acquiring firm will be more strongly against an agreement with a collar offer. The acquirer will prefer a FR stock offer such that its future ownership percentage in the new firm is fixed when the merger is announced. If the target relative size is small, the threat is insignificant. As discussed above, the non-value-maximizing acquirer preference gives a larger target firm better relative bargaining position to choose a collar offer, since the target abnormal return in collar offers is higher than in FR stock offers. However, the better bargaining position of a larger target firm should not threaten the acquirer's control rights of the new firm.

The alternative hypothesis is:

H(b). If the prior objective of the acquiring firm is value maximization, the probability of a collar offer is not related to the relative size of the target to the acquiring firm.

When two firms' objectives are both value maximization, their focus is the allocation of the potential synergy. There is no necessary link between the target relative bargaining position and its size. A larger size does not guarantee the target firm a better bargaining position in the merger negotiation process.

4.5 Why not collar offers

The different announcement effects associated with different stock offer forms is documented in the cross-sectional analysis above. In the hypothesis above, I propose that the choice of an offer form is the result of the trade-off between value maximization and the acquiring firm's objective of control rights.

In this section, I find that the likelihood of a collar offer increases with the relative size of the target to the acquirer when the relative size is small, while the likelihood decreases when the relative size is large. This results follows when control rights are the prior concern of acquiring firms rather than value maximization.

4.5.1 Logistic regressions

The choice of stock exchange form depends on such factors as information asymmetry, the uncertainty of the two firms's values, the relative size of the two firms, etc. The multinomial logistic regression shows the effect of these factors on the probability that a particular form is chosen. Suppose there are m unordered choices indexed with $j = 0, 1, ..., m-1$. The probabilities are:

$$\Pr(Y = j) = \frac{\exp(B_j X)}{\sum_{k=0}^{m-1} \exp(B_k X)} \qquad j = 0, 1, 2, ...m-1$$

Here Y is the choice variable. X is a vector of variables that are related to the decision making. B_j is the coefficient vector. So, we have:

$$B_j X = \alpha + \beta_{1j} X_1 + \beta_2 X_2 + ... + \beta_{nj} X_n,$$

when there are n variables. Usually we use $j = 0$ as the reference choice and set $B_0 = 0$.

First I use binary logistic analysis to look at factors affecting different binary choices of stock exchange, then use multinomial logistic regression to look at the choices of a fixed value stock offer, a fixed ratio stock offer, and a collar offer. The results are reported in Table 4.4.

4.5.2 Larger RSIZE decreases the likelihood of collar offers

I hypothesize that the relative size of the target firm to the acquiring firm affects the likelihood of different offer forms. Here, the relative (target to bidder) market value is used as the proxy for the relative size. Not considering other factors, the relative size is usually positively correlated with the target firm's ability to maximize its payoff in a merger, when the acquirer's prior objective is not value maximization. In the hypothesis *H(b)*, the likelihood of a collar offer is not related to the relative size, if both firms try to maximize their payoffs from the merger.

Previous empirical literature suggests there exists higher uncertainty when the target and the acquiring firms are in different industries. I use the variable INDUSTRY to capture this factor. As predicted by Chapter 3, it is expected to see higher uncertainty between two firms increases the likelihood that a collar offer would be chosen. To understand if the choice of a collar offer is because of the risk-aversion of a target firm, I also include ACQVAR in the logistic regressions. If the risk-aversion is a concern, we should expect to find a collar offer is more likely to be chosen when ACQVAR is higher. I also try to separate market risk and unique risk of an acquiring firm to check the effect of unique risk when

market risk is perceivable. Similar risk variables for the target firm are also included in the analysis.

I use two models in the regressions. Model 1 is:

$$\begin{aligned} BX &= \alpha + \beta_1 RSIZE + \beta_2 INDUSTRY + \beta_3 ACQVAL \\ &\quad + \beta_4 TARVAL + \varepsilon \end{aligned}$$

And Model 2 is:

$$\begin{aligned} BX &= \alpha + \beta_1 RSIZE + \beta_2 INDUSTRY + \beta_3 ACQBETA \\ &\quad + \beta_4 ACQURISK + \beta_5 TARBETA + \beta_6 TARURISK + \varepsilon \end{aligned}$$

In Panel A of Table 4.4, I report the results of binary logistic regressions. Between two choices: FV stock offer ($Y = 1$) and FR stock offer ($Y = 0$), the coefficient of RSIZE is significantly negative at the 10% level in model 1 and is not significant in model 2. Comparing the FV stock offer to the FR stock offer, I can not find evidence that RSIZE is associated with FV stock offers. Instead, I find mergers between different industries are more likely to use FV stock offers over FR stock offers, because the coefficient of INDUSTRY is significantly positive in both models. The result also shows the acquirer's unique risk is a significant factor in determining the choices between FR and FV stock offer. When the acquirer's unique risk is higher, the probability of a FR stock offer is higher than that of a FV stock offer. Though the second hypothesis does not suggest the decision between a FV stock offer and a FR stock offer, the result in the cross-sectional analysis shows that FV stock offers are treated very similar to collar offers by the outside investors. So, it is not surprising to see that INDUSTRY is a significant factor.

In the binary logistic regression with the FR stock offer ($Y = 0$) and the collar offer ($Y = 1$) as choice variables, I find RSIZE, INDUSTRY and ACQURISK are significant factors. The probability of a FR stock offer over a collar offer increases when the relative size of the target to the acquirer is large, the target and the acquirer are in the same industry, or the acquirer's unique risk is high. The coefficient of RSIZE is significant, which rejects *H(b)*. The likelihood of a collar offer over a FR stock offer is decreasing with the relative size. Though a collar offer is more favored by the market for the target firm, the target firm's chance of having a collar offer is not positively correlated with its size. On contrary, the chance is less when the target firm's market value is relatively larger compared to the acquiring firm. This rejects the hypothesis that value maximization is the prior concern of acquiring firms.

The significant positive coefficient of INDUSTRY is consistent with the results of Chapter 3. When there exists higher uncertainty of the acquirer's value, a collar offer encourages more types of acquiring firms to accept the offer and increases the expected gain from the merger. Because the characteristics of industries are different, there might exist more asymmetric information between two firms in different industries. ACQURISK is also significant. The design of a collar offer uses perceivable information. However, the acquirer's unique risk is an unpredictable factor, which discourages a collar offer to be written. As for the collar offers and the FV stock offers, no factor is significant. This, again, confirms the explanation that the market treats a FV stock offer similar to a collar offer.

If we can think that firms are given a menu with the collar offer, the FV stock offer and the FR stock offer after the method of payment is chosen as by stocks, a multinomial

logistic regression is more appropriate. In the multinomial logistic regression, I show the results with both collar offers and FR stock offers as the comparison groups in Panel B of Table 4.4. The results are similar to binary logistic regressions. As a summary of the results, when three choices are jointly determined, I find: (1). Between FV stock offers and FR stock offers, RSIZE, INDUSTRY and ACQURISK are significant factors. (2). Between FR stock offer and collar offer, RSIZE, INDUSTRY and ACQURISK are significant factors. (3). Between FV stock offer and collar offer, there is no significant factors.

4.5.3 Control rights are the prior concern

The hypothesis that value maximization is the prior objective is rejected in the logistic test. RSIZE has been entered into the logistic regression as a factor in determination of offer forms. However, two effects are embedded in this variable. First, RSIZE is hoped to capture the impact of the size on the bargaining position of target firms. Second, RSIZE also contains factors that may threaten the acquiring firm's future control of the new firm.

To separate these two effects, I divide the sample of stock offers and collar offers into three equally-sized groups: large RSIZE, medium RSIZE, and small RSIZE by the order of RSIZE. I use multinomial logistic regression in three groups and report the results in Table 4.5. When the FR stock offers are compared to the collar offers, in the large RSIZE group, RSIZE is significantly positive with the p-value 0.05. In the medium RSIZE group, the coefficient of RSIZE is still positive but not significant any more. In the small RSIZE group, the coefficient becomes negative with the p-value 0.17. There exists a clear trend of the coefficient of RSIZE. When the relative size of the target to the acquiring firm is

large, the larger size becomes a factor against the target to have more bargaining power to maximize its payoff. Only when the relative size is small, does it contribute to increasing the target firm's bargaining power. The findings support the hypothesis *H(a)*.

My explanation is that the acquiring firm is more concerned with the control rights in the merged firm when the target firm's size is relatively large. And the uncertainty of the control right decreases the equivalent utility the acquiring firm could obtain from the merger. The ownership percentage of an acquirer in the new firm is the prior concern. When a target firm's size is relatively large, the ownership percentage for the target firm is higher, which threatens the control of the acquirer. A FR stock offer fixes the ownership percentage, thus eliminating the uncertainty of the acquirer's control rights. A collar offer creates some degree of uncertainty in the ownership percentage. The finding suggests that the acquiring firm is willing to let the target firm have more bargaining power to obtain higher payoffs from the merger, when the merger does not threaten the acquirer's first objective: getting the control of the new firm. If the threat is realistic, the acquiring firm is only willing to allow the target firm to obtain higher payoffs by agreeing to fix the future ownership structure. The evidence is consistent with Shleifer and Vishny (1988) but not with Roll's (1986) over-optimistic theory.

This control concern of acquirers is also shown on the ACQURISK variable in Table 4.5, when the whole sample is used. If the FR stock offer is the comparison group, higher ACQURISK decreases the probability that either a collar offer or a FV stock offer is chosen. When the unique risk of an acquirer's return is higher, the uncertainty of the acquirer's ownership in the new firm becomes higher. Because acquirer firms are risk averse

towards the control uncertainty, they would prefer the FR stock offer to the collar offer or the FV stock offers, thus the unpredictable factor will not enter into the offer form and will not affect the final ownership percentage.

I also use simultaneous equations in three RSIZE groups to examine if the announcement effect is the same given the concern of control rights. The results for the small RSIZE and the large RSIZE groups are shown in Table 4.6. When the FR stock offers are compared to the collar offers, in the small RSIZE group, the difference between two forms disappears. It is because the small RSIZE group already limits the bargaining power of the target. However, in the large RSIZE group, for the target firm, I_DUM becomes significantly negative. The market considers that a collar offer is not a good signal of the target firm's bargaining position when the relative size is large and threatens the acquiring firm's control rights. In another perspective, this confirms that the control right is the primary concern in the negotiation process for the acquiring firm. As for the acquiring firm, I_DUM is also negative, which is consistent with the previous result. In the large RSIZE, for the target firm, the market reaction to a collar offer is more favorable than to a FV offer. It can be explained that a collar offer has a fixed ratio range, thus the uncertainty of control rights in a collar offer is not as high as in a FV stock offer.

So, my explanation of why we do not observe more collar offers is that the acquirers have the prior objective of maintaining control rights. The target firms have limited bargaining powers, when the acquiring firms are threatened by the uncertainty of future control rights. Empirically, it is reflected as more collar offers observed when the relative size of target to acquirer is small, but less observed when the relative size is large. The

empirical evidence shows that the acquiring firms have objectives other than value maximization, but care very much about control rights. The hypothesis *H(a)* is supported, and *H(b)* is rejected by the empirical findings. Though the market favors the target firms in collar offers, the choice is constrained by the relative size and the potential control threat to acquirers. The empirical findings suggest that there exists the behavior of "value for control" between the two firms. The acquiring firm obtains the control of the new firm, while the target firm gets more payoffs from the merger.

4.6 Conclusion

Different stock offer forms are examined empirically in a large sample with detailed information of collar offers. Because the firms' choice of offer forms is endogenously determined, I used a two-stage probit least squares model to solve the endogeneity problem. The empirical findings shows that stock offer forms are associated with different wealth effects. I find that the abnormal return of target firms in collar offers is higher than that in FR stock offers. The acquirer's announcement abnormal return in FR stock offers is significantly lower than that in FV stock offers or collar offers.

The results show the relative size of the target to the acquirer is an important factor in determination of offer forms. When the relative size is large, I find a FR stock offer is more likely to be used than a FV stock offer or a collar offer, because the acquirer uses the FR stock offer to eliminate any uncertainty of control right. The study of stock offer forms provides a unique angle to examine the incentives of stock mergers.

My findings are consistent with Shleifer and Vishny's (1988) theory. The acquirer (more likely the acquiring firm's manager) obtains control of the newly merged firm. In compensation of losing the control, the target firm is given more power in deciding offer forms to maximize its expected gain from the merger. However, the target's choice of offer form also depends on the bargaining power in the merger process, and the choice cannot threaten the acquirer's control. I find when a target's size is relatively large, which means the acquirer preference gives the target better bargaining position, a collar offer is preferred to a FR stock offer. But at the same time, the larger relative size increases the uncertainty of control rights for the acquirer. The acquirer intends to accept FR stock offers. Thus, why we do not observe more collar offers is because of the acquirer's prior concern of control rights.

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Table 4.1. Sample distribution

This table shows the distribution of the merger sample from 1991 to 2000, the distribution of a sub-sample of mergers that has collar features from 1991 to 2000, and descriptions of mergers' value of transaction and the period length between announcement and closing. In Panel A, the numbers of mergers are listed under different categories. In "stock offers with no collar", the method of payment is 100% stock exchange but without collar features. Under this category, FR stock is fixed ratio stock offer without collar feature; FV stock is fixed value stock offer without collar feature. In Panel B, the sub-sample distribution of collars is listed from 1991 to 2000. In Panel C, V is the value of transaction ($M) and T is the length of pre-closing period (days). Medians are in parenthesis.

Panel A: Distribution of the merger sample across year

	Number of mergers in the sample				
	Stock offers with no collar			Collar Offers	All
	FR stock	FV stock	Total		
1991	0	22	22	0	22
1992	17	4	21	10	31
1993	22	3	25	16	41
1994	19	10	29	18	47
1995	68	12	80	24	104
1996	50	19	69	16	85
1997	69	8	77	26	103
1998	63	12	75	24	99
1999	75	12	87	40	127
2000	97	4	101	20	121
Total	480	106	**586**	**194**	**780**

Panel B. Distribution of collar offers across year

	Number of mergers in the sample				
	Stock offers (with no collar)	Collar offers			Total Collar
		FR collar	FV collar	Others	
1991	22	0	0	0	0
1992	21	1	2	7	10
1993	25	4	5	7	16
1994	29	5	6	7	18
1995	80	6	12	6	24
1996	69	7	6	3	16
1997	77	5	16	5	26
1998	75	7	14	3	24
1999	87	4	32	4	40
2000	101	5	11	4	20
Total	586	44	104	46	194

Panel C: Value of transaction and pre-closing period of the merger sample.

Year	Stock offers with no collar						Collar offers	
	FR stock offer		FV stock offer		All stock offers			
	V	T	V	T	V	T	V	T
1991			704.2	162.6	704.2	162.6		
1992	229.5	181.8	474.4	155	276. 1	176. 7	258. 7	261
1993	464.9	162.5	98.9	137.3	421. 0	159. 44	1334. 3	192. 8
1994	344.3	173.6	84.0	141.9	254. 5	162. 7	609. 8	183. 9
1995	892.6	172.9	255.2	213.1	797. 0	178. 9	346. 6	150. 7
1996	1148.9	163.2	162.4	133.2	877. 2	155. 0	585. 6	123. 0
1997	732.4	147.7	120.5	189.1	668. 8	152. 0	285. 5	146. 9
1998	3092.0	169.1	282.0	143.3	2642. 4	165. 0	1296. 4	162. 2
1999	2848.5	157.5	449.3	191.8	2517. 6	162. 2	1222. 3	161. 8
2000	3870.8	121.6	481.9	170.8	3736. 6	123. 5	1863. 7	170. 6
Total	2027. 6	**154.9**	342. 8	**163.5**	1722. 8	156. 4	913. 9	165. 9
	(227. 5)	**(137)**	(121. 8)	**(114.7)**	(203. 8)	(137)	(191. 3)	(149. 5)

Panel D. Value of transaction and pre-closing period of collar offers

	All collars		FR collars		FV collars	
	V	T	V	T	V	T
1992	258.7	261	162.00	290	125.4	270.67
1993	1334.3	192.8	904.96	133.50	265.77	220
1994	609.8	183.9	1060.72	149.22	155.23	173.85
1995	346.6	150.7	385.57	139.11	334.44	157.15
1996	585.6	123.0	336.94	111.44	857.34	171.23
1997	285.5	146.9	302.51	146.11	2596.98	150.96
1998	1296.4	162.2	1990.48	132.78	1292.60	151.22
1999	1222.3	161.8	989.87	130.67	1340.29	147.98
2000	1863.7	170.6	1304.84	163.86	2572.72	170.08
Total	913. 9 (191. 3)	165. 9	**857.18 (151.96)**	**152.35**	**1343.05 (308.85)**	**161.67**

Table 4. 2. Abnormal returns and comparisons of means

Acquirer and Target average abnormal returns (AR_0) and cumulative abnormal returns (CAR_3, CAR_5, and CAR_7) are given in this table. AR_0 is the announcement day abnormal return. CAR_i (i=3, 5, 7) is the cumulative 3 day, 5 day and 7 day abnormal returns respectively. The mergers are classified by pure stock offer (Stock), collar offer (Collar), fixed ratio stock offer with no collar (FR stock), fixed value stock offer with no collar (FV stock), fixed ratio collar offer (FR collar), and fixed value collar offer (FV collar). We reported results of two-tail t-test of means, and compare the means of different categories using one-tail t-test. (The alternative hypothesis is that the means of the column categories are larger than the means of the row categories correspondingly.) *, **, and *** indicate the t-test is significant at the 10%, 5% and 1% levels respectively.

Panel A

Acquirer abnormal returns (AR_0)

Stock	Collar	FR stock	FV stock	FR collar	FV collar
-0.01778***	-0.00988***	-0.0225***	-0.0086***	-0.0070	-0.0119***

Comparison of means for acquirer abnormal returns

	Collar	FR stock	FV stock	FR collar	FV collar
Stock	-0.0079***			-0.011**	-0.0059*
Collar		0.0126***	-0.0012		
FR stock			-0.0139***	-0.0156***	-0.0106***
FV stock				-0.0016	0.0033
FR collar					0.0049

Target abnormal returns (AR_0)

Stock	Collar	FR stock	FV stock	FR collar	FV collar
0.1067***	0.1211***	0.1019***	0.1052***	0.1245***	0.1338***

Comparison of means for target abnormal returns

	Collar	FR stock	FV stock	FR collar	FV collar
Stock	-0.0145*			-0.0179	-0.0271**
Collar		0.0193*	0.0159		
FR stock			-0.0033	-0.0227	-0.0319**
FV stock				-0.0194	-0.0286*
FR collar					-0.0092

Panel B

Acquirer 3-day cumulative abnormal returns (CAR_3)

Stock	Collar	FR stock	FV stock	FR collar	FV collar
-0.0269***	-0.0175***	-0.0338***	-0.0057	-0.0079	-0.0181***

Comparison of means for acquirer abnormal returns

	Collar	FR stock	FV stock	FR collar	FV collar
Stock	-0.0094**			-0.0190**	-0.0087*
Collar		0.0163***	-0.0118**		
FR stock			-0.0281***	-0.0260***	-0.0157***
FV stock				0.0021	0.0124**
FR collar					0.0103

Target 3-day cumulative abnormal returns (CAR_3)

Stock	Collar	FR stock	FV stock	FR collar	FV collar
0.1559***	0.1715***	0.1534***	0.1399***	0.1863***	0.1824***

Comparison of means for target abnormal returns

	Collar	FR stock	FV stock	FR collar	FV collar
Stock	-0.0155*			-0.0304	-0.0265**
Collar		0.0181*	0.0316**		
FR stock			0.0135	-0.0330	-0.0290**
FV stock				-0.0465*	-0.0425**
FR collar					0.0040

Panel C

Acquirer 5-day cumulative abnormal returns (CAR_5)

Stock	Collar	FR stock	FV stock	FR collar	FV collar
-0.0310***	-0.0148***	-0.0369***	-0.0122***	-0.0169	-0.0140**

Comparison of means for acquirer abnormal returns

	Collar	FR stock	FV stock	FR collar	FV collar
Stock	-0.0161***			-0.0139	-0.0169***
Collar		0.0221***	-0.0026		
FR stock			-0.0247***	-0.0200**	-0.0229***
FV stock				0.0047	0.0018
FR collar					-0.0029

Target 5-day cumulative abnormal returns (CAR_5)

Stock	Collar	FR stock	FV stock	FR collar	FV collar
0.1622***	0.1791***	0.1589***	0.1493***	0.1946***	0.1870***

Comparison of means for target abnormal returns

	Collar	FR stock	FV stock	FR collar	FV collar
Stock	-0.0169*			-0.0324	-0.0248*
Collar		0.0202*	0.0299**		
FR stock			0.0096	-0.0358	-0.0281**
FV stock				-0.0454*	-0.0377**
FR collar					0.0076

Panel D

Acquirer 7-day cumulative abnormal returns (CAR_7)

Stock	Collar	FR stock	FV stock	FR collar	FV collar
-0.0331***	-0.0196***	-0.0392***	-0.0098*	-0.0205	-0.0158**

Comparison of means for acquirer abnormal returns

	Collar	FR stock	FV stock	FR collar	FV collar
Stock	-0.0137*			-0.0128	-0.0175**
Collar		0.0196***	-0.0098*		
FR stock			-0.0294***	-0.0187*	-0.0234***
FV stock				0.0107	0.0060
FR collar					-0.0048

Target 7-day cumulative abnormal returns (CAR_7)

Stock	Collar	FR stock	FV stock	FR collar	FV collar
0.1657***	0.1892***	0.1604***	0.1542***	0.2043***	0.1981***

Comparison of means for target abnormal returns

	Collar	FR stock	FV stock	FR collar	FV collar
Stock	-0.0235**			-0.0387	-0.0324**
Collar		0.0287**	0.0349**		
FR stock			0.0062	-0.0439*	-0.0376**
FV stock				-0.0501*	-0.0439**
FR collar					0.0063

Table 4.3. Simultaneous equation estimations

Target and acquirer abnormal returns for different forms of stock exchanges are re-examined when endogeneity problem is considered. DUM is a dummy variable for choice of offer forms. RSIZE is the relative size of the market value of target firms to the market value of acquiring firms four weeks prior to merger announcement. LOGTAR (LOGACQ) is the natural logarithm of the market value of target firm (acquiring firm) four weeks prior to merger announcement. INDUSTRY is the industry dummy variable that is equal to 0 if target and acquiring firm's SIC codes have the same first three digits, and is equal to 1 otherwise. ACQVAR (TARVAR) is the standard deviation of acquiring firm (target firm) daily returns. ACQBETA (TARBETA) is the acquiring firm's (target firm) beta estimated in the market model. ACQURISK (TARURISK) is the standard deviation of residuals in the market model for acquiring firm (target firm). YEAR equals 1 if the merger is announced between 1997 and 2000, and 0 otherwise. *, **, and *** indicate the coefficient is significant at the 10%, 5% and 1% levels respectively.

Panel A

Panel A1: Fixed ratio stock offers vs. Collar offers

DUM=0 if FR stock offer

DUM=1 if collar offer

Target abnormal returns

OLS regression		Simultaneous equations			
TARRET		**TARRET**			
Constant	0.147***	I_DUM	0.0579***		
DUM	0.0070	Constant	0.195***		
RSIZE	-0.0761***	LOGTAR	-0.0064		
INDUSTRY	0.0202	YEAR	0.0414***		
YEAR	0.0246*				
				DUM	
				I_TARRET	-3.549
				Constant	0.514
				RSIZE	-0.886**
				INDUSTRY	0.289**
				ACQBETA	-0.0097
				ACQURISK	-8.060*
				TARBETA	-0.162
				TARURISK	-3.288

Panel A2: Fixed ratio stock offers vs. Collar offers

DUM=0 if FR stock offer

DUM=1 if collar offer

Acquirer abnormal returns

OLS regression

ACQRET	
Constant	-0.020***
DUM	0.0142*
RSIZE	-0.0141*
INDUSTRY	0.0040
YEAR	-0.201***

Simultaneous equations

ACQRET	
I_DUM	0.0484***
Constant	0.0083
LOGACQ	-0.1200
YEAR	-0.0119

DUM	
I_ACQRET	7.818
Constant	-0.084
RSIZE	-0.495**
INDUSTRY	0.167
ACQBETA	-0.0008
ACQURISK	-0.188
TARBETA	-0.060
TARURISK	-4.803

Panel B

Fixed value stock offers vs. Collar offers

DUM=0 if collar offer

DUM=1 if FV stock offer

Panel B1: Target abnormal returns

OLS regression		Simultaneous equations			
TARRET		**TARRET**			
Constant	0.179***	I_DUM	-0.0541		
DUM	-0.0342	Constant	0.227***		
RSIZE	-0.0863**	LOGTAR	-0.163		
INDUSTRY	0.0276	YEAR	-0.0326		
YEAR	-0.0227				
				DUM	
				I_TARRET	24.681
				Constant	-5.171
				RSIZE	2.510
				INDUSTRY	-0.524
				ACQBETA	0.608
				ACQURISK	-23.59
				TARBETA	-0.317
				TARURISK	28.22

Panel B2: Acquirer abnormal returns

OLS regression		Simultaneous equations			
ACQRET		**ACQRET**			
Constant	-0.0033	I_DUM	-0.0371		
DUM	0.0116	Constant	-0.0383		
RSIZE	-0.0465***	LOGACQ	0.0031		
INDUSTRY	-0.0073	YEAR	-0.0281		
YEAR	-0.0043				
				DUM	
				I_ACQRET	9.232
				Constant	-0.784**
				RSIZE	0.496
				INDUSTRY	0.190
				ACQBETA	0.236
				ACQURISK	-1.742
				TARBETA	-0.0597
				TARURISK	5.974

Panel C

Stock offers vs. Collar offers

DUM=0 if stock offer

DUM=1 if collar offer

Panel B1: Target abnormal returns

OLS regression		Simultaneous equations			
TARRET		**TARRET**			
Constant	0.177***	I_DUM	0.0841***		
DUM	0.0063	Constant	0.227***		
RSIZE	-0.270***	LOGTAR	-0.0062		
INDUSTRY	0.0162	YEAR	0.0248		
YEAR	0.0131				
				DUM	
				I_TARRET	-1.903
				Constant	0.202
				RSIZE	-1.682
				INDUSTRY	0.168
				ACQBETA	-0.0947
				ACQURISK	-3.757
				TARBETA	-0.0678
				TARURISK	-5.272

Panel B2: Acquirer abnormal returns

OLS regression		Simultaneous equations			
ACQRET		**ACQRET**			
Constant	-0.0048	I_DUM	0.0735***		
DUM	0.0084	Constant	0.0321		
RSIZE	-0.0816***	LOGACQ	0.0004		
INDUSTRY	0.0027	YEAR	-0.0173*		
YEAR	-0.0214***				
				DUM	
				I_ACQRET	-0.528
				Constant	-0.143
				RSIZE	-1.147**
				INDUSTRY	0.137
				ACQBETA	-0.104
				ACQURISK	-5.639
				TARBETA	-0.0802
				TARURISK	-4.107

Panel D

FV stock offers vs. FR stock offers

DUM=0 if FR stock offer

DUM=1 if FV stock offer

Panel B1: Target abnormal returns

OLS regression		Simultaneous equations			
TARRET		**TARRET**			
Constant	0.156***	I_DUM	0.0917**		
DUM	-0.0190	Constant	0.143***		
RSIZE	-0.0773***	LOGTAR	0.0089		
INDUSTRY	0.0158	YEAR	0.0891***		
YEAR	0.0141				
				DUM	
				I_TARRET	-20.558
				Constant	2.306
				RSIZE	-1.895*
				INDUSTRY	0.644
				ACQBETA	0.554
				ACQURISK	-11.598
				TARBETA	-0.274
				TARURISK	-2.267

Panel B2: Acquirer abnormal returns

OLS regression		Simultaneous equations			
ACQRET		**ACQRET**			
Constant	-0.0214***	I_DUM	0.0494***		
DUM	0.0215**	Constant	0.0129		
RSIZE	-0.0088	LOGACQ	0.0001		
INDUSTRY	0.0058	YEAR	0.0113		
YEAR	-0.0215***				
				DUM	
				I_ACQRET	30.748***
				Constant	-0.844***
				RSIZE	-0.187
				INDUSTRY	0.0624
				ACQBETA	0.271
				ACQURISK	27.038
				TARBETA	0.122
				TARURISK	-9.169

Panel E

FV collar offers vs. FR collar offers

DUM=0 if FR collar offer

DUM=1 if FV collar offer

Panel B1: Target abnormal returns

OLS regression		Simultaneous equations			
TARRET		**TARRET**			
Constant	0.169***	I_DUM	-0.0042		
DUM	0.0086	Constant	0.282***		
RSIZE	-0.088*	LOGTAR	-0.0190*		
INDUSTRY	0.0668**	YEAR	-0.0187		
YEAR	-0.0324				
				DUM	
				I_TARRET	-13.592
				Constant	3.322*
				RSIZE	-1.832
				INDUSTRY	0.691
				ACQBETA	-0.420
				ACQURISK	-1.490
				TARBETA	0.0159
				TARURISK	-1.068

Panel B2: Acquirer abnormal returns

OLS regression		Simultaneous equations			
ACQRET		**ACQRET**			
Constant	0.0151	I_DUM	0.0871		
DUM	-0.0235*	Constant	0.0459		
RSIZE	-0.0738***	LOGACQ	-0.0104		
INDUSTRY	-0.0036	YEAR	-0.0566		
YEAR	-0.0033				
				DUM	
				I_ACQET	-29.560
				Constant	2.370*
				RSIZE	-3.066
				INDUSTRY	-0.314
				ACQBETA	-0.517
				ACQURISK	-12.711
				TARBETA	-0.360
				TARURISK	-20.433

Table 4.4. Binary and multinomial logistic regressions

Logistic regression results are reported in this table. RSIZE is the relative size of the market value of target firms to the market value of acquiring firms four weeks prior to merger announcement. INDUSTRY is the industry dummy variable that is equal to 0 if target and acquiring firm's SIC codes have the same first three digits, and is equal to 1 otherwise. ACQVAR (TARVAR) is the standard deviation of acquiring firm (target firm) daily returns. ACQBETA (TARBETA) is the acquiring firm's (target firm) beta estimated in the market model. ACQURISK (TARURISK) is the standard deviation of residuals in the market model for acquiring firm (target firm). In Panel A, binary logistic regression is used. The dependent variable is 0 or 1 for two choices of stock exchange forms. In Panel B, multinomial logistic regression is used. The dependent variable is 0, 1, or 2. Two models were estimated. The independent variables in Model 1 are: Constant, RSIZE, INDUSTRY, ACQVAR, and TARVAR. The independent variables in Model 2 are: Constant, RSIZE, INDUSTRY, ACQBETA, ACQURISK, TARBETA, and TARURISK. *, **, and *** indicate the coefficient is significant at the 10%, 5% and 1% levels respectively. McFadden R^2 is also reported

Panel A. Binary logistic regression

	FR stock offer=0 FV stock offer=1		FR stock offer=0 Collar offer=1		Collar offer=0 FV stock offer=1		Stock offer=0 Collar offer=1	
	M1	M2	M1	M2	M1	M2	M1	M2
Constant	-0.935***	-1.062***	-0.0820	-0.0043	-0.867***	-1.027***	-0.323	-0.223
RSIZE	-0.780*	-0.568	-1.093***	-1.045***	0.143	0.176	-1.830***	-1.851***
INDUSTRY	0.544**	0.552**	0.369**	0.371**	0.197	0.199	0.228	0.227
ACQVAR	-25.487**		-15.340**		-8.198		-10.563	
TARVAR	1.701		-8.536		10.007		-9.131	
ACQBETA		0.249		-0.106		0.397*		-0.177
ACQURISK		-27.673***		-14.854**		-10.479		-8.966
TARBETA		-0.330*		-0.233		-0.1677		-0.125
TARURISK		3.151		-5.331		7.654		-6.807
McFadden R2	0.0453	0.0499	0.0435	0.0477	0.0058	0.0128	0.0285	0.0318

Panel B. Multinomial logistic regression

	FV stock offer (Y=1) FR stock offer (Y =2) : comparison group Collar offer (Y=3)				FV stock offer (Y=1) FR stock offer (Y =2) Collar offer (Y=3): comparison group			
	Model 1		Model 2		Model 1		Model 2	
	Y=1	Y=3	Y=1	Y=3	Y=1	Y=2	Y=1	Y=2
Constant	-7.60***	0.0110	-0.888***	0.0885	-0.771**	-0.0110	-0.976**	-0.0885
RSIZE	-2.312***	-2.228***	-1.913**	-2.180***	-0.090	2.228***	0.267	2.180***
INDUSTRY	0.527**	0.338*	0.531**	0.338*	0.189	-0.338*	0.193	-0.338*
ACQVAR	-22.331**	-13.964**			-8.368	13.964**		
TARVAR	-0.737	-9.327			8.590	9.327		
ACQBETA			0.226	-0.132			0.358	0.132
ACQURISK			-24.011**	-12.715*			-11.300	12.715*
TARBETA			-0.325*	-0.192			-0.133	0.192
TARURISK			0.743	-6.560			7.303	6.560
McFadden R2	0.0376		0.0410		0.0376		0.0410	

Table 4.5. Multinomial logistic regression in three RSIZE groups.

The sample of stock offers and collar offers is divided into three equally sized groups by the order of RSIZE. RSIZE is the relative size of the market value of target firms to the market value of acquiring firms four weeks prior to merger announcement. INDUSTRY is the industry dummy variable that is equal to 0 if target and acquiring firm's SIC codes have same first three digits, and is equal to 1 otherwise. ACQBETA (TARBETA) is the acquiring firm's (target firm) beta estimated in the market model. ACQURISK (TARURISK) is the standard deviation of residuals in the market model for acquiring firm (target firm). Multinomial logistic regression is used. The dependent variable is 0, 1, or 2. The independent variables are: Constant, RSIZE, INDUSTRY, ACQBETA, ACQURISK, TARBETA, and TARURISK. *, **, and *** indicate the coefficient is significant at the 10%, 5% and 1% levels respectively. P-values are reported in parenthesis.

Multinomial logistic regression

Y=0 if FV stock offer, Y=1 if FR stock, Y=2 if collar offer (comparison group)

	Small RSIZE		Medium RSIZE		Large RSIZE		Total	
	Y=0	Y=1	Y=0	Y=1	Y=0	Y=1	Y=0	Y=1
Constant	0.389	0.803*	0.026	-0.589	-2.839***	-0.553	-0.976***	-0.0884
	(0.563)	(0.094)	(0.974)	(0.301)	(0.003)	(0.403)	(0.005)	(0.719)
RSIZE	-26.764*	-14.84	-9.227*	3.488	3.549	3.146**	0.267	2.180***
	(0.066)	(0.170)	(0.092)	(0.337)	(0.110)	(0.050)	(0.788)	(0.001)
INDUSTRY	0.635	-0.401	0.280	-0.0237	-0.956*	-0.835**	0.193	-0.338*
	(0.110)	(0.181)	(0.516)	(0.938)	(0.072)	(0.014)	(0.431)	(0.056)
ACQBETA	-0.210	-0.080	0.420	0.491*	0.780*	-0.0026	0.358	0.132
	(0.579)	(0.760)	(0.289)	(0.067)	(0.083)	(0.994)	(0.102)	(0.397)
ACQURISK	-10.483	20.50	-19.74	1.942	-2.186	26.80	-11.30	12.715*
	(0.640)	(0.184)	(0.295)	(0.848)	(0.930)	(0.117)	(0.326)	(0.085)
TARBETA	-0.306	0.320	-0.066	-0.095	0.108	0.530	-0.133	0.192
	(0.384)	(0.207)	(0.861)	(0.721)	(0.812)	(0.106)	(0.531)	(0.212)
TARURISK	-2.787	-6.715	8.778	16.381*	22.95	3.716	7.303	6.560
	(0.837)	(0.518)	(0.543)	(0.089)	(0.309)	(0.822)	(0.379)	(0.719)
McFadden R2	0.0473		0.0507		0.0743		0.0410	

Multinomial logistic regression

Y=0 if FV stock offer, Y=1 if FR stock (comparison group), Y=2 if collar offer

	Small RSIZE		Medium RSIZE		Large RSIZE		Total	
	Y=0	Y=2	Y=0	Y=2	Y=0	Y=2	Y=0	Y=2
Constant	-0.413	-0.803*	0.615	0.589	-2.286***	0.553	-0.888***	0.088
	(0.504)	(0.094)	(0.400)	(0.301)	(0.004)	(0.403)	(0.004)	(0.719)
RSIZE	-11.93	14.84	-12.715***	-3.488	0.402	-3.146**	-1.913**	-2.180***
	(0.383)	(0.170)	(0.012)	(0.337)	(0.818)	(0.050)	(0.028)	(0.001)
INDUSTRY	1.036***	0.401	0.304	0.024	-0.121	0.835**	0.531**	0.338*
	(0.005)	(0.181)	(0.440)	(0.938)	(0.796)	(0.014)	(0.016)	(0.056)
ACQBETA	-0.130	0.080	-0.071	-0.491*	0.783**	0.0026	0.226	-0.132
	(0.712)	(0.760)	(0.841)	(0.067)	(0.029)	(0.994)	(0.243)	(0.397)
ACQURISK	-30.983	-20.50	-21.682	-1.942	-28.99	-26.80	-24.01**	-12.72*
	(0.132)	(0.184)	(0.217)	(0.848)	(0.152)	(0.117)	(0.019)	(0.085)
TARBETA	-0.626*	-0.320	0.029	0.095	-0.422	-0.530	-0.325*	-0.192
	(0.057)	(0.207)	(0.929)	(0.721)	(0.252)	(0.106)	(0.083)	(0.212)
TARURISK	3.927	6.715	-7.605	-16.383*	19.232	-3.716	0.743	-6.560
	(0.754)	(0.518)	(0.543)	(0.089)	(0.281)	(0.822)	(0.918)	(0.283)
McFadden R2	0.0473		0.0507		0.0743		0.0410	

Table 4.6. Simultaneous equation estimations in different RSIZE groups

Target and acquiring abnormal returns for different forms of stock exchanges are re-examined in RSIZE groups. The sample of stock offers and collar offers is divided into three equally sized groups by the order of RSIZE. Other variables are defined as in Table 8.

Panel A: FV stock offers vs. Collar offers

DUM=0 if collar offer

DUM=1 if FV stock offer

Small RSIZE group				**Large RSIZE group**			
TARRET				**TARRET**			
I_DUM	0.025			I_DUM	-0.057**		
Constant	0.191			Constant	0.130*		
LOGTAR	-0.001			LOGTAR	-0.001		
YEAR	-0.044			YEAR	-0.079		
		DUM				**DUM**	
		I_TARRET	4.692			I_TARRET	-6.169
		Constant	-0.481			Constant	-0.642
		RSIZE	-17.77			RSIZE	0.187
		INDUSTRY	0.213			INDUSTRY	-0.562
		ACQBETA	-0.286			ACQBETA	0.137
		ACQRISK	6.853			ACQURISK	5.454
		TARBETA	-0.340			TARBETA	0.444
		TARRISK	0.131			TARURISK	19.59
ACQRET				**ACQRET**			
I_DUM	0.011			I_DUM	0.0011		
Constant	-0.018			Constant	-0.025		
LOGACQ	0.0027			LOGACQ	0.0005		
YEAR	-0.022**			YEAR	-0.006		
		DUM				**DUM**	
		I_ACQRET	31.35			I_ACQRET	14.25
		Constant	-0.682			Constant	-2.74**
		RSIZE	-13.06			RSIZE	4.877
		INDUSTRY	0.515			INDUSTRY	-0.276
		ACQBETA	-0.350			ACQBETA	0.212
		ACQRISK	50.86			ACQURISK	34.70
		TARBETA	-0.176			TARBETA	0.114
		TARRISK	0.494			TARURISK	0.460

Panel B: FR stock offers vs. Collar offers

DUM=1 if FR stock offer

DUM=0 if collar offer

Small RSIZE group			
TARRET			
I_DUM	0.080		
Constant	0.227***		
LOGTAR	-0.014		
YEAR	0.017		
		DUM	
		I_TARRET	6.257*
		Constant	-0.661
		RSIZE	-3.260
		INDUSTRY	-0.444
		ACQBETA	-0.023
		ACQRISK	14.30
		TARBETA	0.037
		TARRISK	-6.793
ACQRET			
I_DUM	-0.0028		
Constant	-0.006		
LOGACQ	0.0005		
YEAR	-0.0112		
		DUM	
		I_ACQRET	-37.62
		Constant	0.753
		RSIZE	-18.30
		INDUSTRY	0.0159
		ACQBETA	0.307
		ACQRISK	-24.00
		TARBETA	0.150
		TARRISK	-6.139

Large RSIZE group			
TARRET			
I_DUM	-0.039***		
Constant	0.137***		
LOGTAR	-0.000		
YEAR	0.0053		
		DUM	
		I_TARRET	-4.786
		Constant	0.734
		RSIZE	0.186
		INDUSTRY	-0.489***
		ACQBETA	0.078
		ACQURISK	18.93**
		TARBETA	0.224
		TARURISK	0.096
ACQRET			
I_DUM	-0.043**		
Constant	0.0585		
LOGACQ	-0.0066		
YEAR	-0.037*		
		DUM	
		I_ACQRET	4.351
		Constant	-0.353
		RSIZE	1.947***
		INDUSTRY	-0.567***
		ACQBETA	0.095
		ACQURISK	21.34**
		TARBETA	0.357**
		TARURISK	0.657

Panel C: FV stock offers vs. FR stock offers

DUM=0 if FR stock offer

DUM=1 if FV stock offer

Small RSIZE group				Large RSIZE group			
TARRET				**TARRET**			
I_DUM	-0.024			I_DUM	0.031		
Constant	0.0255***			Constant	0.079**		
LOGTAR	-0.024*			LOGTAR	0.008		
YEAR	0.058**			YEAR	0.030		
		DUM				**DUM**	
		I_TARRET	-4.44			I_TARRET	-5.249
		Constant	0.401			Constant	-0.329
		RSIZE	-7.96			RSIZE	-1.436
		INDUSTRY	0.770***			INDUSTRY	-0.124
		ACQBETA	-0.094			ACQBETA	0.574*
		ACQURISK	-15.97			ACQURISK	-15.04
		TARBETA	-0.260			TARBETA	-0.307
		TARURISK	3.897			TARURISK	10.66
ACQRET				**ACQRET**			
I_DUM	0.0046			I_DUM	-0.039		
Constant	0.0055			Constant	-0.0152		
LOGACQ	-0.0008			LOGACQ	-0.0056		
YEAR	-0.0038			YEAR	-0.092***		
		DUM				**DUM**	
		I_ACQRET	76.37			I_ACQRET	20.13**
		Constant	1.494			Constant	-1.565**
		RSIZE	-18.43			RSIZE	-0.278
		INDUSTRY	-0.408			INDUSTRY	-0.243
		ACQBETA	-0.558			ACQBETA	0.889**
		ACQURISK	19.72			ACQURISK	2.197
		TARBETA	-0.277			TARBETA	-0.095
		TARURISK	-19.99			TARURISK	14.42

Chapter 5

Conclusion

This dissertation discusses three different topics in the area of corporate finance. Chapter 2 and Chapter 3 develop theoretical models that both incorporate asymmetric information as the key element in the setting. Chapter 2 argues that asymmetric information can be the reason that firms do not adopt hedging strategies. Hedging or not is considered a signal of firm quality by the market. Bettter firms do not hedge or hedge less to separate them from worse firms. At the same time, they bear higher costs such as financial distress costs. Chapter 3 finds that the choice of stock offer forms depends on the information environment of two firms in a merger. It offers an explanation for the existence of collar offers and shows that collar offers are more socially desirable because of its efficiency of utilitzing economic resources. Chapter 4 documents empirical evidence that stock offer forms have different wealth effects reflected as the announcement effects for targets and acquirers. More importantly, the empirical study of stock offer forms sheds light on the incentive of mergers. The evidence suggests that control rights are the prior objective of

acquiring firms rather than value maximization.

Though Chapter 4 offers intuitive explanations of the announcement effects based on the model developed in Chapter 3, a structural model could be more helpful to bring empirical implications of the model in Chapter 3 in the market's point of view. In the future work, a structual model that accounts for the information updating process between the market and firms involved in mergers is needed to explore further into the choice of stock offer forms in mergers and acquisitions.