

Merger Arbitrage: Profits, Holdings, and Impact on The Takeover Process

Jim Hsieh *

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ABSTRACT

This research examines the role arbitrageurs play in the takeover market and the relationship between arbitrage holdings and realized returns to merger-arbitrage portfolios. The sample consists of 680 offers spanning the 1992-1999 period and includes 152 collar offers. We find that arbitrage holdings of target shares are positively correlated with both the probability of success and bid premia. However, they purchase fewer target shares in deals where the bidders face competition even though those offers provide higher returns on average. In addition, the arbitrageurs' decision to enter the market for corporate control is shown to benefit target shareholders. Consistent with the theoretical arguments of Cornelli and Li (2001) and Gomes (2001), the probability of takeover success increases with arbitrageurs' participation. While holdings and probability of success are higher in collar offers, arbitrageurs earn lower returns in those deals. Finally, the results indicate that arbitrage holdings are positively associated with both revision returns and the possibility that target firms receive subsequent bids within two years after the initial bids are terminated.

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*Fisher College of Business, The Ohio State University, 2100 Neil Avenue, Columbus, OH 43210. Tel: (614) 292-4712. Email: hsieh.61@osu.edu. I thank Natasha Burns, Stephen Cosslett, Jean Helwege, David Hirshleifer, Rene Stulz, Karen Wruck, and seminar participants at Ohio State University for valuable discussions and comments. I am especially grateful to Ralph Walkling for his guidance and encouragement. All remaining errors are my responsibility alone.

I. Introduction

Following a takeover announcement, a merger arbitrageur purchases the target company's stock hoping to profit from the deal. If the deal succeeds, the arbitrageur profits from the difference between the purchasing price and the final selling price of the target's stock. In stock-swap deals, this investment strategy is often accompanied by shorting the acquirer's stock simultaneously.¹

Existing empirical studies report substantial abnormal returns to arbitrage portfolios over long periods (see for example, Dukes, Frohlich and Ma (1992), Karolyi and Shannon (1998), Baker and Savasoglu (2001), Mitchell and Pulvino (2001) and Jindra and Walkling (2001)). The popular press also describes these investment strategies as generating extraordinary profits. Why do arbitrageurs consistently earn positive returns over time? Prior empirical evidence as in Larcker and Lys (1987) suggests that the abnormal returns are partially due to the fact that arbitrageurs are better informed than the market about the probability of deal success.

Recent theories further suggest that not only are arbitrageurs active participants in takeover contests, but they may also exert significant impact on the takeover process. Their decision to enter the market for corporate control will, by itself, influence takeover results *regardless of* arbitrageurs' superior ability to predict the takeover outcome. For instance, Cornelli and Li (2001) develop an information-based model in which the information advantage that an arbitrageur possesses arises from his own position rather than from his capability of predicting outcomes. The arbitrageur has incentives to accumulate target shares as long as the expected profit is positive. His purchase of shares helps overcome the free-rider problem and consequently, facilitates the takeover process. Gomes (2001) further shows that arbitrageurs are capable of attaining hold-out power derived from accumulating large blocks of target shares. This potential threat will force bidders to offer higher takeover premiums.

Despite the growing theoretical interest in merger arbitrage activities, there is little empirical evidence on the effect of arbitrageurs' participation in the takeover market. This paper intends to fill the

¹This process is called merger or risk arbitrage. By definition, classic "arbitrage" refers to a simultaneous transaction in two separate markets and attempts to profit from disparate pricing between these two markets without incurring risks. Risk arbitrage, however, bears risks. Two differences are noticeable. First, arbitrageurs typically buy the target shares, wait until the effective date of the deal, and then tender them to the bidder. The transactions of buying and tendering are not simultaneous as in traditional arbitrage process. Second, their profit is not secured since there exists certain probability that the proposed takeover is cancelled. If it happens, the target prices may drop and arbitrageurs may suffer large losses.

gap by investigating the role that arbitrageurs play in merger activities. Using 680 offers over the period from 1992 to 1999, we examine the impact of arbitrage holdings on the takeover process and the relationship between these holdings and the realized returns to merger-arbitrage portfolios. Among the questions addressed: Are arbitrageurs' decisions to enter the market for corporate control beneficial to target shareholders? To what extent does the change of arbitrage holdings affect the performance of takeover portfolios? What types of deals do arbitrageurs get involved with? What is the impact of form of payment and in particular, a recent phenomenon, the collar offers?

The acquisition literature has long established the importance of method of payment in takeover-related contests (see, e.g., Travlos (1987) and Huang and Walkling (1987)). In addition, the role of arbitrageurs in cash and stock offers is likely to be quite different. In cash offers, arbitrageurs simply purchase the target at the post announcement price and hope to profit from subsequent increments in this price. In stock offers, arbitrageurs commonly buy the target shares and attempt to form a hedge by shorting the appropriate number of bidder shares. Obviously, the resulting returns to arbitrage in stock offers are a function of both the target's and the bidder's stock prices in the post announcement period. Because the bidder's stock price often varies considerably in the post announcement period, the return to target shareholders can be dramatically different from originally proposed at the time of the announcement.

A major innovation affecting stock deals in the last decade is the collar offer. Collar offers provide specific adjustments in the exchange ratio of bidder to target shares contingent on the subsequent stock prices of both firms.² Given the effect of collar inclusion on the pricing and on the bid process, it is imperative to include collar offers when analyzing arbitrage holdings and returns. Two recent studies suggest that, relative to cash and stock deals, collar offers provide significantly different deal characteristics. Fuller (2001) shows that collar offers provide higher returns for target shareholders than cash deals. Officer (2001) further presents evidence that the inclusion of collar provisions increases the probability of bid success. Nonetheless, it is unclear what effect collar offers have on the merger arbitrage process. To date the relation between collar offers, arbitrage holdings and returns has not been examined.

²To be more specific, if the bidder's price does not fall within a pre-specified range, the offer terms are subject to adjustment according to a pre-determined formula. In many cases, both parties are granted the right to cancel the transaction when the bidding firm's stock price moves out of the price range. See Appendix A for a detailed description of collar offers.

Recognizing the importance of form of payment and the recent development of collar offers, we pursue three objectives. First, we examine the performance of takeover-related portfolios conditional on method of payment. This study is the first to analyze the effect of collar offers on the profitability of arbitrageurs' investment strategies. Second, the cross-sectional relationship between merger portfolio returns, bid characteristics and arbitrage holdings is investigated. Third, this paper explores, in a simultaneous equation framework, arbitrageurs' decision to enter the takeover market and their impact on the takeover process.

The first section of this study analyzes the performance of three takeover-related portfolios formed according to the method of payment: cash, stock, and collar offers. Using a conditional Fama-French (1993) performance measure, the results suggest that the three constructed portfolios based on the method of payment exhibit systematically different performance. On average, after taking into account transaction costs, arbitrageurs earn monthly abnormal returns of 0.18% (value-weighted) to 1.56% (equal-weighted); individual deals exhibit extensive variations. In general, the portfolio of cash offers provides the highest return while the portfolios of stock or collar offers provide the lowest return, depending on the model specifications. In contrast to related research on cash and stock offers, stock and collar offers provide returns insignificantly different from the risk-free rate in several models after transaction costs are considered.

Second, having documented the performance of arbitrage portfolios, we examine the source of cross-sectional differences in returns to merger portfolios and the relationship between the returns and arbitrage holdings. The analysis is further extended by incorporating offer parameters that are important in the takeover process and that can be influenced by arbitrage holdings. As indicated by theoretical models in the literature (e.g., Cornelli and Li (2001) and Gomes (2001)), several variables of interest such as arbitrage holdings, returns, and premia, are determined endogenously. Thus, to mitigate this endogeneity issue, the empirical analysis explicitly accounts for the joint determination of four important offer characteristics: bidders' toeholds, the takeover premiums, arbitrage holdings and their realized returns.³

³Due to the availability of the database, this section of analysis is conducted using the sub-sample of deals which have institutional ownership over the period from January 1992 to March 1997. This section also serves as a robustness check for the analysis in the first section. In general, the results from both sections are consistent. See Section VI for the methodology of estimating holdings.

The results indicate that returns are positively related to takeover premiums and deal success rates. Interestingly, arbitrageurs also earn higher profits in deals involving multiple bidders and when target management opposes the initial bids. Although the deal risks are higher in these cases, arbitrageurs in fact are compensated with higher profits. In addition, the returns have a positive contemporaneous relationship with the abnormal trading volume of target firms, a result consistent with case studies cited in Cornelli and Li (2001). Higher toeholds, on the other hand, are associated with lower subsequent returns although this result is sensitive to model specifications. Furthermore, we find a weakly positive curvilinear relation between arbitrage returns and holdings. The curve initially slopes upward when the aggregate holdings are low. Arbitrage returns start to diminish as holdings increase.

A third major objective of this paper is to analyze arbitrageurs' decision to enter the takeover market and to determine the impact of their presence on the market. Again, the methodology in this section explicitly takes into account the endogeneity of holdings and other variables of interest. We show that arbitrage holdings of target shares are positively correlated both with the probability of success and with post-announcement abnormal trading volume. Moreover, higher premiums and returns attract more arbitrage holdings. These results support the theoretical predictions in Cornelli and Li (2001) and Gomes (2001). Arbitrageurs, however, purchase fewer target shares in deals where the bidders face competition even though those offers provide higher returns on average. One possible explanation in stock and collar offers is that, in line with the argument of limited arbitrage as in Shleifer and Vishny (1997), arbitrageurs are more likely to face capital constraints due to their short-sale positions in bidders' stocks. They may be unable to fulfill their desired hedge position in time because competition usually arrives quickly (Betton and Eckbo (2000)). Finally, there is little evidence that the bidder's toehold and the target management's attitude significantly affect arbitrageurs' decision to enter the market.

In addition to their ability to predict deal success rates, arbitrageurs influence the takeover market through two channels. First, they are perceived as favoring the bidder's success since they have short-term objectives of holding target shares. The information they reveal to the market also could facilitate the takeover process and increase the value of the target company. Therefore, their presence could increase the probability of the takeover success. This hypothesis is strongly supported in the empirical analysis. The results from the simultaneous-equation estimation indicate that the probability of success

is positively associated with arbitrageurs' participation. Consistent with other studies, the model also suggests that the probability of deal success is correlated with bidders' toehold (Betton and Eckbo (2000)), the target management attitude (Walkling (1985) and Schwert (2000)), and the lockup options granted by the target managers (Burch (2001)).

A second channel of influence arises before the announcement. Bidders will take into account the presence of potential bidders and arbitrageurs before deals are publicly announced. Thus, they might increase premiums to avoid competition, decreasing the possibility that target shares are held out by arbitrageurs. On the other hand, increased price markups attract greater holdings after the deal announcement. Block shareholders and arbitrageurs may also exercise their hold-up power as in Gomes (2001), and force the bidders to increase the overall premiums. In equilibrium, the relationship between the premium and the holdings should be positive and determined endogenously. This argument is supported in the sample.

Finally, we present additional evidence that supports the active role of arbitrageurs in the takeover process. First, we find a positive association between holdings and revision returns. After taking into account the endogeneity of holdings, this relationship suggests that the deals with greater holdings are more likely to be revised. We further find that, once the initial deal is cancelled, the possibility of the target firm's receiving a subsequent bid within two years is higher when the initial deal has higher arbitrage holdings. This implies that arbitrageurs have some ability to predict which targets will eventually be taken over. Collectively, the results indicate that arbitrageurs are involved actively in the takeover market with better information, but their participation also has significant impact on the takeover outcome as well. The remainder of the paper is organized as follows. Section II discusses related literature. Section III details the sample selection procedure and describes the basic characteristics of the sample. Section IV examines the methodology of portfolio formation. The results from the portfolio evaluation are presented in Section V. Section VI details the determinants of arbitrage holdings, while Section VII concludes the paper.

II. Related Literature

As discussed in the previous section, this study intends to address three broad questions: Is the performance of arbitrage portfolios affected by different methods of payment?, Does there exist a relationship between returns to those portfolios and arbitrage holdings?, and more importantly, Do arbitrageurs play a significant role in the takeover market?

The existing literature concludes that arbitrageurs earn positive abnormal returns over time. For instance, Dukes, Frohlich and Ma (1992) and Jindra and Walkling (2001) use samples of cash tender offers and document 117% and 46.5% annualized returns, respectively. Baker and Savasoglu (2001) use both cash and stock deals from 1981 to 1996 and find the average annualized risk-adjusted return is 9.6%. Using a portfolio of Canadian cash and stock mergers in 1997, Karolyi and Shannon (1998) document 26% annualized return with a beta of 0.4. In contrast, Mitchell and Pulvino (2001) find that merger arbitrage generates merely 4% annualized excess returns after controlling for the non-linearity of portfolio returns and taking into account transaction costs. The theory of limited arbitrage as in Shleifer and Vishny (1997) and Baker and Savasoglu (2001) suggests that portfolio returns are affected by the limited supply of arbitrage capital. When the available capital falls, arbitrageurs require higher returns to compensate for the “completion risk” that they bear in merger deals; thus, subsequent returns increase.

The literature is unclear on the role arbitrageurs play in the takeover market. In particular, it is unclear whether their abnormal profits are driven by their superior knowledge or whether their actions actually influence bid characteristics and outcomes. Larcker and Lys (1987) are the first to conduct cross-sectional tests and suggest that arbitrageurs have the superior ability to predict takeover outcomes. They hypothesize that arbitrageurs are better informed than the market about the probability of deal success. Using a sample of 94 SEC 13D filings from 1977 to 1983, they find evidence consistent with their hypothesis. Firms have higher success rates than the probability of success implied by market prices at the date when arbitrageurs acquire target shares. Arbitrageurs are therefore able to generate

average excess returns of 5.3% on their portfolio positions from the transaction date to the resolution date.⁴

Nevertheless, it is plausible that arbitrageurs' participation, by itself, influences the takeover process *irrespective of* their ability to predict takeover outcomes. To investigate this possibility, the null hypothesis is that arbitrageurs may not exert any influence on the takeover market even though they earn substantial returns on their portfolios. Specifically, their involvement may provide no effect or even impose costs to the market, especially to target shareholders. Arbitrageurs have incentives to disguise their trades so that they can maximize their profits. Although it does not imply that their trading information will not be impounded into the stock price, the information effect is in fact reduced by their attempt to hide their trades. Therefore, arbitrageurs' abnormal profits are mainly due to their superior ability. In addition, while target shareholders benefit the most from the bid with the highest premium, arbitrageurs' profits depend on the spread rather than on the bid premium. Therefore, arbitrageurs might help the deal with the highest spread to succeed even though that deal does not provide the highest premium to target shareholders.

Alternatively, it is believed that merger arbitrageurs are active participants in takeover contests. Unlike small shareholders or noise traders, they tend to accumulate large blocks of target shares and sell them to the bidder. As a result, their presence helps overcome the free-rider problem described by Grossman and Hart (1980), and thus facilitates the takeover process. Recent theories provide strong support for this view.

In line with this argument, Cornelli and Li (2001) develop an information-based model which explains why arbitrageurs have an incentive to enter the market for corporate control. In particular, their argument is distinct from the general perception that arbitrageurs have better information about the probability of deal success than the general public. Instead, the information advantage that an arbitrageur possesses arises from her own position. Owing to this advantage, the arbitrageur is capable of paying a higher price to persuade the small shareholders to sell their shares. Consequently, she will choose to purchase shares while the expected profit is positive. In equilibrium, the arbitrageurs' decision to take positions, their holdings, and the purchase prices are determined endogenously. The

⁴Early studies by Brown and Raymond (1986) and Samuelson and Rosenthal (1986) examine the price movements of target stocks as predictors of tender offer success. Absent from the content of risk arbitrage, both papers conclude that the evolution of target price movements is an accurate indicator of the final outcome.

model further predicts that the increased presence of arbitrageurs is positively related to the probability of offer success and a higher takeover premium.

In the context of freezeout tender offers,⁵ Gomes (2001) develops a dynamic model in which arbitrageurs accumulate large blocks of target shares by trading with noise traders (e.g., *current shareholders*) as in Kyle and Vila (1991). Because of the hold-out power derived from accumulated shares, arbitrageurs along with block shareholders can purposely delay their tenders until the bidder offers a higher premium. One implication from his model is that there exist a positive relation between increased merger arbitrage activity and the takeover premiums.

The above two theoretical models suggest that, if arbitrageurs do influence bid characteristics and outcomes, it would likely be through their holdings and takeover premiums. Ex ante, the decisions made before the announcement would affect arbitrageur's participation. An important decision made during merger negotiations is the payment method. A major development of this decade regarding the form of payment is the collar offer. Two recent studies show that collar deals exhibit different characteristics from those in cash or stock deals. Using a sample of 632 announced mergers during 1992-1997, Fuller (2001) shows that collar offers provide higher announcement-day returns for target shareholders than cash deals. Collar offers, however, do not benefit the bidders. Using a sample of mergers and tender offers from 1991 to 1999, Officer (2001) further presents evidence that the inclusion of collar provisions increases the probability of bid success. The results indicate that a collar offer contributes two sources of value to target shareholders: the offer premium and the value implicit in the collar provisions. In addition to the above two academic studies, Amobi (1997) suggests that the bidder "may be concerned about the negative impact of arbitrage trading activity on its share prices following announcement of the merger. As a result, it may want to mitigate this by" including collar provisions for price protection.⁶

⁵After a majority of shareholders approve a tender offer, the rest of the shareholders are required to tender their shares at the bid price even though they did not vote for the offer. It is said that they have been *frozen out* their positions. See Gaughan (1999) for a detailed description on this topic.

⁶The financial press also indicates the possible impediment that collars may bring about to arbitrageurs' decision-making. For instance, in an interview with *BARRON'S*, Fred Green, the co-manager of the Merger Fund, indicates that "... in some deals, [investment bankers] have deliberately structured the transaction [as a collar offer] to make it difficult for arbs to hedge." ("*Paradise Lost?*" March 30, 1998) One article from *Forbes* in August 26, 1996, addressed a similar concern and warned investors that "... if [the deals] have walk-aways, consider selling your shares."

Given the popularity in the 1990s and the effect of collar inclusion in the takeover-related contests, the arbitrageurs' role in collar offers could be different from the role they play in offers with different forms of payment. It is unclear which effect collar offers provide during the merger or takeover process.

This paper begins by examining whether arbitrageurs earn systematically different returns to portfolios formed on the basis of method of payment. Cash offers are more prevalent in hostile takeovers and, on average, are associated with higher returns. Arguably, arbitrageurs involved in those deals also face higher completion risk, in addition to risk associated with cases of multiple bidders. If arbitrageurs consider all potential risks efficiently, then we should expect insignificant systematic differences in portfolio returns formed on method of payment. On the contrary, if arbitrageurs do not differentiate among deals, systematic difference in returns would be observed. In addition, this paper provides evidence on the impact of arbitrage holdings on deal probabilities and takeover premia. To control for the problem of endogeneity, the empirical analysis explicitly accounts for the joint impact of five key variables: The toehold, the offer premium, the success rate, and arbitrage returns and holdings. Overall, results in this study are consistent with the hypothesis that arbitrageurs play a pivotal role in the market. The sample selection and characteristics are described in the next section.

III. Sample description and preliminaries

A. Initial sample – SDC Mergers & Acquisitions database

The initial sample is taken from the Securities Data Company (SDC): Mergers and Acquisitions database. SDC started to record merger agreements with collars in 1992. To avoid sample selection bias, the sample period is restricted from 1992 to 1999. To be included in the sample, a merger must meet the following selection criteria:

- Both firms have reported CUSIP numbers or ticker symbols.
- There are no other major contaminating events such as stock splits or asset sales from the announcement date to the deal resolution date.

- The method of payment does not contain mixed forms (e.g., convertible preferred, convertible notes, ... etc.) except for collar provisions. Therefore, the transaction is either pure cash, pure stock, or pure stock with collar provisions. Determining the appropriate “hedge ratios” in the merge-arbitrage strategy is not possible for hybrid securities since their market values are in general not obtainable.⁷
- The acquirer owns less than 50% of target stock before the announcement and is seeking control of the target company. Thirty-two mergers of equals are excluded because we can not identify which party is the target.

Based on the above four criteria, the initial sample contains 955 deals. Further excluded are 13 cases classified by SDC as reverse takeovers, divestiture, restructuring, and bankruptcy takeovers. Finally, the remaining sample is reduced from 942 to 680 because either bidder or target stock returns are not covered on the CRSP tapes or are not available for at least 100 days before deal announcement. Therefore, it is not possible to estimate the market model effectively in those cases.

The details of transaction information such as announcement dates, agreement dates, withdrawal dates, deal values, and target manager’s attitude are from SDC. However, SDC does not further classify stock deals as either fixed-exchange-rate offers (FX) or fixed-value offers (FV), and usually does not contain detailed description of collar offers. The detailed transaction terms are gathered by searching Lexis/Nexis Business News (Mergers & Acquisitions) or SEC Edgar Database. These terms include the payoff function, the evaluation period, and any “walk-away” rights in which the bidder or the target has the right to terminate the deal if the bidder stock price dropped out of the collar range during the evaluation period.

Panel A of Table 1 shows the distribution of the sample by the method of payment over the period from 1992 to 1999. While there are more stock deals each year, which may be due to the bull stock market in the 1990’s, it does not appear that the proportion of each method of payment varies significantly over time. This pattern is consistent with those in Fuller (2001) and Officer (2001).

One of the major concerns in a pure stock-swap transaction is the acquirer’s stock price volatility. If the acquirer’s pre-closing share price declines significantly, the target might be averse to accepting the

⁷See Mitchell and Pulvino (2001) for a discussion of the robustness of excluding deals with mixed forms.

offer. On the other hand, if the acquirer's share price increases dramatically, the acquirer might wish to issue fewer shares. Thus, since collar provisions are essentially designed to provide protections for both takeover parties, we would expect more collar offers to be from industries such as Computers or Chemicals. The firms' stock prices in those industries are usually more volatile than in other industries. Financial, Utilities, and Telecommunications industries are also possible candidates for collar offers because mergers and acquisitions usually take longer to complete in those industries because of the regulation issues.

Panel B of Table 1 reports the distribution of the sample across 46 industry groups. The assignment of the firms to industry groups is based on 2-digit SIC codes in CRSP. In general, more bidders and targets are from the Financial, Services, and Retail industries. However, Panel B provides little indication that collar offers are more clustered in the aforementioned industries than the rest of the sample.

B. Sample characteristics

We begin the return analysis by estimating the cumulative abnormal returns for the bidders and the targets over the three-day window centered on the announcement date. Following the standard market-model procedure with the model parameters estimated from day -379 to -127, the results (not reported) indicate that both bidders and targets have the highest abnormal returns in cash offers. They are 1.7% and 22.4%, respectively. Consistent with previous studies (e.g., Travlos (1987) and Huang and Walking (1987) for cash and stock deals; Fuller (2001) and Officer (2001) for collar deals), bidders employing stock offers experience the most negative returns (-3.0%), and targets in stocks offers also experience the least positive returns (11.1%). The market reactions to collar offers are on average in between for the bidders (-1.4%) and the targets (16.1%).

Table 2 provides descriptive statistics for takeover characteristics based on form of payment. The difference of variables between the full sample and the three sub-samples is then tested. The results indicate that cash offers exhibit more differences than stock and collar offers. For example, cash offers are smaller and are associated with higher bidders' toeholds, shorter deal durations and lower spreads. Consistent with numerous studies in toeholds, the probability of deal success is higher when the bidder has a higher percentage of target shares before announcement even though most bidders do not acquire

toeholds beforehand. The average size of toehold in cash offers is only 2.4 percent. Additionally, more cash deals are associated with hostile attitude from the target management, an important determinant of deal success (Walkling (1985)). It is also consistent with Schwert (2000) stating that SDC is more likely to classify withdrawn deals as hostile takeovers even though they might not be. Following Jindra and Walkling (2001), the spread is defined as the difference between the initial offer price and the target firm's stock price one day after the announcement (P_{+1}^T) normalized by P_{+1}^T . The revision return (if applicable) is then calculated as the difference between the final and the initial offer prices normalized by P_{+1}^T . Interestingly, even though more cash offers are hostile, the spread is smaller in those offers than in stock and collar offers. This may imply that the market expects a higher probability of revision in cash deals. Specific tests are further performed between stock and collar offers. The results (not reported) reveal that collar offers do not exhibit significantly different characteristics from stock offers except for the takeover premium. Cash and collar offers provide higher premia than stock deals. Arbitrageurs' profits come from three major sources: the spreads, the revision returns and the probability that deals are complete. Combining the results from the spread along with the premia, we might expect that collar offers have the highest returns while cash offers provide the lowest returns before adjusting for risks.

Finally, although one of the major reasons why the deals are structured to include collar provisions is that the participating companies expect a longer period of time to complete the deal, the difference in deal durations between stock and collar offers is not statistically significant. The next section discusses the procedure to construct three takeover portfolios. Their performance is then evaluated under the conditional Fama-French (1993) three-factor framework.

IV. Portfolio formation and evaluation

A. The procedure of portfolio formation

The arbitrageur's investment depends on the acquirer's method of payment to the target shareholders. In a cash deal i , the arbitrageur simply purchases the target stock and holds the position until deal consummation. The primary source of this investment strategy is the difference between the price

at which the target company trades after the deal announcement and the cash price offered by the acquirer. This source can be decomposed into two elements: the spread and the revision return.⁸ The second source of profit comes from any dividend that will be received on the target stock before deal consummation. Besides these two sources of profit, the transaction also requires the arbitrageur to pay the financing cost.⁹ Here it is assumed that the arbitrageur borrows at the risk-free rate. Therefore, the return for a cash deal i on day t has the following form:

$$r_{it} = \frac{P_{it}^T + D_{it}^T}{P_{it-1}^T} - 1 - r_f \quad (1)$$

where P_t^T is the target firm's price at time t , D_t^T is the target firm's dividend payment at time t , and r_f is Treasury bill rate. For a stock-swap or a collar transaction, the arbitrageur takes a long position in the target stock and hedges his position by shorting δ shares of the acquirer's stock where δ is the exchange rate of the offer. Similar to a cash offer, the three sources of a stock or a collar offer are the return and the dividend on the target and the return of the proceeds from a short position in the acquirer's stock. Again, it is assumed the arbitrageur earns the risk-free rate from his short position. The associated costs are the borrowing cost (the risk-free rate by assumption) and the return and the dividend from the short position. Therefore, the return for a stock/collar deal i on day t has the following form:¹⁰

$$r_{it} = \frac{P_{it}^T + D_{it}^T}{P_{it-1}^T} - 1 - r_f - \left(\frac{P_{it}^A + D_{it}^A}{P_{it-1}^A} - 1 - r_f \right) \delta \frac{P_{it-1}^A}{P_{it-1}^T} \quad (2)$$

where P_t^A is the acquiring firm's price at time t , D_t^A is the acquiring firm's dividend payment at time t . For a fixed-exchange-rate (FX) stock/collar deal, the arbitrageur's short position is determined right after the takeover announcement. For a fixed-value (FV) stock/collar deal, the exchange rate δ varies across time until the end of the valuation period. Ideally, the arbitrageur's short position also varies with δ such that a perfectly hedged net position is reached. In reality, it is not possible to reach this

⁸Although the spread is positive in most cases, Jindra and Walkling (2001) finds that over 23% of the spreads are actually negative in their sample of 362 cash tender offers in the 1981-1995 period.

⁹This is known as the broker call rate.

¹⁰The return functions are similar with those in Mitchell and Pulvino (2001) and Baker and Savasoglu (2001). However, there exist two differences. First, in this paper, the borrowing costs are entered explicitly into the return functions. Mitchell and Pulvino estimate transaction costs by using the price impact model developed by Breen, Hodrick, and Korajczyk (1999). Baker and Savasoglu do not consider the transaction costs. Second, Baker and Savasoglu assume the arbitrageur can not access the proceeds from the short sale position. On the other hand, the formation strategy in this paper assumes that the arbitrageur will be paid interest on his short position. (see e.g. Pitaro (1999), pp. 33).

goal due to transaction costs. Thus, it is assumed the arbitrageur determines the exchange ratio by the formula: $\delta = (\text{acquirer's offer price})/(\text{acquirer's stock price one day after announcement})$, and his position is held until the deal resolution (defined below). If the deal is revised, we assume arbitrageurs re-balance their positions, and thus, the new exchange ratio is applied in the return formula.

Following the procedure of portfolio formation in Mitchell and Pulvino (2001), daily returns are calculated from the day after the announcement to the resolution day. For successful deals, the resolution day is the day on which the target company's stock is delisted from CRSP. For withdrawn deals, the resolution day is the day after deal failure is publicly announced. Hence, we do not take into account the shares that arbitrageurs accumulate and target price runup until the day after announcement.¹¹ More importantly, the portfolio returns are not biased upward by the takeover premium when the day after the announcement is used as the starting date. The returns also are not biased upward when the day after the deal failure is publicly announced is used as the last date to calculate holding-period returns.

The portfolio returns are then calculated using two alternative approaches. The first method is to estimate monthly returns by using a calendar-time approach. Specifically, daily returns are first compounded monthly for each deal. Only available daily returns are used if a transaction does not occupy for a full month. Both equal-weighted and value-weighted monthly portfolio returns are then calculated. The target's average market value of equity from days (-126, -54) relative to the announcement day is used as a weighting factor for value weighted portfolios. The monthly abnormal returns are then estimated by applying the conditional Fama and French (1993) three-factor models. The details of the methodology are described in the next section.

The second method is to calculate buy-and-hold returns by using an event-time approach. In each deal, the daily returns are first compounded from the day after announcement to the resolution day instead of compounded monthly. The computed deal return serves as a proxy for arbitrageurs' buy-and-hold return in that deal. One potential problem in buy-and-hold returns is that offers have different periods of time. To put all offers on a comparable basis, the returns are annualized by multiplying the period returns by $365/(\text{offer duration})$.

¹¹This assumption is not unreasonable. Larcker and Lys (1987) report in their sample that in only three cases did arbitrageurs take positions prior to the takeover announcement. In fact, arbitrageurs usually start to assemble as much information as possible about the deal *after* a transaction is announced. They however, do not predict the occurrence of the events before the announcement. See Moore (1999) for a practitioner's description about a typical investment process.

B. Conditional portfolio evaluation

The unconditional estimation of the Fama-French (1993) three-factor model assumes that the factor loadings (β) are constant over time. In light of recent studies that the expected returns and risks of stocks are predictable using publicly available information, it is important to control for common variation caused by public information and to test the null hypothesis of zero abnormal portfolio returns in a conditional asset-pricing framework. Specifically, monthly excess returns of a takeover portfolio are regressed against the excess return of the market factor, the Fama and French (1993) book-to-market (HML) and size (SMB) factors, and Carhart (1997) momentum factor:

$$\begin{aligned} r_{pt} - r_{ft} = & \alpha + \beta_m(Z_{t-1}MktRP_t) + \beta_{smb}(Z_{t-1}SMB_t) + \beta_{hml}(Z_{t-1}HML_t) + \\ & + \beta_{pr1yr}(Z_{t-1}PR1YR_t) + \beta_{bvool}(Z_{t-1}BVOL_t) + \beta_{tvool}(Z_{t-1}TVOL_t) + \epsilon_t. \end{aligned} \quad (3)$$

where $r_{pt} - r_{ft}$ is the excess return of the individual portfolio of cash, stock, or collar deals. $MktRP_t$ is the market risk premium, SMB_t and HML_t are Fama-French size and book-to-market factors,¹² and $PR1YR_t$ is the return on the portfolio long in the winner portfolio and short in the loser portfolio over the previous year.¹³ Bidding and target firms' trading volumes ($BVOL$ and $TVOL$, respectively) are also included in the regressions to control for the phenomenon in which volumes are generally higher than the normal period after the merger announcement. Trading volume is defined as bidder's and target's average monthly turnover ratios, measured by dividing trading volume by total shares outstanding. The period of time for estimating trading volume is in uniformity with the period of time for calculating deal returns.

In addition, Z_{t-1} is a vector of pre-determined information variables which include the lagged dividend yield on the CRSP value-weighted market index, the lagged one-month Treasury bill rate, a dummy variable for the month of January, and the lagged measures of the credit and yield curve spread. Two additional information variables are included: the lagged market risk premium and the logarithm of the total number of takeovers in the previous month. Three zero-investment portfolios are further constructed by going long in one takeover portfolio and shorting another one. For example,

¹²We thank Ken French for providing the return series on these three factors.

¹³This momentum factor is constructed similarly to Carhart (1997). In particular, each month we form a high-performance portfolio ("winners") and a low-performance portfolio ("losers") based on their buy-and-hold one-year returns lagged one month. Both portfolios are equally weighted. The high-performance portfolio contains the third of the firms with the highest realized return, while the low-performance portfolio contains the third of the firms with the lowest realized return. $PR1YR$ is then defined as the difference of the returns of the winner-portfolio and loser-portfolio.

“collar - stock” is a zero-investment portfolio by going long in a portfolio of collar offers and shorting a portfolio of stock offers. The resulting alpha is an estimate of the difference of abnormal returns from both portfolios. Table 3 provides summary statistics of portfolio returns from January 1992 to December 1999 while Table 4 presents the estimates of the conditional models.¹⁴

V. Comparison of Arbitrage Portfolios

Panel A.(1) of Table 3 reports buy-and-hold returns for equal-weighted (EW) and value-weighted (VW) portfolios. Arbitrageurs, as expected, earn substantial positive returns, ranging from 4.35% (VW-stock) to 11.41% (EW-cash) in each deal. The median returns are lower, from 2.15% (VW-cash) to 5.39% (VW-collar), but still significant at the one percent level.

As discussed above, one potential problem of using buy-and-hold returns is that offers have different durations. It is imperative that the returns be annualized by multiplying the period returns by the quotient of (365/offer duration) in order to place all offers on a comparable basis. Panel A.(2) shows that cash offers provide higher annualized returns than stock and collar offers. The latter two, however, provide similar profits despite the fact that collar offers are associated with higher premium as shown in Table 2. In addition to buy-and-hold returns, the average monthly returns along with the Sharpe ratios are presented in Panel B. Interestingly, the results show a different picture. The equal-weighted returns of collar offers have the lowest Sharpe ratio compared with the returns of cash and stock offers, but stock offers earn the lowest returns and Sharpe ratio in value-weighted portfolios. To further investigate the difference between the three portfolios and to take portfolio risk into consideration, we first apply the classical asset-pricing approach to measuring relative performance of these three portfolios. The determinants of cross-sectional buy-and-hold returns are then further analyzed. The difference between

¹⁴An alternative specification of the model (eq.(3)) is a piecewise linear CAPM-type model as in Mitchell and Pulvino (2001). A similar model can be estimated by introducing a dummy variable, D_t , that equals unity for negative monthly excess returns and zero otherwise. Specifically, the alternative equation takes the form,

$$r_{pt} - r_{ft} = (\alpha + D_t\delta_p) + (\beta_m + D_t\delta_m)MktRP_t + \beta_{smb}SMB_t + \beta_{hml}HML_t + \beta_{pr1yr}PR1YR_t + \beta_{bvol}BVOL_t + \beta_{tvol}TVOL_t + \epsilon_t,$$

where the δ parameters are those associated with the dummy structural-break variables. However, the major results remain unchanged, the new parameters do not increase significant explanatory power in almost all of the regressions. To save the space, the results from this set of regressions are not reported.

these two approaches is that the first method estimates the abnormal returns in a time-series portfolio setting while the second method investigates the cross-sectional difference of individual offers. The second approach allows us to control for deal-specific characteristics and most importantly, to further investigate the impact of arbitrage holdings on the portfolio returns and in the takeover market.¹⁵

A. Monthly portfolio estimates

Panel A of Table 5 presents the conditional alphas and factor loadings for takeover portfolios of all deals. Panel B reports the intercepts from the portfolios of subsamples according to the form of payment. Several major results emerge. First, consistent with the preliminary analysis, takeover portfolios still exhibit significant abnormal returns after adjusted for market risk and other risk variables. The expected portfolio returns, however, also exhibit considerable variations based on the reported p-values. The average monthly returns range from 0.18% (p-value = 0.794) to 1.56% (p-value = 0.000). Second, the alphas from zero-investment portfolios indicate that cash portfolios earn higher returns than stock and collar portfolios after risk adjustment. Strikingly, collar and stock portfolios earn returns insignificantly different from risk-free rates in several estimations.

B. Determinants of buy-and-hold takeover returns

Panel A of Table 5 categorizes annualized returns by offer characteristics. In withdrawn stock and collar deals, arbitrageurs earn returns insignificantly different from zero. This is consistent with the existing literature that the target shareholders do not realize the wealth increase in withdrawn mergers, and the stock price drops to the pre-announcement level. Cash offers, by contrast, exhibit an interesting result in which takeover returns are higher in withdrawn than in completed deals. It implies that the market expects the target to be a possible candidate in the near future.

Furthermore, takeover returns are generally not affected by pre-announcement takeover activities such as the bidder's toehold and the target price runup. Specifically, while higher bidder toeholds

¹⁵While the procedure of annualizing returns allows us to put all offers on a comparable basis, it might have some undesirable costs. One potential drawback of using annualized cross-sectional returns is that it is assumed arbitrageurs can obtain buy-and-hold returns continuously (see, e.g., Mitchell and Pulvino (2001)). Thus, the annualized returns seem unattainable. To mitigate this issue, a control variable, duration, is included into the systems. Intuitively, if the problem exists, we would observe negative relationship between the returns and the durations, *ceteris paribus*.

reduce the probability of competition and bid premia (Betton and Eckbo (2000)), they do not affect the profitability of takeover portfolios. Similarly, as shown in Panel B, takeover returns are not influenced by pre-bid runups in the target firm's stock price, but are positively correlated with post-bid markups. This evidence is consistent with Schwert (1996) that shows little substitution exists between the runups and the markups.

The relation between takeover returns and the target firm's post-announcement trading behavior is further investigated. Existing theoretical models suggest that the target trading volume and the expected profits are highly correlated. For example, the target volume has a positive relationship with the expected profits in the model of Cornelli and Li (2001). The abnormal trading volume for the target i is defined as

$$AV_i = \frac{(1/T) \sum_{t=+1}^{\min[50, delisting-1]} V_{it}}{(1/73) \sum_{t=-126}^{-54} V_{it}} - 1 \quad (4)$$

Where V_{it} is the trading volume on day t . To ensure a consistent measure of abnormal trading volume across the sample deals, the post-announcement volume is averaged only in fifty days or until one day before the target is delisted from CRSP, whenever comes first. Ninety percent of the sample deals have duration longer than fifty days. Panel B.(4) reveals that the higher the trading volume, the higher the takeover returns except for the insignificant case of collar offers.

B.1. The relationship of takeover returns to the spreads and the revision returns

Takeover returns can be decomposed into two components: the initial spreads and the revision returns. Following Jindra and Walkling (2001), the spread is defined as $(\text{Initial offer price} - P_{+1}^T)/P_{+1}^T$ where P_{+1}^T is target stock price one day after announcement. Accordingly, the revision return is defined as $(\text{Final offer price} - \text{Initial offer price})/P_{+1}^T$. Panel C.(1) presents the takeover returns separated by the sign of spreads. The deals with negative spreads account for 11.8% of the whole sample. The percentage of deals with negative spreads maintains a comparable magnitude across three subsamples. Jindra and Walkling report 23.1% of cash tender offers with negative spreads during the period of 1981 to 1995. For subsamples, it is apparent that the annualized buy-and-hold returns are higher when the spreads are positive for stock and collar mergers. Cash offers, on the other hand, provide positive

profits even when the spreads are negative. Further investigation (not reported) reveals that 7 out of 17 (41%) negative-spread cash offers are indeed revised up. This figure is higher than the stock (2 out of 49; 4%) and collar offers (3 out of 14; 20%). It indicates that the market effectively expects the possible revisions from the bidders. Takeover returns from cash offers are further increased by the revision returns.

Panel C.(2) reveals that conditional on revisions, cash offers are more likely to be revised up than down (15 “up” cases versus 5 “down” cases) whereas stock and collar offers have similar possibility to move in either direction (17 versus 18 and 13 versus 15). In addition, once revised upward, cash offers also provide higher takeover returns than the other two subsamples. The median revision return to the cash-offer portfolio is an impressive 63.2% while the other two portfolios provide median revision returns around 6.2% for stock offers and 12.3% for collar offers. Sections VI. E and VI. F investigate in greater detail about the impact of arbitrage holdings on spreads and revision returns.

VI. Determinants of Arbitrage Holdings

A. Identifying arbitrage holdings – Spectrum Database

Following Baker and Savasoglu (2001), arbitrageurs are identified from SEC 13F filings of institutional ownership recorded by Spectrum over the period from 1992 to 1996. Because of the restriction to this time period, the number of deals in the analysis decreases from 680 to 325. The proportion of each type of deal is similar despite the reduction in the number of observations. Stock offers still account for around half of the sample size. This subsample is further used to perform robustness checks for the analysis performed in the full sample.

The Spectrum Database provides information about quarterly holdings of financial institutions with investment discretion over \$100 million in equity securities. These institutions are required to disclose all common-stock positions greater than \$200,000 or 10,000 shares. There are three limitations by using the Spectrum Database. First, institutions are not required to disclose their holdings below the

threshold of \$200,000 or 10,000 shares.¹⁶ This introduces a downward bias in the measure of arbitrage holdings in each deal. If the holdings have consistent and significant impact on other variables of interest such as realized returns and takeover premium no matter whether the relation is positive or negative, then the estimates are more conservative and will run against the findings.

Second, institutions are required to report their holdings only in an aggregate level. Due to the situation that more arbitrage departments are divisions of financial powerhouses instead of being individual investment companies, the total net holdings might be lower than the thresholds; thus, they could be absent from reporting. Again, however, this will be more supportive of the null hypothesis of no relation between holdings and other interested variables.

Third, institutions only report their holdings on a quarterly basis; therefore, it is not possible to align the change of their holdings with other interested variables such as returns and takeover premia more precisely. In addition, the information of the holdings between the latest reporting date and the final resolution date is unattainable. As a result, it is assumed that arbitrageurs' positions at quarters' ends are indicative of their positions until the deal resolution.

Spectrum divides the institutional investors into five categories: banks, insurance companies, investment companies and their managers, independent investment advisors, and other institutions. Intuitively, we might expect that arbitrageurs fall into the category of independent investment advisors. Further examination reveals that this may not be the case on account of the complex composition of each group. For example, since 1980s, investment companies have begun to establish arbitrage departments which were generally managed in the capital markets areas of the firms. (See Moore (1999) for a description of the industry.)

The arbitrage holdings in each deal are derived by using a methodology similar to Baker and Savasoglu (2001). First, the net changes of institutional ownership in the target firm are calculated from the quarter immediately before to the quarter immediately after a takeover announcement.¹⁷ While we

¹⁶An alternative database is the data on SEC 13D filings. When an investor exceeds an ownership limit of five percent of shares outstanding, she is required to file a 13D report *within ten days of purchase*. To perform an initial task, we search 13D filings for 135 collar offers. However, only twenty 13D reports are found from SEC EDGAR database. Although the 13F filings might have lower reporting threshold than 13D filings, it is conceivable that arbitrageurs have intentions not to disclose their holdings on a timely basis.

¹⁷The sample consists of 331 deals during the period of 01/1992 - 03/1997. However, six deals are deleted because they do not cross two quarters. The final sample is 325 deals.

expect arbitrageurs to be net buyers in most of the cases, one potential problem exists. When a merger is announced, there usually exists a certain level of uncertainty about the success of the deal. Because of heterogeneous beliefs about the final outcome, arbitrageurs might not always act in the same direction during the entire takeover process. This problem is more severe when the uncertainty of the deal is higher. Nonetheless, we would still expect positive net changes of arbitrage holdings around the announcement dates.

Second, to be identified as a risk arbitrageur, the institution needs to have positive net change in holdings for at least six deals and more than fifty percent of all deals in which they are involved. These cutoff points are arbitrary. To ensure the results are insensitive to these choices, we perform robustness checks.¹⁸ Overall, these choices do not alter the main results.

Based on the above filter rule, holdings in *all* of the sample deals are then calculated for the identified arbitrageurs. Finally, the net change of holdings in each deal is aggregated by summing all net holdings across arbitrageurs. The holdings are measured from the quarter immediately before the announcement date to the quarter before the deal resolution date.¹⁹ There are 1807 institutions reported in Spectrum during the sample period from 1992 to 1996. 94 institutions are identified as arbitrageurs. Panel A of Table 6 reports a summary of the final sample and total number of selected arbitrageurs in each category. As expected, independent investment advisors account for 55.3% of the sample. This group covers mostly large investment banks and brokerage firms as well as hedge funds. In our sample, the top five institutions involving the most deals are Wells Fargo Institutional Traders, Bankers Trust New York, Primerica, Bear Stearns & Co. and Dimensional Fund Advisors. Interestingly, 12.8% of the sample consists of “other” institutions which cover the largest pension funds, foundations and university endowments. As discussed in Moore (1999), pension funds used to be net sellers of target companies once the transactions were announced. Since the late 1980s, pension funds have hired arbitrageurs to make the investment decisions on securities subject to takeovers.

¹⁸To be specific, the cutoff points are modified from six to ten deals with increments of two *or* the percentage of involved deals is changed from fifty to seventy percent with increments of ten percent. The analysis reported in Tables 7 and 8 is then re-performed. Those results are available upon request.

¹⁹Baker and Savasoglu (2001) also utilize Spectrum Database to measure arbitrage capital. However, for the different objectives of their paper, they aggregate the “non-merger related equity holdings” and label them as arbitrage capital.

B. Deal characteristics categorized by number of arbitrageurs and their holdings

Panel B of Table 6 displays the distribution of arbitrage holdings over the period from January 1992 to March 1997. On average, there are 12 arbitrageurs in each deal with 3.6% net increase of target shares held by them²⁰. As expected, these figures are rather conservative due to the data availability and the stringent screening procedure. Panel C further divides the holdings according to the method of payment. Surprisingly, the right two columns show that arbitrageurs have the highest holdings in collar deals. The time-series patterns of arbitrage holdings (not reported) do not indicate any significant changes in a particular year. The average holdings range from 2.47% (1993) to 4.63% (1995) while the average number of arbitrageurs in each deal is from 8.6 (1992) to 13.28 (1995).

Panel D reports the holdings categorized by deal characteristics. The results show that larger transactions not only attract more arbitrageurs – the average holdings are also higher as well. Large market-capitalization targets receive more attention by the market. They also provide greater liquidity levels such that tradings are less salient. Furthermore, consistent with existing literature, successful deals are associated with more arbitrageurs and larger holdings. This suggests that arbitrageurs possess superior capability of predicting the outcomes of the offers. Additionally, Panel D.(9) reveals that while the greater number of arbitrageurs, the narrower the spreads, there is no significant association between holdings and spreads. The next section presents a multivariate analysis of arbitrage holdings.

C. Takeover premium, arbitrage holdings, and returns

Given the potentially joint determination of four interested variables, arbitrage holdings are analyzed along with bidders' toeholds, premiums and arbitrage returns in a system of four simultaneous equations. The methodology of joint estimation is imperative in this study. First, existing theoretical models suggest that these variables are determined endogenously. For example, Gomes' (2001) model implies that the bidder is willing to increase the takeover premium to mitigate the potential hold-out problem. At the same time, arbitrageurs also are more likely to increase their holdings when the premium is high. In addition, Cornelli and Li (2001) suggest that there is a positive relationship between arbitrage

²⁰In this study, one arbitrageur is synonymous with an institution as reported in Spectrum. Therefore, specifically, we are interested in "aggregate" holdings in each reported institution. It is apparent that in one large institution, some departments are usually net sellers while others are net buyers. Due to the data limitation, it is not possible to explore this possibility.

holdings and returns. If the interested variables are endogenous, then least squares estimates will be inconsistent. (See Greene (1997), Chapter 16.)

Panel A of Table 7 shows the results from the exogeneity tests. They indicate the rejection of the null hypothesis that the four variables are exogenous.²¹ In particular, when one estimates the takeover premiums and the returns, the endogeneity issue that arises from the variable of arbitrage holdings needs to be taken into consideration. Furthermore, since all four interested variables are continuous variables, simultaneous-equations models provide a convenient and effective approach to correct for the endogeneity bias.

Table 7, Panel B shows the results from the estimated systems using the two-stage least squares (2SLS) and the three-stage least squares (3SLS) models. In Panel C, the endogenous variable, arbitrage holdings, is replaced with the logarithm of number of arbitrageurs [$\log(1 + N_{arbs})$]. In general, the results are consistent with existing studies. Tender offers provide higher premiums. Toeholds are negatively, albeit insignificantly, correlated with premiums while friendly deals are associated with higher premiums. The fourth equation further shows that friendly deals, however, have lower returns. Moreover, the takeover returns increase when the premiums and the probability of deal success are higher. Consistent with the univariate results, stock and collar offers provide lower profits. After controlling for deal characteristics, the annualized returns of stock (collar) offers is 46.5% (90.1%) less than the returns of cash offers.

Table 7 also demonstrates a positive contemporaneous relationship between takeover returns and abnormal post-announcement volume in target company's stock. More importantly, arbitrage holdings of target shares are positively correlated with the premiums and the takeover returns. The holdings also have a positive relationship with post-announcement trading volume. These results strongly support the theoretical predictions in Cornelli and Li (2001) and Gomes (2001).

The results further reveal that the relationship between arbitrage holdings and returns is marginally curvilinear. The curve initially slopes upward when the aggregate holdings are low. Arbitrage returns start to diminish as holdings increase. The curvilinear property explains why arbitrageurs have the

²¹Essentially the exogeneity test is a Hausman test. See Greene (1997, p. 763) for a description of the procedure.

incentive to disguise their trading patterns and intend not to hold up more than five percent of target shares. When more arbitrageurs are involved in the deal, the profits gradually decrease.

In addition, arbitrageurs purchase fewer target shares in deals in which the bidders face competition even though those offers provide higher returns. One plausible explanation for stock and collar deals is that, in line with the argument of limited arbitrage as in Shleifer and Vishny (1997), arbitrageurs are more likely to face capital constraints in the cases of multiple bidders because of their additional short-selling positions. The capital constraints are exacerbated by the quick arrival of competition. Betton and Eckbo (2000) document that rival bids on average arrive within 15 days.

Further, arbitrage holdings are significantly higher in collar offers even after controlling for other variables. Target management attitude and the deal duration, on the other hand, affect the number of arbitrageurs but not arbitrage holdings. Finally, both holdings and number of arbitrageurs are positively correlated with takeover returns depending on model specifications. We discuss this result in the next section.

D. Is the probability of offer success influenced by arbitrage holdings?

As shown in the previous sections, arbitrageurs seem able to generate private information regarding the outcome of mergers. On the other hand, is it plausible that arbitrageurs' involvement might improve the probability of offer success *irrespective of* their superior prediction ability? An alternative hypothesis is that they are regarded as noise traders; thus, their participation does not have any influential effect on the market of corporate control. Therefore, bidders do not need to take into account arbitrageurs' presence on the takeover process.

Existing theoretical studies support the first view of the argument. For instance, Cornelli and Li (2001) show that even though arbitrageurs do not possess superior private information about the success rates of the deals, they still have an information advantage relative to noise traders in the market. The information advantage arises from their decision to take positions and their subsequent holdings. In equilibrium, the decision to enter the market, their holdings, the probability of offer success and the profits are determined endogenously.

This study provides strong empirical support for the above argument. However, before interpreting the empirical evidence, we need to be cautious about the endogeneity issue between arbitrage holdings and probability of deal success. As argued by Larcker and Lys (1987), arbitrageurs are capable of predicting deal success rates. Thus, even though we conclude that arbitrage holdings influence the probability of success, it could simply be so because of arbitrageurs' superior predicting ability.

This study utilizes two alternative econometric models to control for this endogeneity of arbitrage holdings. The first model incorporates the deal success rate into the system of simultaneous equations as in the previous section. Hence, the deal success rate is treated as an additional linear equation in the system.²² In this setting, five variables of interest are then estimated together. Although the applied linear model has some shortcomings, the obtained estimates are consistent. The second model follows the procedure in Maddala (1983, p. 244). It estimates the probability of deal success in logistic regressions by including the *fitted* arbitrage holdings as a regressor. The fitted value is obtained by first regressing holdings against other explanatory variables except the probability of success and then calculating the expected value of holdings in each deal.

Table 8, Panel A performs the exogeneity test as in Table 7 and shows that some of the variables of interest are in fact endogenously determined. After taking into account the endogeneity issue and controlling for variables that also affect the probability, the system estimation in Panel B shows that the probability of success is positively related to arbitrage holdings. The last four columns in Panel B present the results from logistic regressions. Regression (I) uses the arbitrage holdings as an explanatory variable while the fitted value is used in regressions (II - IV). Overall, the results still hold and most importantly, the relationship between the probability of deal success and holdings remains economically significant.

The system estimation also reveals that higher toeholds increase the probability of deal success, a result consistent with Betton and Eckbo (2000) and others. In addition, higher holdings are associated with higher takeover returns. This is consistent with the view that arbitrageurs have motives not to reveal their trading patterns in the market. If their trading behavior is discovered, spreads and expected payoffs will be diminished. Another possible explanation is that arbitrageurs in general are attracted by

²²Ideally, it should be estimated as a non-linear probability model (e.g., probit or logit). However, it is technically infeasible by incorporating the model into the system of equations.

deals with higher premia after adjusting for the deal risk. Thus, we should observe that higher premia increase arbitrage holdings. On the other hand, before deciding the premium, the bidder considers the possible effect that arbitrageurs would bring into the takeover process. He has an incentive to provide higher premium to ensure the support from arbitrageurs. In equilibrium, we should observe a positive contemporaneous relationship between holdings and takeover returns.

E. Regression analysis of arbitrage holdings and deal spreads

As uncovered in the simultaneous-equation estimations from the previous sections, depending on model specifications, there exists a curvilinear relationship between arbitrage holdings and returns. One of the major variables that affect arbitrage returns is the deal spread, the difference between the initial bid price and the target stock price one day after announcement. If we assume that block tradings from arbitrageurs reveal information about the deal situation and affect the target price, then we would expect a negative relationship between holdings and spreads. In Table 9, a multivariate analysis of spreads is performed with other variables known at the time of the bid. Two methods are utilized to lessen the endogeneity of holdings. First, only the initial holdings are included in the regressions. The initial holdings are defined as the net change of holdings from the quarter immediately before to the quarter immediately after the announcement. Second, the spreads and the holdings are estimated in the system of two simultaneous equations.

As shown in Table 9, greater deal spreads are associated with lower holdings. Regressions (I) and (III) reveal that spreads decrease with arbitrage holdings and when target firms have defensive strategies as reported by SDC. Surprisingly, collar offers have higher spreads even though Tables 7 and 8 have shown that both success rates and arbitrage holdings are higher in those mergers. The strong negative relationship between spreads and holdings is also supported by 2SLS and 3SLS estimations.

Next, arbitrage holdings are replaced with the number of arbitrageurs as in regressions (II) and (IV). The coefficients for the number of arbitrageurs are also negative and economically significant. It implies that both the number of arbitrageurs and their holdings provide similar information to the deal spreads.

F. Regression analysis of arbitrage holdings and revision returns

Can arbitrageurs anticipate deal revision? If the deal is terminated, can arbitrageurs predict the possibility that the target firm will receive subsequent bid(s) in the near future? If so, it is more likely that arbitrageurs have a significant impact on the takeover market. This section intends to address these two questions. Again, to minimize the causality issue between arbitrage holdings and revision returns, the tests are performed by only using the initial net change in holdings normalized by total target shares outstanding from the quarter immediately before to the quarter immediately after the announcement.

Table 10 presents a multivariate analysis by regressing revision returns against arbitrage holdings and other control variables which may affect revision returns. The results indicate that the arbitrage holding is a strong determinant of revision returns. When arbitrageurs' initial holdings are high, the deals are more likely to be revised. The relation is statistically and economically significant.

On the other hand, it is possible that arbitrageurs tend to choose deals with characteristics which also explain the revision returns. For instance, in the previous section, we have established that arbitrageurs are important in determining deal spreads. The deals with smaller spreads might also be more likely to be revised. To control for this type of effect, it is necessary to include the control variables into the regressions such as spread, target management attitude, and bidder's initial toehold. The positive relation between arbitrage holdings and revision returns remains. In addition, as expected, friendly deals are less likely to be revised while the cases of multiple bidders are more likely to have further revision.

The next logical question to address is whether arbitrage holdings are associated with cancelled deals with higher possibility of receiving new bids. For 46 failed deals, we first exclude 7 multiple-bidder cases in which the target firms are acquired by other bidders during the original takeover period. The remaining 39 deals are then tracked and examined whether they receive new bids by the end of 2000. Panel A of Table 11 shows that 9 firms receive new takeover attempts within one year, 5 firms after one year but within two years, and 7 firms after two years.

Panel B compares arbitrage holdings and number of arbitrageurs in deals receiving subsequent bids with other deals. The target firms indeed are more likely to receive new bids when arbitrage holdings are higher. Holdings are 1.22% higher in firms receiving new bids than other firms. Panel C performs

a similar analysis but compares firms receiving new bids *within two years* with the rest of the sample. The result is even stronger. The average (median) difference in holdings between firms with new bids and those without is 1.47% (0.44%). Further t- and Wilcoxon-tests, however, show insignificance. The associated p-values are 0.218 and 0.349, respectively. Overall, the results in this section indicate that arbitrageurs are associated with higher probability of deal revision. After the mergers are terminated, they possess some ability to predict whether new bids will eventually emerge.

VII. Conclusions

Despite the increased prominence of merger arbitrage activity since the 1980s, much remains unknown about the impact of the arbitrageurs' decision to enter the takeover market. This paper analyzes the role that arbitrageurs play in the takeover market and the relationship between their holdings and returns to arbitrage portfolios. The methodology of the paper recognizes the endogeneity of arbitrage holdings and other variables of interest. It also explicitly incorporates the role of collar offers. Collar offers have received their popularity in the 1990s, and account for 22% of our sample during 1992-1999. Collar offers also have an impact on the takeover process.

We first show the systematic difference in returns of portfolios formed according to the method of payment. Cash offers provide the highest returns over time while stock and collar offers have the lowest returns. Cross-sectional analysis indicates that returns are positively related with premia and the probability of success. Arbitrageurs also earn higher returns in multiple-bidder deals and when target management opposes the initial bids.

Second, the determinants of arbitrage holdings are investigated. Arbitrageurs purchase fewer target shares in multiple-bidder deals even though those deals provide higher returns. It is plausible that, for stock and collar offers, arbitrageurs are more likely to face capital constraints in those cases. Additionally, arbitrage holdings are higher in collar offers than in cash and stock offers. There exists a marginally positive curvilinear relationship between arbitrage returns and holdings of target stocks. The curve initially slopes upward when holdings are low, but arbitrageurs' returns start to diminish as holdings increase.

Third, this study presents evidence that, in addition to their apparent ability to anticipate the deal success rates, arbitrageurs exert influence in the takeover market. The information that they reveal to the market could facilitate the takeover process. To control for the problem of endogeneity, the empirical analysis explicitly accounts for the joint impact of five key variables: the bidders' toehold, offer premium, probability of success, arbitrage returns and holdings. The results show that the probability of deal success and takeover premia are positively related to arbitrage holdings. The probability of success is also affected by bidders' toeholds, target management attitude, and bidders' lockup options granted by target managers.

Finally, holdings are positively associated with revision returns and with the possibility that target firms receive subsequent bids within two years of when the deals failed. Arbitrage holdings are associated with an increased probability of bid revisions. When the deals are terminated, arbitrageurs also tend to keep their holdings for deals involving targets that are more likely to receive new bids. Putting the results together, one can conclude that arbitrageurs play a pivotal role during the takeover process.

Appendix A. Description of collar offers

A typical stock-for-stock merger or acquisition specifies the number of acquiring firm's shares offered as consideration for each target firm's share. This exchange ratio can be determined at the time of announcement (Fixed-exchange-rate offer, FX) or calculated based on a pre-specified pricing period (Fixed-value offer, FV). The pricing period usually takes several days before shareholders vote or before the closing date of the deal.

Since stock offers on average take a longer period to complete (Gaughan (1999)), the acquirer's stock price is subject to significant fluctuations before deal closing. As a result, a collar provision in stock deals is constructed to allow for changes in the terms of the deal conditional on the level of the acquirer's stock price during the pricing period.

Two major features are usually described in collar offers: the acquirer's stock price range and a cancellation option²³. A FX offer specifies a constant exchange ratio over a range of bidder's stock prices. The ratio is subject to adjustment if bidder's average stock price falls out of the range during the pricing period. A FV offer, on the other hand, specifies a constant dollar value for each target share if bidder's stock price stays in a certain range; otherwise, the terms would be adjusted according to a minimum or a maximum exchange ratio. Finally, a cancellation option grants the target company the option to terminate the transaction if the acquirer's stock price falls below a specified level. Sometimes the acquiring company is also granted a cancellation option if its stock price experiences an abnormal increase after the announcement.²⁴ In essence, the termination option is a barrier option, and can be valued using standard options-valuation techniques.

²³ Also known as a "walk-away" right.

²⁴ As discussed in Fuller (2001), the termination option is different from material adverse change (MAC) clauses which are necessarily specified in one independent section of the contract but rarely exercised in regular conditions. The termination option on the other hand, joins other deal terms and completes the deal structure.

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