PPBRI PAN-PACIFIC JOURNAL OF BUSINESS RESEARCH

Volume 1, No. 1 Summer, 2010

Table of Contents

Pan-Pacific Journal of Business Research

Estimating the Profit Potential of Risk Arbitrage Opportunities

Ben Branch: University of Massachusetts, USA.branchb@som.umass.edu

Taewon Yang*: California State University-SanBernardino, USA. taewon@csusb.edu

*The corresponding author.

ABSTRACT

In this paper, we develop a model that is designed to estimate the ex-ante profitability potential of risk arbitrage opportunities. We use merger attempt announcements for the 1991 to 2001 period to construct a data set for both in and out-of-sample test. The following variables are found to have a measurable impact on the profit potential of risk arbitrage opportunities: 1. the initial spread between the offer price and market price for a target stock, 2. payment method, 3. merger types and 4. bid premium. Merger types and payment methods, in particular, are found to have strong impacts on risk arbitrage returns: 1. the probability of merger success, 2. losses incurred if merger attempts fail and 3. merger duration. Our findings support the proposition that information asymmetry plays a key role in determining the ex-ante profitability of risk arbitrage. Accordingly, we have developed a scoring model based upon the estimates for the unknown factors that shows promise as a mean of estimating the potential profit of risk arbitrage opportunities.

Introduction

Risk/Merger arbitrage is a trading/investment strategy that involves placing investment bets on prospective mergers. The risk arbitrageur tracks and evaluates "potential" and particularly "announced" merger intentions. He or she then assumes a combination of long and short positions in those opportunities to extract the offer premium as reflected in the difference between the market price of a target firm' stock and the offer. Risk/Merger arbitrage is generally considered as an investment strategy designed to generate a stable but low return with limited risk. *Business Week* on 12/17/2001 reported "Over the past 10 years, the Merger (risk) Funds had only 28% of the volatility of Standard Poor's 500 stock index but produce 90% of the return." Many professional fund managers have tried to capitalize these stable return and low risk of the risk/merger arbitrage to control their return and risk profiles for portfolios. However, not all applications of merger risk arbitrage generate the expected return and risk patterns. If a merger attempt fails or the promised offer premium shrinks, the risk/merger arbitrage strategy would not be likely to generate a positive return. Thus professional arbitrageurs' major task is to identify merger attempts that likely to be successfully completed and that produce a decent offer premium over the market price of a target firm's stock called "spread" or "locked up spread". In this paper, we explore which risk factors tend to determine the ex-ante return of risk/merger arbitrage strategy around a merger announcement.

Generally risk arbitrageurs take one of two types of positions in order to realize the offer premium, depending upon the payment methods of the acquirer: when the would be acquiring firm offers payment in the form of stock, risk arbitrageurs usually take a long position in target firms' stocks hedged by corresponding short positions in acquiring firms' stocks. When cash is offered, arbitrageurs only need to purchase the target firm's stock. If a merger attempt is successfully consummated, the offer premium between the offer price and the market price for a target firm's stock will be earned by the risk arbitrageur. If a merger attempt fails, however, the performance of the target and acquiring firms' stocks (rather than the locked up spread), will determine the return for that particular risk arbitrage transaction. Thus, risk arbitrage returns are largely determined by four factors: 1) The probability of the merger attempt succeeding, 2) The premium/locked up spread immediately after the announcement, 3) The expected length of time before the deal closes or is cancelled and 4) The loss (or possibly gain) if the deal falls through and the relevant stock prices move adversely (favorably). Among these factors, only the premium/locked-up spread is known with certainty to risk arbitrageurs immediately after a merger announcement (when they typically undertake their positions). Other factors are endogenously determined during each merger attempt process. Accordingly, risk arbitrageurs need to analyze any relevant information available in order to deal with the endogenous variables (unknown factors) in estimating the profit potential of risk arbitrage opportunities. In literature, Branch and Yang (2004) find that a friendly attitude of takeover generally improves the

probability of merger completion. A stock offer tends to have a lower probability of merger completion than a cash offer. Mitchell and Pulvino (2001) find that the performance of risk arbitrage relates to the market conditions during down markets rather than up markets. Baker and Savasoglu (2002) report that the excess risk arbitrage returns tend to increase with (merger) completion risk and target size, implying the importance of idiosyncratic risk to determine the performance of risk arbitrage strategies.

Many scholars have explored and confirmed the ex-post profitability of the risk arbitrage strategy. Duke et al. (1992) and Jindra and Walkling (2001) examine cash tender offers during 1971 to 1985 and 1981 to 1995. They report that a risk arbitrage strategy involving cash tender offers tended to generate annualized returns of greater than 100%. Mitchell and Pulvino (2001) report an annual excess return of 4%, using stock and cash offer mergers for the 1963 to 1998 period. Baker and Savasoglu (2002) calculate a monthly abnormal return of 0.6 to 0.9% (approximate annual returns of 7.2% to 10.8%) in risk arbitrage, using stock and cash mergers during 1981 to 1996.

In this paper, we explore several predictions/hypotheses that seek to explain the endogenity of unknown factors and the ex-ante profit potential of risk arbitrage opportunities. We utilize a sample of cash tender, stock swap and collar merger attempts occurring during the 1991 to 2001 period. In particular, we test how information asymmetry associated with merger types/payment methods and accounting/financial information from the period prior to the merger announcement date explain the endogenity of unknown factors and the ex-ante profit potentials of risk arbitrage opportunities. Then, we use our results to develop a prediction model designed to estimate the ex-ante profit potential of risk arbitrage opportunities. Finally, we test the significance of the prediction model, using in and out-of-sample tests. Our test results reveal that in addition to the locked-up spread, the following variables impact the ex-ante profit potential of risk arbitrage opportunities: bid premium, attitude of takeover (friendly or not) and the market performance. The in-sample and out-of-sample test results indicate that our scoring model is able to predict the profit potentials of risk arbitrage opportunities with a fair degree of accuracy.

Section 2 of this paper introduces the predictions/hypotheses for estimating profit potentials of risk arbitrage. Section 3 explains the data and methods. Section 4 shows predictions and test results. Section 5 introduces the scoring model and in and out-of-sample test results with risk arbitrage and unhedged (simple long position) strategies. Section 6 concludes.

II. Predictions

1) Payment Method/Merger Type

The asymmetric information hypothesis [Myers and Majiluf (1984)] suggests that when an acquirer's stock is overvalued, the acquirer prefers to finance a merger by issuing stock.

Otherwise, cash payment may be used to finance the merger attempt, indicating that either the target stock is fairly priced or that the acquirer's stock is undervalued. Therefore, as the adverse selection hypothesis [Houston and Ryngaert (1997)] implies, the stock payment may signal a declining value for a target stock and increase the chance of merger failure, compared to merger attempts with cash payments. Also, when a merger attempt that utilizes an offer of stock fails, the disappearance of the offer premium may result in greater losses to risk arbitrageurs than for merger attempts offering cash payment. Merger types may also imply something about the level of information asymmetry. In collar mergers, for example, the exchange ratio will vary over a range designed to minimize the overpayment (underpayment) risk to acquirers (targets). The existence of this range is likely to result in less information asymmetry than a fixed exchange ratio (Houston and Ryngaert (1997) and Fuller (2003)). At the same time, such a structure will reduce the need for time-consuming renegotiation when relative prices change. Therefore, collar merger efforts may have a higher probability of success than stock swap merger efforts (which have a fixed exchange ratio). Thus:

Prediction 1: The profit potentials of risk arbitrage opportunities depend on payment methods and merger types.

2) Leverage.

Stultz (1988) and Harris and Raviv (1988) have explored the theoretical relationship between target ownership structure, bid premium and success as well as between ownership structure, payment method, price changes and success. They find that the probability of success for a takeover is negatively related to the targets' leverage. Stultz (1988) contends that increasing leverage (debt-to-equity ratio) indicates increasing substitution of debt for equity, reducing α (fraction of voting right controlled by management) and the bidder' gain. Therefore, increasing the targets' debt-to-equity ratio may decrease the likelihood of takeover attempt success and reduce the probability of a hostile takeover effort. Harris and Raviv (1988) argue that capital structure change as an antitakeover device usually increases the bargaining power of targets in control contests. Those leverage increases tend to be smaller for targets of successful tender offers than for firms involved in proxy contests and targets of unsuccessful tender offers. In addition, the increased debts may have a negative impact on the target or acquirer stock price performance if the merger attempt fails. Thus:

Prediction 2: The profit potentials of risk arbitrage opportunities are associated with the level of debts in target companies.

3) Target Size.

Hoffmeister and Dyl (1981) find that firm size is an important factor in predicting the success of a takeover attempt. They contend that the larger the target (market value of equity plus debt), the lower the merger success rate. This finding implies that resistance from targets increases with size and/or the ability of acquirers to handle increasing financial burdens decreases with the size of the target. Target size may have various impacts on the target or acquirer stock price if the merger attempt fails. And Baker and Savasoglu (2002) find that the target size is one of the major determinants of risk arbitrage returns. These considerations lead to the third prediction.

Prediction 3: The profit potentials of risk arbitrage opportunities are associated with the sizes of the target companies.

4) **Bid Premium.**

Walkling (1985) reports that the size of the bid premium is positively related to the success of tender offers. He notes that the previous findings of insignificance for the bid premium resulted from an incorrect premium specification. Also, Jennings and Mazeo (1993) find that a high bid premium tends to deter competing offers and reduce the likelihood of resistance. These findings imply that an increased bid premium will improve the chance of merger success. But if a merger attempt fails, a disappearing high bid premium may have a negative impact on the performance of target stocks. This provides the fourth prediction.

Prediction 4: The profit potentials of risk arbitrage opportunities are associated with the size of the bid premium.

5) Resistance of Targets / Friendly Merger.

Hoffmeister and Dyl (1981) find that the resistance of targets is one of several major factors in determining the success of merger attempts. Later, Walkling and Long (1984), Mikkelson and Partch (1989) and Cotter and Zenner (1994) report that this resistance is negatively related to the wealth/cash flow changes to managers. More recently, Schwert (2000) shows that unnegotiated hostile offers have the lowest success rates. These findings imply that a friendly attitude promotes the chance of merger success. On the other hand, the failure of friendly merger

attempts may have a more negative impact on the profitability of risk arbitrage, compared to the failure of non-friendly merger attempts. Thus:

Prediction 5: The profit potentials of risk arbitrage opportunities depend upon the attitude of the target to a takeover attempt.

6) Post Announcement Target Stock Price Behavior.

Samuelson and Rosenthal (1986), Brown and Raymond (1986) and Huston (2000) examine the relationship between target stock price movements and the probability of success for merger attempts. They show that in successful merger attempts, the market price of a target stock tends to converge to the offer price during a merger attempt period. Cornel and Li (2001) contend, on theoretical grounds, that the return of risk arbitrage is positively related to the trading volume of target stocks. Thus:

Prediction 6: The profit potentials of risk arbitrage opportunities are associated with the post announcement target stock price behavior.

7) Percentage of Equity Sought.

The percentage of equity sought may influence the probability of success for takeover attempts. Takeover attempts may involve an acquisition of less than 100% or exactly 100% of the targets' outstanding equity. The percentage of equity sought by an acquirer may well represent actual merger transaction costs as well as demands on the target stocks. Therefore, the percentage of equity sought by an acquirer may influence the success of takeover attempts and target stock prices. Thus:

Prediction 7: The profit potentials of risk arbitrage opportunities are associated with the percentage of equity sought.

8) Markets.

Mitchell and Pulvino (2001) find that the performance of risk arbitrage is influenced by market conditions. And the market performance (daily compounded monthly return) a month before a merger announcement negatively impacts the probability of merger failure. This finding suggests our eighth prediction:

Prediction 8: The profit potentials of risk arbitrage opportunities are associated with market condition/performance prior to a merger attempt announcement.

III. Data and Method

We utilized five data/information sources in our study to collect merger price and firm information: SDC (Security Data Corporation), Data Stream, CompuStat, Form 8-K files in SEC and Lexis-Nexis. First, we downloaded raw merger information from SDC. We used Lexis-Nexis to check the information's accuracy.

********** **Table 1** **********

First, we identified 1,058 completed (successful or not) stock, cash tender and collar merger offers for the 1991 to 2000 period. Tables 1 summarize information for our current sample. Cash tender, stock swap and collar mergers account for approximately 21 %, 65 % and 15 % of our sample, respectively.

1) Return formulas for risk arbitrage

We assume that each risk arbitrage position is set up one day after the merger attempt announcement and held until the consummation or termination date. With cash tender offers, risk arbitrageurs don't need to establish short positions in the acquirers' stocks in order to hedge their positions. Accordingly, neither dividends on the acquirer's stock nor the cash return on the short balance are relevant for these types of transactions. Only dividend payments on the target shares need to be considered as an additional part of the risk arbitrage returns.

$$\text{Return} = \frac{(C - T_1)}{T_1} + \frac{CD}{T_1} \qquad (1)$$

C: Cash offer per target share.

T_1: The target stock price one day after a merger announcement date.

CD: Accumulated cash dividend payments per target share during the holding periods.

Equation (1) describes the return calculation for successful tender offers. If the cash tender offers are successfully consummated, target stockholders will receive the original or

revised offered cash amounts per target share at the consummation date and dividend payments during the holding period.

$$\text{Return} = \frac{T_F - T_1}{T_1} + \frac{CD}{T_1} \qquad (2)$$

T_F: Target stock price at the closing date.

Equation (2) illustrates the return calculation in closing the position for failed merger cases. If a merger attempt fails, the capital gains (or losses) and dividend payments during the holding period are returns (positive or more likely negative) to the risk arbitrageurs.

Risk arbitrage return calculations for stock swap mergers and collar mergers need to take account of both dividend and interest payments due on the short positions in the acquirer stocks.

$$\text{Return} = \frac{(R \times A_1 - T_1)}{T_1} + \frac{CD_{T-A}}{T_1} + \frac{IS}{T_1} \qquad (3)$$

$$\text{Return} = \frac{(R \times A_1 - T_1)}{T_1} - \frac{(R \times A_F - R_F \times A_F)}{T_1} + \frac{CD_{T-A}}{T_1} + \frac{IS}{T_1} \qquad (4)$$

R: Announced exchange ratio.

R_F: Final exchange ratio

A_1: Acquirer stock price one day after a merger announcement date.

A_F: Acquirer stock price at the closing date.

T_1: Target stock price one day after a merger announcement date.

CD_{T-A}: Accumulated difference between dividends from target stocks and acquirer stocks during the holding periods.

IS: Interest payments (3 month T-Bill) from the short position during the holding periods.

Equation (3) describes how we calculate the return for risk arbitrage involving a successful stock swap merger, considering the dividend and interest payments. If a stock swap merger is successfully consummated, risk arbitrageurs will earn the initial spread between the offer price represented by acquirer stock and the market price of target stock. However, if the exchange ratio is revised, as Equation (4) shows, risk arbitrageurs may have to consider the difference between the original exchange ratio and a revised exchange ratio in the short position in the return calculation.

$$\text{Return} = \frac{(R \times A_1 - T_1)}{T_1} - \frac{(R \times A_F - T_F)}{T_1} + \frac{CD_{T-A}}{T_1} + \frac{IS}{T_1} \quad (5)$$

$$\text{Return} = \frac{(R \times A_1 - T_1)}{T_1} - \frac{(R_F \times A_F - T_F)}{T_1} + \frac{CD_{T-A}}{T_1} + \frac{IS}{T_1} \quad (6)$$

T_F: Target stock price at the closing date.

Equation (5) illustrates the return calculation in closing the position for failed stock swap merger cases. The return of risk arbitrage in those cases is largely determined by the capital gains (or losses) in the target and acquirer stocks during the holding period. If the exchange ratio is revised, the changed short position will impact on the return, as indicated in Equation (6).

A collar merger offer does not specify a fixed exchange ratio. Accordingly, any attempt to lock up the initial spread in a risk arbitrage opportunity involving such an offer requires arbitrageurs to estimate the final exchange ratio. We utilize a mid ratio in a range of exchange ratios as the initial exchange ratio used to calculate projected returns (spreads). Then we use the actual final ratio reported in the news reports to calculate actual returns. We primarily use Equations (4) and (6) to calculate the risk arbitrage returns in collar mergers, reflecting the changing exchange ratios.

Table 1 shows that risk arbitrage for cash tender, stock swap or collar mergers produce an average return of more than 5%. Overall, 58% of our sample generates returns of 0% to 9%. Among the three types, collar merger attempts tend to produce the highest volatility in the risk

arbitrage return. In terms of merger duration, cash tender offers tend to have shorter merger periods, compared to stocks swap and collar mergers. Collar merger offers tend to have a longer merger duration than stock swap merger offers.

2) Models Estimating Profit Potentials of Risk Arbitrage Opportunities.

We first develop a linear model (Equation 7) to explore those predictions/hypotheses for estimating the ex-ante profit potentials of risk arbitrage opportunities, considering the initially locked spreads. Then using a stepwise (logistic) regression and additional variables, we test the determinants of unknown variables in the risk arbitrage returns.

$$y = \alpha + \beta_1 S + \beta_2 L + \beta_3 BP + \beta_4 F + \beta_5 PS + \beta_6 MT1 + \beta_7 MT2 + \beta_8 T + \beta_9 IS + \beta_{10} 20VWM + \varepsilon \quad (7)$$

y: Return of risk arbitrage or merger period (duration)

S: Relative size, Ln(Target Asset Size/Acquirer Asset Size)

L: Debt ratio, Target's Ratio of total debts to assets or LN(Debt ratio)

BP: Bid Premium, Absolute value of (offered price / target price 14 days before a merger announcement date- 1)

F: Dummy variable for friendly mergers (Friendly =1; Unfriendly=0)

PS: Post announcement price reaction, Absolute value of (target price 3 days after a merger announcement date/offered price - 1)

α : Intercept, a Dummy variable for Cash Tender Offers

MT1: Dummy variable for Stock Swap Mergers (Stock swap = 1; otherwise = 0)

MT2: Dummy variable for Collar Mergers (Collar merger = 1; otherwise = 0)

T: Transaction Size, Percentage of outstanding target equities sought by an acquirer

IS: The initial spread between the offer price and the market price for a target stock one day after a merger announcement.

20VWM: The daily compounded value-weighted CRSP return for 20 business days prior to the merger announcement date.

IV. Test Results for Models

1) Predictions/Hypotheses

As shown in Table 2, Model 1 tests predictions/hypotheses explaining the ex-ante profit potential of risk arbitrage opportunities. Model 2 is a reduced form model containing only statistically significant variables. As the test results indicate, the initially locked up spread is undoubtfully a key component of risk arbitrage profit potential. And merger type/payment methods and bid premium tend largely to determine the ex-ante profitability of risk arbitrage opportunities. Specifically, collar attempts (beta = - 0.0355) seem to reduce the profitability of risk arbitrage more than stock swap merger attempts (beta = - 0.0228). Stock payments (betas of stock swap and collar mergers) show negative impacts, compared to cash payments (intercept). Thus as the information asymmetry or adverse selection hypothesis imply, compared to cash payments, stock payment seems to have a negative impact on the ex-ante profitability of risk arbitrage opportunities. The range of exchange ratios, however, is unlikely to enhance the profit potential of risk arbitrage, compared to a fixed exchange ratio. And the bid premium (beta = - 0.0357) is found to be negatively related to the profit potential of risk arbitrage. This finding may be attributed to a high bid premium inviting many arbitrageurs to take a position, eventually decreasing arbitrage after the merger announcement. Interestingly, our test results don't support the predicted roles of market and accounting/financial information in estimating the profitability of risk arbitrage opportunities.

2) A probability of merger success

As Model 3 in Table 3 indicates, debt ratio (beta = 0.827) and attitude (Friendly, beta = 3.019) tend to increase the probability of merger success. However, other variables are found to decrease the probability of merger success. Specially, in terms of merger types/payment methods, cash payment (intercept) is found to improve the probability of merger success as compared to stock payment (betas of stock swap and collar mergers). Collar mergers (a range of exchange ratio, beta = - 0.802) tends to increase the chance of merger success, compared with stock swap mergers (a fixed exchange ratio, beta = - 1.045) at the level of $\alpha = 0.13$.

3) Expected Losses if Merger Attempts Fail

Using only failed merger attempts and additional variables, we estimate Model 4. The result reveals that risk arbitrage for failed merger attempts tend to produce losses to risk arbitrageurs (negative intercept). Furthermore, except for transaction size (beta = 1.302), debt ratio, equity

ratio, attitude (Friendly) and dummy variables for stock swap and collar mergers tend to increase the losses of risk arbitrage if a merger attempt fails. Interestingly, cash payment (intercept) tends to generate more losses compared to stock payment (betas of stock swap and collar mergers). This finding may be attributed to the hedging position (long and short positions) in risk arbitrage for merger attempts with stock payment. While statistically insignificant, stock swap mergers tend to incur more losses, compared to collar mergers.

4) Merger Duration

As shown in Model 5, merger duration is found to be negatively related to bid premium (beta = -89.129) but have a positive relationship with the dummy variable for collar mergers. Therefore, collar mergers tend to have longer merger durations than other types of merger attempts. Thus rather than payment method, merger types tend to impact merger durations.

These test results for Model 3, 4 and 5 show that, in addition to firm and deal specific information, merger type/payment methods tend to play an important role in estimating the profit potential of risk arbitrage opportunities, variously impacting merger success, losses in failed merger attempts and merger duration.

V. Estimating Profitability Potentials: Scoring Model

1) Scoring Model

Based on the test results discussed above, we develop a scoring model (Equation 8) designed to estimate the ex-ante profit potential of risk arbitrage opportunities. This scoring model is structured to limit potential problems of using a simple linear model with skewed data. In particular, because of historically high success rates, a simple linear model may tend to underestimate the impact of losses from merger failure.

$$S = [P \times EG + (1-P) \times EL] * (253/T) \qquad (8)$$

S: Score (expected return) for potential profits

P: Estimated probability of takeover attempt success.

EG: Expected gain (%) if a takeover attempt is successful.

EL: Expected loss (%) if the takeover attempt is not successful.

T: Estimated length of time that takeover attempt will take.

In words, the scores (expected return) is equal to the probability of success of the takeover attempt times the expected gain if successful, plus the probability of failure in the takeover attempt times the expected loss if the takeover attempt fails, adjusted by the impact of the estimated time until resolution (here, 253 is used to reflect the number of total business days in a year). If a merger attempt has a large locked up spread, a high probability of merger success and a short expected merger period, it will have a high score (for a profit potential for risk arbitrage opportunity). Since the probability of success equals 1 minus the probability of failure, our score is seen to depend upon four variables, P, EG, EL and T defined above. The variable EG can be computed as the locked up spread in terms of percentage.

2) In Sample Test: 1991 to 2000

Based on the test results for unknown factors (Model 3, 4 and 5) and the scoring model, we estimate scores for announced merger attempts during 1991 to 2000. To test the significance of the scoring model, we perform an in-sample test. In this test, we sort scores from Equation (8) and explore actual raw returns for a risk arbitrage and an unhedged strategy (simple long position in target stocks) in the percentile of scores. For example, "10" in Table 4 means the highest 10 % in scores and "20" means the highest 20 % in scores. And "Return" in the same row indicates an average raw return without considering risk (standard deviation) and merger duration in the percentile. "Risk Adjusted Return" is an average ratio of raw return to standard deviation in the percentile. "Annualized Risk Adjusted Return" is an annualized ratio of raw return to standard deviation, considering the risk and merger duration in the percentile. The in-sample test shows that as the percentile of scores increases from 10 to 100, the average returns and annualized risk adjusted return (ratio of return to risk) tend to decrease from 0.195 to 0.056 and from 1.724 to 0.678, indicating that the scoring model has a capacity for appropriately estimating the profit potentials of risk arbitrage opportunities. And comparison of the performance of risk arbitrage to that of the unhedged strategy (simple long position) reveals that due to the lower volatility (from the long and short positions), risk arbitrage tends to outperform (on a risk adjusted basis) the unhedged strategy in each percentile. Also, t-tests show that the difference in annualized risk adjusted returns of risk arbitrage and unhedged strategies is significant at 95% confidence interval. The outperformance appears to be significant in the top percentiles, confirming again the capability of the scoring model to enhance the performance of risk arbitrage.

3) Out-of-Sample Test: 2001.

We also perform an out-of-sample test to supplement the in-sample test results, using 96 merger attempts announced during 2001. The out-of-sample test result (Table 5) shows similar test results to the in-sample test in a down market (2001). Increasing the percentile of scores tends to decrease average returns and annualized risk-adjusted returns in each percentile, supporting the significance of the scoring model to estimate profitability potentials. Also, t-tests indicate the significant difference between performances of two trading strategies. Interestingly, despite negative returns from the unhedged strategy in a down market, risk arbitrage tends to generate superior positive return (from 0.180 to 0.063) and annualized risk adjusted returns (from 1.224 to 0.802) over increasing percentiles. These findings suggest that the long and short positions inherent in the risk arbitrage strategy provides an advantage in a down market, compared to the simple long position of the unhedged strategy.

VI. Conclusion.

In this paper, we explore the ex-ante profit potential of risk arbitrage opportunities. Also, we test the impacts of financial factors and merger types/payment methods on estimating the profit potentials of risk arbitrage opportunities. Our results reveal that in addition to the initial spread between the offer price and the market price for a target stock, merger types and payment methods seem to play important roles in determining the ex-ante profit potential of risk arbitrage opportunities. Especially, merger types and payment methods variously impact unknown factors in the risk arbitrage returns: the probability of merger success, losses incurred if merger attempts fail and merger duration. It supports the role of asymmetric information in estimating the ex-ante profit potential of risk arbitrage. Moreover a scoring model based on these findings shows a capability of estimating ex-ante profit potential of risk arbitrage around a merger announcement date.

References

Baker, M and S. Savasoglu, 2002. Limited arbitrage in mergers and acquisitions, *Journal of Financial Economics* 64, 91-115.

Branch, B and T.W. Yang, 2001. Merger arbitrage: evidence of profitability, *Journal of Alternative Investments* 4, 17-32.

Branch, B and T.W. Yang, 2002. Predicting successful takeovers: cash tender, stock swap and collar mergers, Working paper, University of Massachusetts, Amherst

Brown, K and M. Raymond, 1986. Risk arbitrage and the prediction of the successful Corporate Takeovers, *Financial Management* 11, 54-63.

Cornelli, F and D. Li, 1998. Risk arbitrage in takeovers, *Review of Financial Studies* 15, 837-868.

Duke, W, C. Frohlich and C. Ma, 1992. Risk arbitrage in tender offers, *Journal of Portfolio Management* 18, 47-55.

Fuller. K. P, 2003. Why some firms use collar offers in mergers, *The Financial Review* 38, 127-150

Grinblatt, M and S, Titman, 1989. Mutual fund performance: An analysis of quarterly portfolio holdings, Journal of Business 62, 393-416

Hoffmeister, J. Ronard and E. Dyl, 1980. Predicting outcomes of cash tender offers, *Financial Management* 9, 50-58.

Houston, J and M. Ryngaert, 1997. Equity issuance and adverse selection: A direct test using conditional stock offers, *Journal of Finance* 52. 197-219

Jensen, M, C, 1968, The performance of mutual funds in the period 1945 – 1964, Journal of Finance 23, 389-416

Jindra, J and R. Walkling, 2001. Speculation spreads and the market pricing of proposed acquisitions, working paper, Ohio State University.

Karolyi, A and J. Shannon, 1999. Where's the risk arbitrage? *Canadian Investment Review* 12, 12-18.

Laker, D and T. Lys, 1987. An empirical analysis of the incentives to engage in costly information acquisition: the case of risk arbitrage *Journal of Financial Economics* 18, 111-126.

Marin, K, 1996. The method of payment in corporate acquisitions, investment opportunities and management ownership, *Journal of Finance*, 51, 1227-1246

Mitchell, M and T. Pulvino, 2001. Characteristics of risk in risk arbitrage *Journal of Finance* 56, 2135 – 2175.

Moore, K, 1999. *Risk Arbitrage: An Investor's Guide*. (Wiley, New York, NY).

Samuelson, W and L. Rosenthal, 1986. Price movements as indicators of tender offer success *Journal of Finance* 41, 481-510.

Shleifer, A and R. Vishny, 1997. The limit of arbitrage *Journal of Finance* 52, 35-55.

Walkling, R, 1985. Predicting tender offer success: a logistic analysis" *Journal of Financial and Quantitative Analysis* 20, 461-478.

Table 1. Raw Return Distribution of Risk Arbitrage During 1991 to 2000

	Cash Tender	Stcok Swap	Collar	Total
Above 29%	12	27	10	49
20% to 29%	12	44	14	70
10% to 19%	15	112	38	165
0% to 9%	157	404	55	616
-10% to -1%	18	46	26	90
-20% to -11%	3	21	8	32
-30% to -21%	0	9	2	11
Below -30%	1	20	4	25
Total	218	683	157	1058
Average	0.0536	0.0582	0.0542	0.0567
Stdev	0.1044	0.1552	0.2621	0.1671
Merger Duration	78	137	144	126

Table 2. Testing Predcitions/Hypotheses

Our sample is composed of cash tender, stock swap and collar merger attempts during 1991 through 2000. We estimate models, using OLS.

	Model1	St Error	Model 2	St Error
Dependent	Returns		Returns	
Intercept	0.0320	0.0394	0.0471*	0.0119
Initial Spread (IS)	0.5347*	0.0433	0.5245*	0.0421
Stock Swap (MT1)	-0.0213	0.0133	-0.0228**	0.0124
Collar (MT2)	-0.0361*	0.0176	-0.0355*	0.0167
Size (S)	-0.0050	0.0032		
Debt (DA)	0.0186	0.0180		
Transaction Size (TS)	-0.0160	0.0381		
Bid Premium (BP)	-0.0357*	0.0137	-0.0340*	0.0134
Friendly Attitude (F)	0.0143	0.0166		
Post Price (PP)	-0.0081	0.0187		
Market (VWM20)	-0.0771	0.1188		
Adjusted R-square	13.00%		13.03%	

* indicates significant at 95% confidence interval

* indicates significant at 90% confidence interval

Table 3. Estimating Models

Model 3 estimate a probability of merger success. Model 4 estimate losses if merger attempts fail. Model 5 estimate merger duration. We use stepwise (logistic) regressions to estimate models, considering more variables such as interaction variables.

	Model 3	St Error	Model 4	St Error	Model 5	St Error
Dependent	Merger Success		Loss		Merger Duration	
Intercept	5.116**	(2.932)	-1.009	(0.694)	164.969*	(35.034)
Size (S)	-0.534*	(0.091)				
Debt (DA)	0.827**	(0.465)				
LN(Debt(DA))			-0.232*	(0.117)		
Equity to Asset			-0.669*	(0.284)		
Friendly Attitude (F)	3.019*	(0.458)	-0.143*	(0.050)		
Transaction Size (TS)	-6.754*	(2.977)	1.302**	(0.706)		
Attitude(F)*Post Price(PP)	-0.426*	(0.125)				
Bid Premium (BP)					-89.129**	(51.815)
Stock Swap (MT1)	-1.045*	(0.403)	-0.163*	(0.060)	-24.355	(34.140)
Collar (MT2)	-0.802	(0.516)	-0.143	(0.090)	247.177*	(66.693)
Adjusted R-square	48.22%		16.83%		18.00%	

* indicates significant at 95% confidence interval
** indicates significant at 90% confidence interval

Table 4. Estimating Profitability Potentials: In Sample Test (1991 to 2000)

Here, Return indicates averages of cumulative percentile in scores. Risk adjusted return is a ratio of return to standard deviation in cumulative percentiles. Annualized risk adjusted return is calculated by risk adjusted return*253/average merger duration of cumulative percentile. T-test shows that the performance of risk arbitrage sigificantly differs from that of unhedge stragety at 95% confidence interval.

	Risk Arbitrage			Unhedged Strategy for Targets		
Percentile	Return	Risk Adjusted Return	Annualized Risk Adjusted Return	Return	Risk Adjusted Return	Annualized Risk Adjusted Return
10	0.195	0.960	1.724	0.226	0.485	0.872
20	0.160	0.907	1.631	0.187	0.421	0.757
30	0.137	0.834	1.493	0.177	0.431	0.771
40	0.111	0.543	0.991	0.156	0.417	0.761
50	0.097	0.520	0.954	0.137	0.381	0.699
60	0.088	0.500	0.935	0.127	0.372	0.697
70	0.080	0.478	0.912	0.120	0.367	0.700
80	0.074	0.468	0.915	0.113	0.355	0.694
90	0.066	0.423	0.845	0.103	0.331	0.662
100	0.056	0.338	0.678	0.093	0.299	0.600

Table 5. Estimating Profitability Potentials: Out of Sample Test (2001)

Here, Return indicates averages of cumulative percentile in scores. Risk adjusted return is a ratio of return to standard deviation in cumulative percentiles. Annualized risk adjusted return is calculated by risk adjusted return*253/average merger duration of cumulative percentile. T-test shows that the performance of risk arbitrage sigificantly differs from that of unhedge stragety at 95% confidence interval.

	Risk Arbitrage			Unhedged Strategy for Targets		
Percentile	Return	Risk Adjusted Return	Annualized Risk Adjusted Return	Return	Risk Adjusted Return	Annualized Risk Adjusted Return
20	0.180	0.545	1.224	-0.136	-0.408	-0.916
40	0.137	0.567	1.212	-0.051	-0.182	-0.389
60	0.101	0.486	1.093	-0.074	-0.266	-0.598
80	0.083	0.456	1.086	-0.051	-0.184	-0.439
100	0.063	0.318	0.802	-0.051	-0.185	-0.467