國 立 交 通 大 學

財 務 金 融 研 究 所

碩 士 論 文

風險套利的報酬與特性分析–

以美國融資收購為實證分析

Profitability and Characteristics of Risk Arbitrage:

Evidences from Leveraged Buyouts in the U.S.

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摘要

本文以風險套利的方法來探討 1991 至 2006 年之間美國融資收購的績效。我們的結果顯示以風險套利的方式，針對融資收購的目標公司所形成的投資組合平均每年報酬率為 12%。我們亦將風險套利報酬率拆解成價差報酬率(收購公司在宣告日宣告的支付價格與投資人在宣告日買入的價格之差)與修正報酬率；對一般投資人而言，價差報酬率可視為已知的報酬率，他們將依此報酬率來預期未來的風險套利報酬與持有目標公司股票的期間。第一部份的實證，主要討論價差報酬與一些因子的關聯性，我們發現價差報酬與持有期間、購併溢酬呈正相關，與修正報酬率呈負相關。第二實證結果的部分，我們應用羅吉斯迴歸模型發現股價淨值比越高的公司，其股價在收購過程中越容易向下修正。整體而言，風險套利的獲利能力取決於三個因子：持有期間、購併溢酬、股價淨值比。

關鍵字:融資收購、風險套利

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ABSTRACT

This paper explores the performance of leveraged buyouts on risk arbitrage over the period of 1991-2006. Our results reveal that a portfolio of risk arbitrage positions in leveraged buyouts produces annual arbitrage returns of 12%. By dividing risk arbitrage returns to spread returns (the percentage difference between the offer price and market price on the announcement date) and revision returns, we model spread returns as the visible component of total risk arbitrage returns, because investors would set spread returns to anticipate expected arbitrage returns and the period of deals. We discuss the relationship between spread returns and some determinants of deals, and find that spreads returns are significantly negatively related to the magnitude of price revision and significantly positively related to offer duration and bid premium. The second empirical result is that the Logistic regression model provides the evidence that target firms with higher price-to-book ratio (P/B) tend to reverse their prices during the period of deals. Overall, these findings indicate that the profitability of risk arbitrage on leveraged buyouts is influenced by the bid premiums, duration and P/B.

Key words: Leverage buyouts; risk arbitrage

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謹誌於 新竹交大

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1. Introduction

Risk arbitrage, also called merger arbitrage, is a type of investment or trading strategy that attempts to profit from the spread between the offer price and the market price on the announcement day. This type of trading, associated with private equity, is regarded as a conservative investment strategy that generates a relatively steady return. In general, for cash offer acquisitions, arbitrageurs usually only take a long position on the target firm's stock, and the holding period performance of each long position determines the returns of the risk arbitrage. If a deal is successfully completed, the risk arbitrageurs would earn positive returns. However, if a deal fails, the arbitrageurs might incur great losses. Recent empirical studies on risk arbitrage reported that arbitrageurs can earn substantially excess returns of 10-20% (Mitchell & Pulvino, 2001; Baker & Savasoglu, 2002; Jindra & Walkling, 2004). However, there has been no research on leveraged buyouts (LBOs), which in recent years have become a thriving activity around the world.

An LBO is the acquisition of a significant stake of a target firm's equity by a private investor group, using high debt financing. Target firms should have adequate stable cash flows and low debt levels. As a result, most LBOs are successful, friendly and cash offers. A number of authors offer some perspective on leveraged buyouts, documenting that the risk-adjusted performances of US leveraged buyouts investment between 1988 and 2004 significantly outperformed the market index (Groh & Gottschalg, 2006; Kaplan & Schoar, 2005). LBOs have been growing since the 1980s, but experience a dramatic decline during 1993-1997 and 2000-2003 as a result of the Junk Bond Crisis and the Dot.com Bubble in the U.S. There is still some criticism. For example, LBO transactions hurt the stakeholders of target firms because an acquirer may manipulate a target firm's stock price during the period of deals so that they can acquire a target at the price cheaper than the market value[1]. Therefore,

[1]. A Seoul court ruled that Lone Star Funds was guilty of stock manipulation in 2008. Lone

we can examine the behavior of this high-leveraged activity within the framework of risk arbitrage. First, private equity funds (acquirers) and professional arbitrageurs can affect the stock movement of target firms. Private equity funds can enjoy great returns after LBOs, because they want to buy the target firms' shares at a price lower than offer price. Arbitrageurs have the advantage of information about deals, and dominate stock markets. As a result, stock price movement affecting arbitrage returns would be an attractive issue. Second, general investors who invest in targets firms enjoy the advantage of LBOs. If general investors have good grasp of LBOs, such investors should earn considerable returns. Can we discover whether investors profit from LBOs?

The starting point was a discussion of the components and determinants of risk arbitrage returns. We divided risk arbitrage returns into spread returns (the percentage difference between the offer price and market price on the announcement date), and revision returns (the percentage difference between the offer price and the market price on the completion date). We investigated two sets of determinants: ex ante variables, such as price-to-book ratios (P/B), bid premiums, bid-ask spreads, and two unknown variables, revision returns and durations.

Next, we established a portfolio of all leveraged buyouts during 1991-2006, and compared the risk arbitrage returns of this portfolio with a market portfolio. We found that average annual (value-weighted) returns for the LBO portfolio and NASDAQ index were 11.8% and 5.6% respectively. However, the finding also showed that LBO portfolios did not do better than the NASDAQ index before the Dot.com Bubble burst in 2000.

Subsequently, we examined the relation between those determinants and spread returns

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Star Funds (a US private equity fund) rigged stock prices in the process of merging the credit card unit of the Korea Exchange Bank (KEB) with the bank in 2003, complicating Lone Star's planned sale of KEB to HSBC.
http://www.koreatimes.co.kr/www/news/nation/2008/02/117_18379.html

by using multi regression analysis, and found that the spread returns largely depended upon bid premiums and durations. We also found that total risk arbitrage returns were significantly positive relation with spread returns. Finally, we concentrated on some target firms with small spread returns but with negative revision returns during the deal period (downward movement), because they may have had negative total returns. In order to ascertain whether the target firms reverse stock prices during the deal period, we explored the relationship between characteristics of target firms and the probability of stock reversal by using logistic regression model, and found that target firms' stocks with higher P/B have a higher chance of reversal, and that risk arbitrageurs prefer stocks with higher liquidity. Overall, we determined that if general investors sought to buy target firms for their portfolios, they preferred stocks with both higher bid premiums and lower price-to-book ratio (P/B).

2. Literature review

The profitability of risk arbitrage in the related literature applies two lines of analysis: time series analysis and cross sectional analysis. Time series analysis involves the construction of a risk arbitrage index portfolio, and focuses on investigating abnormal returns. Baker & Savasoglu (2002) reported annual abnormal returns of 7.2% and 10.8% on risk arbitrage for stock swap and cash offers. Mitchell & Pulvino (2001) analyzed stock swap and cash offers during the period 1963-1998, and reported that, after controlling trading restrictions, an annual abnormal return of 4% for cash offers was realized. On the other hand, cross sectional analysis is used to explore certain factors that help to explain the variation on risk arbitrages returns. Jindra & Walkling (2001) examined cash offers on risk arbitrageurs during the period 1981-1995, and found that the links of arbitrage spread returns were negative with the magnitude of price revision, and positive with duration. Baker & Savasoglu

(2002) tested the cross-sectional implications of limited arbitrage[2], and found that risk arbitrage yielded abnormal returns for cash offers, generating annual returns of 10.8%.

Those previous papers about risk arbitrage did analysis on the general mergers and acquisition or cash offer acquisitions in the U.S, but less of them just focus on the leveraged buyouts (LBOs), which have had a great impact on the acquisitions in decades. In this paper, we just concentrate on the leveraged buyouts deals. Besides, we also extend the previous research on risk arbitrage profitability by exploring how information asymmetry influences the profitability of risk arbitrage. Branch & Yang (2006) reported that information asymmetry in an acquisition is determined from the spread between the offer price and market price of target firm's stock on the announcement date. Their findings indicated that the attributes of cash offers may entice arbitrageurs into the bidding process, thereby pushing up the market price of a target firm's stock on the announcement date, and consequently reducing risk arbitrage profits[3]. This fact also provides us with the important implication that higher spread returns could result in higher risk arbitrage returns, and investors were certain of spread returns on the announcement day. Therefore, for leverage buyouts, most of target firms reverse their stock price during the period of deals; this attribution is quite different from the general acquisitions. Investors can earn spread returns in a successful deal, but they may get great losses in a failed deal. The primary objective of our research is to investigate the relationship between spread returns and key variables such as bid premiums and holding

[2] Limited arbitrage means that arbitrageurs' risk-bearing capacity is constrained by the deal completion risk and the target size. Most risk arbitrageurs are passive investors, who do not influence the acquisitions process and outcome. They buy the target firms' shares and face completion risk. More details are given in "Research design".

[3] When more arbitrageurs are involved in buying the shares of target firms it can boost the price of the target firms' shares, and spread returns will decrease. Investors usually buy shares at the closed market prices on the announcement date, as a result, they earn relatively lower spread returns and total risk arbitrage returns.

period (duration). These determinants actually affect risk arbitrage returns. We explain them as follows.

2.1 Target size

A firm's size has two possible effects. First, most large firms can boast high liquidity. If we hold risk and arbitrage capital constant, larger dollar amounts sold lead to higher returns. However, smaller firms may lead to higher risk arbitrage returns, because arbitrageurs are probably interested in smaller firms where transaction costs are lower. Some authors found that the risk arbitrage returns tend to be positively related to the target firm's size (e.g. Jindra & Walking, 2001; Baker & Savasoglu, 2002). In this paper, a target firm's size is its target equity market value, which is calculated by multiplying the total number of target shares outstanding by the target stock price at the announcement date. We also take one relevant variable into consideration: the price-to-book ratio (P/B), which represents a growth measurement for a firm. Furthermore, P/B anomalies due to mispricing are well known in finance. If target firms have a lower P/B, it will result in higher risk arbitrage returns. P/B is a new and unique factor we discuss, because most previous research investigates the relationship between firms' size and arbitrage returns.

2.2 Bid premium

Bid premium is the ratio of the closing price one day prior to the announcement day scaled by the offer price. The positive link between bid premium risk arbitrage returns is straightforward. Most authors reported that risk arbitrage returns tend to increase with the magnitude of the bid premium (Jindra & Walking, 2001; Mitchell & Pulvino, 2002; Baker & Savasoglu, 2002).

2.3 Liquidity

Some research on the link between liquidity and risk arbitrage returns is inconsistent. Agrawal, et al. (2004) reported that the higher bid-ask spread is, the greater the proportion of investors, including internal shareholders, hedge funds and other institutional investors, who

are likely to have better information than general investors. If these informed investors hold a higher proportion of the target firm's shares than general investors, acquirers would be inclined to make a higher offer price (a higher offer price means larger spread returns). Therefore, targets firms with less liquidity may tend bring higher risk arbitrage returns.

However, Jindra & Walkling (2001) found that spread returns are significantly negatively related to a target firm's liquidity, which is measured as abnormal volume (the ratio of event trade volume relative to pre-announcement volume). Chen & Kan (1995) did not find any reliable relationship between excess arbitrage returns and bid-ask spreads. In this paper we infer that most informed investors will sell off their shares during deals, and that general investors who buy less liquid target firms may sustain considerable losses. To determine the effect of liquidity on risk arbitrage returns, we needed to replace trade volumes with bid-ask spreads. Our observations, however, did not have sufficient trade volume information in the CRSP database, because our sample consisted of large NASDAQ-listed stocks.

2.4 Investment cost

Two components involved in all costs are transaction costs and holding costs. In practice, direct transaction cost include bid-ask spreads and brokerage commissions. Ali, et al. (2003) used historical bid-ask spread as an additional measure of direct transaction cost and bid-ask spread had been indicated in the previous section. In addition, for successful offers, arbitrageurs generally generate higher prices on the completion day, and the holding period is usually more than half a year; brokerage commissions could be ignored. On the other hand, investors buy their target shares and then hold them to the completion day. This holding cost, which is also an opportunity cost of any other investments, should be proportional to the duration of the offer (Ali & Hwang & Tromble, 2003; Jindra & Walkling, 2004).

2.5 Risk

Risk is composed of systematic and unsystematic risk. It is important to assess the relationship between risk and the profitability of leveraged buyouts. First, some authors found that the beta of private equity funds is not a significant driver of performances (e.g. Zollo & Ludo, 2006; Ljunqvist & Richardson, 2003). Their evidence showed that the relationship between stock systematic risk and stock performance is weak. If our research supports this evidence, it indicates that market performance does not affect target stock price movement during the period of risk arbitrage. Second, a cross section analysis on limited risk arbitrage revealed that idiosyncratic risk is a determinant of expected returns (Baker & Savasoglu, 2002). For systematic volatility, arbitrageurs got compensated and could eliminate it by hedging; however, idiosyncratic risk cannot be hedged and were not well diversified. Ali, et al. (2003) reported idiosyncratic volatility of stocks in the portfolio is greater of concern than systematic risks. They computed the variance of the residual term to obtain the idiosyncratic risk or unsystematic risk in the market model.

3. Research design

Professional risk arbitrageurs (active arbitrageurs)[4] claim to profit by providing insurance and liquidity to the investors and shareholders of target firms. They also play an active role in the deal-making process. Generally, after a merger or acquisition has been announced, investors having positioned themselves vis-à-vis a target firm, face completion risk. Some shareholders may wish to secure their risk by selling their shares. In an efficient

[4] There are two roles arbitrageurs can play in the acquisition process. First, active arbitrageurs influence acquisition outcomes and terms. They can change holding periods and influence stock price reversals during the period of deals. Second, passive arbitrageurs do not influence acquisition terms and outcomes. Our paper will focus on passive arbitrageurs. These are naïve investors, who invest in deals that the market expect to succeed. Usually, we would observe a gradual increase in arbitrage holdings over time (Baker & Savasoglu, 2002).

capital market, the stock prices of target firms will fully and immediately reflect all acquisitions information. We can anticipate that stock prices will exceed the offer price after the announcement date. In reality, shareholders sell to a limited numbers of capital-constrained investors (passive arbitrageurs) and financial institutions specializing in risk arbitrage. As a result of this pressure, the price of the target firm's shares can fall below their effective market price. This market inefficiency is also called limited arbitrage (Shleifer & Vishny, 1997). Therefore, to measure the magnitude of price revisions, we had to split risk arbitrages returns into spread returns (also called speculation spread) and revision returns. Greater detail follows.

3.1 The components of risk arbitrage returns

We define investors as anyone purchasing shares subsequent to an acquisition announcement. They include general or passive arbitrageurs as well as active risk arbitrageurs, such as private equity funds, financial institutions and so on. Assume these investors respond to an acquisition announcement and purchase shares of a target at price *P* and hold them to the completion date. Holding a target firm's shares until completion date will yield holding risk arbitrage returns, which can be calculated as

$$R_i = \frac{\left(P_i^F - P_i\right) + D_i}{P_i} - c_i = \frac{\left(P_i^O - P_i\right) + \left(P_i^F - P_i^O\right) + D_i}{P_i} - c_i \quad (1)$$

where i is per cash offer deal, R_i is the realized holding returns of risk arbitrage for successful or failed deal; P_i^O is the offered price of target firms; P_i^F is the final price sold to the acquirers; P_i is the target's closing stock prices on the announcement day; D_i is the accumulated dividend paid by the target firms during the holding periods, and c_i is the percentage of transaction and holding cost. Duration is the period between announcement date and completion date for a successful deal or withdrawing date for failure. Rewriting $P_i^F - P_i$ as $\left(P_i^O - P_i\right) + \left(P_i^F - P_i^O\right)$, we see that total arbitrage returns have two components, SR and RR, and we get the formula:

$$R_i = SR_i + RR_i - c_i \quad (2)$$

Where $SR_i = \left(P_i^O - P_i\right)/P_i$ is the *spread return* for deal i, and $RR_i = \left(P_i^F - P_i^O\right)/P_i$ is the *revision return* for deal i. Stock price movement will be upward, downward or unchanged. Three outcomes are shown in the Figure 1 and Table 2. Here is an example: we assume that an acquirer declares to offer $20 per share to acquire a listed firm on the announcement day, and an investor buys the target stock at a closing market price per share of $15. The stock price traded on the completing day is $18.50, and the period of deal is 180 days (we ignore dividends and trading costs). We know that the spread return is (20-15)/15 = 33 %, and total risk arbitrage is (18.5-15)/15 = 23% for the period. The stock value moved downward and revision return is about 10%.

Table 2 show that most of target firms in leveraged buyouts have negative revision returns, which are quite different the general cash offers, would actually affect the total realized arbitrage returns. However, Jindra & Walkling (2004) investigated the cash offering deals during the period of 1981~1995 in the U.S. and found 80 % of target firms enjoy positive revision returns. As a result, we speculate private equity funds could rig the price to buy target firms' shares at the lower price. Besides, by splitting risk arbitrage returns, we find that spread returns are realized returns for investors in successful deals. In comparison of previous papers, risk arbitrage returns (the difference of market price on the announcement and completion day) are realized returns for investors.

3.2 Variables construction

In the literature review we proposed that certain variables influence spread returns. We need to explain further how we derived these variables. They include two ex post variables: revision returns and durations, and characteristics of deals and target firms: bid premiums, price-to-book ratio (P/B), unsystematic risk and bid-ask spread ratio.

(1) Duration (*Dur*) of the deals is the numbers of days between the announcement date and the completion date for successful deals, and the withdrawal date for fail deals.

(2) The bid premium (*BP*) is $\left(P_i^O - P_b\right)/P_b$, where P^o is offer price, and P_b is the closing price one day prior to the announcement day.

(3) Price-to-book ratio (*P/B*) is the ratio of a target firm's market value divided by equity book value; book value is the target equity value at the end of the most recent fiscal year prior to the announcement, and market value is the target equity market price calculated by multiplying the total number of target shares outstanding by the target stock price on the announcement day.

(4) We computed unsystematic risk (*Risk*) in the market model. At first, we calculated the market model beta of target firms, so as to determine the systematic volatility during the period of deals. Then we subtract systematic volatility from total volatility to obtain unsystematic risk. Target firms' stock returns and market returns (S&P 500 NYSE/AMEX/NASDAQ value-weighted market index) are obtained from the CRSP; the period of returns is one month before and after announcement date.

(5) The bid-ask spread ratio (*Spread*) is abnormal spread divided by normal spread; the spread is $\frac{\left(P_{ask} - P_{bid}\right)}{\frac{1}{2}(P_{ask} + P_{bid})}$, where P_{ask}, P_{bid} are the asking price and the bid price on transaction day (the abnormal spread for this measurement is the average ratio in the interval of t = -42 to t = +2, normal spread is the average ratio in the interval of t = –50 to t = –25; t is the announcement date).

3.3 Research hypotheses

Hypothesis 1: Given offer price and the duration, spread returns would be negatively relative to revision returns and positively relative to durations.

This hypothesis is intuitive. First of all, all prices are driven by the expectation of subsequent returns. If spread returns are relatively smaller, higher expected revision returns for certain acquisition generate higher immediate prices. This assertion is consistent with the findings of Jindra & Walkling (2001). They do a regression analysis of spread returns cf.

revision returns resulting in a significantly negative coefficient. Second, longer holding duration should lower the total realized arbitrage returns and spread returns. However, Table 1 shows that spread returns seem to be positively associated with expected duration, measured as the period from announcement to completion. We speculate that investors enjoying higher spread returns prefer to hold their shares longer.

Hypothesis 2: Target stocks with both higher bid premium and lower liquidity yield higher spread returns.

This suggests that investors will buy target firms with not only higher bid premium but lower liquidity. Bid premium (the ratio of closing price one day prior to the announcement day scaled by offer price) will lead to higher spread returns and higher total risk arbitrage returns. During the deal, acquirers would acquire shares from the stock markets, and most investors would sell their shares at fair prices on the completion day[5]. In reality, as Table 2 shows, 70% of our observations tend downward, and that the price of the target firm can fall below its offer price on the completion day. This phenomenon may result from the possibility that more arbitrageurs engage in the bidding process and sell out their shares prior to the completion day. If more arbitrageurs hold shares of target firms, these target firms will be less liquid in the market.[6] Agrawal et al. (2004) showed that stocks with a greater proportion of

[5] Investors can sell off their shares at market price to an acquirer on the completion date. However, most target firms' stock prices do not equal the offer price on completion day; and investors should sell their stocks at the offer price to an acquirer. As a result, spread returns would equal to realized arbitrage returns.

[6] The institutional ownership of a target firm is a good indicator of liquidity, but we can not acquire this information from the SDC databases. The Securities Exchange Act stipulates that institutional investors can be exempted from the 13F filing requirements of disclosing ownership of target firms. This is the confidential treatment (CT) rule, which is applicable to an arbitrage position throughout the period of deals. Besides, private equity funds in leveraged buyouts are not required to disclose their asset holdings to the SEC. Therefore, we would use bid-ask spread to measure liquidity.

informed institutional investor will tend to lower the liquidity of target firms. This implies that if target firms have both higher bid premium and lower liquidity, arbitrageurs will earn considerable risk arbitrage returns with certainty.

Hypothesis 3: Target firms with less liquidity could easily reverse their stock price post the announcement day.

We support the assertion that the higher the bid-ask spread will be, the greater the proportion of informed investors who will tend to have better information than general investors (Agrawal et al., 2004). There are two ways that informed investors can sell their shares. They can sell their shares to general investors or acquirers in the stock market, or they may negotiate with private equity funds (acquirers) for a reasonable price during the deal. Whatever option they take, targets firms with a higher ownership of informed investors will lower their liquidity. As a result, those target firms tend to reverse prices post the announcement day. An intriguing question is whether less liquid target firm stocks could easily loose value and result in lower total risk arbitrage returns.

4. Sample selection and description

4.1 Sample selection

Our initial sample of 4463 leveraged buyouts was taken from the Securities Data Company (SDC) Mergers and Acquisitions database for the period of 1991-2006. We deleted 6 hostile deals, 30 deals that were pure stock swaps, and other non-pure cash acquisitions. To be included in our sample, the deals had to meet four criteria. (1) Deals had to have an offer price, announcement dates, completion or withdrawal dates, and deal size information. (2) Transaction values had to be more than 10 million dollars. (3) We took out a few observations which were rumored deals and secondary LBOs. (4) Acquirers had to be a private investment group. They held listed targets during the period, and then made targets go private on the completing date. The remaining 1816 samples were pure cash offers, which included 1667

successful deals and 149 failed deals. Some information on announcement dates, competing dates, cash offers, deal values and offer prices were also obtained from the SDC database.

Stock prices and dividends were drawn from the Center for Research on Security Prices (CRSP). We were limited by the fact that many LBO target firms in the U.S. were mainly privately held and rather small, and we therefore excluded 1484 firms that were private companies not listed in the CRSP. We then determined whether the acquisition and price information was consistent with information obtained from Lexis-Nexis. If the information was inconsistent, the data was deleted. This left us with 332 examples. The results are shown in the Table 1. Finally, we delete 33 whose stock tickers did not match each other in the SDC and the CRSP. Our final sample consisted of 299 cash offers during the 1991-2006 periods. Of these, 234 deals were successful and 65 deals were failed.

4.2 Distribution of spread returns, risk arbitrage returns and durations

Table 3 shows the statistical distribution of spread returns, revision returns and total arbitrage returns for the whole sample, both successful and failed deals. The mean and median spread returns were 11.46% and 6.03% respectively. Fortunately, only 20 observations, which consisted of 14 successful and 6 failed deals, had negative spread returns. By comparing the two kinds of deals, failed deals obviously had larger mean and median spread returns than successful deals, and they were highly dispersed. The average total returns, the sum of spread returns and revision returns, were positive, with mean and median returns of 7.12% and 4.24% respectively.

Since offers were outstanding for different periods, it was important to calculate annual post-announcement returns. We also annualized returns by multiplying the period return by the quotient of x/365 of the duration. The annual mean and median of spread returns were 41.71% and 17.4%, and the annual mean and median of risk arbitrage returns were 19.84% and 13.51% respectively.

Table 4 shows the frequency distribution of offer durations. The majority (62%) of

offers had durations of 2-5 months, to more than 7 months. The mean and median duration of deals in our sample were 141 and 127 days. The duration range was large, from a minimum of 14 days to a maximum of more than 425 days.

4.3 Descriptive statistics of variables and characteristics of target firms

Table 5 shows several attributes of target firms and deals. (1) Most target firms were small cap firms whose market equity value was less than $10 billion, and only two firms were large cap firms. (2) The industries mostly belonged to the manufacturing, service and trade sectors (see Table 6). (3) Acquirers have completed ownership after acquiring targets firms. (4) The average transaction values during the period of 1999~2006 are about 742 millions. (5) 70% of the firms yielded less than 20% sales growth and 15% ROE. We are surprised that targets firms seem to have had acceptable profitability. (6) Private equity funds preferred target firms with stable cash flows and lower debts. (7) Target firms had 1.6 times average P/B, which indicated they were valuable firms or firms with potential. (8) Most target firms (about 75%) largely enjoyed high liquidity. This finding provided direct evidence that private equity funds liked highly liquid firms. (9) Bid premiums in our final observation were 29% on average. Apparently, private equity funds were willing to offer higher prices in order to acquire target firms.

4.4 Realized arbitrage returns in the portfolios

First, to understand the economic and statistical significance of realized risk arbitrage returns of LBOs to arbitrageurs, we calculated the returns on a simple trading strategy: buying a target firms' stock 1 day after announcement day and holding it until completion or withdrawal of the deals. Realized arbitrage returns are spread returns (SR) for successful deals and total returns (R) for failed deals. We computed annual returns based on the different weight of transaction value to calculated annualized value-weighted returns of LBO portfolios during the period of 1990-2006. Second, to compare LBO portfolio returns to market

portfolio returns, we calculated annualized value-weighted returns of market portfolios during the period of 1990-2006. We assumed we had same capital to invest in the market index (S&P 500 NYSE/AMEX/NASDAQ value-weighted market index) during the period of every compared acquisition. We adjusted equivalent period of every compared deal for the market index to obtain market returns.

Average value-weighted returns were 11.75% for LBOs and 5.61% for the market index at the end of the period. We found that LBO portfolios did not necessary overwhelm market returns before the bursting of Dot.com Bubble in 2000. However, LBO portfolios returns have risen since 2001, and beat the market portfolio performance by some degree (see Figure2). Table 7 also shows that total risk (volatility) were 18.53% and 6.48% for LBOs and the market index.

5. Model

The objective of our cross-sectional analysis was to investigate that the relationship between bid premiums, duration, P/B, beta, bid-ask spread and spread returns. We modeled this relationship as following:

$$SR_i = \beta_0 + \beta_1 RR_i + \beta_2 BP_i + \beta_3 Dur_i + \beta_4 P/B_i + \beta_5 Risk_i + \beta_6 Spread_i + \varepsilon_i \quad \varepsilon_i \overset{iid}{\sim} N(0,\sigma^2) \qquad (3)$$

where i is ith deal offer, *SR* is spread returns. *RR* is revision returns; *Dur* is duration for every deal. *BP* is bid-premium; *P/B* is measure as the ratio of total market equity to equity book value; *Risk* is the idiosyncratic (unsystematic) risk in the market model, and *Spread* is the bid-ask spread ratio. ε is the random error

5.1 Model selection

Before going through our model selection, we calculated the variation inflation factors (VIF) of variables to test for the existence of the multicolinearity. We found that the multicolinearity problem of explanatory variables was not serious. The objective of our

cross-sectional tests was to draw inferences about the relationship between bid premiums, duration, P/B, beta, bid-ask spread and spread returns. We proposed one simpler and two more elaborate techniques. At first, we used ordinary least-squares (OLS) analysis to estimate the relationship between arbitrage returns and variables. This empirical model is both simple and commonly used in other research. Second, we employed a generalized weighted least-squares (GLS) analysis to solve the possible problems of heteroscedasticity and cross-sectional correlations among the residuals[7].

Third, an endogeneity problem may have affected our model. We argued that bid premiums, durations and spread returns were jointly determined. Some theoretical models of risk arbitrage indicated that many takeover variables were endogenously determined. These variables include durations, bid premiums and risk arbitrage returns. For example, arbitrageurs were also more likely to increase their holdings when the bid premiums were high (Hsieh & Walkling, 2005). Cornelli & Li (2002) suggested that there was a positive relation between a change of duration and arbitrage returns. One important source of endogeneity is reverse causality of variables. If variables are endogenous, estimates forming ordinary least-squares (OLS) will be biased and inconsistent. Therefore, we employed the endogeneity test to check whether spread returns, duration and bid premiums were exogenous in the equation. The result in Table 8 shows that spread returns and bid premiums are more likely to be endogenous. Therefore, we recognized this potential endogeneity in our analysis, testing the link between spread returns and variables through use of appropriate instruments

[7] There is a serious problem in our analysis of OLS. The random errors are not normal distribution in the regression model. As a result, we find the generalized linear model (GLM) is a general framework to deal with non-normal models. GLM is a flexible generalization of ordinary least squares regression. It relates the random distribution of the measured variable of the experiment to the systematic portion of the experiment (the *linear predictor*) through a link function. Our link function is:

$\ln(\mu) = X\beta$, *where* μ *is mean of SR* X *are independent variables*

with two-stage least-squares (2SLS). The requirement for the instrument was that it should be closely correlated with the corresponding dependent variables, but not with other dependent variables. We used a target firm's size and Run-up as the instrument variables for bid premiums. A target firm's size is the equity market value at the announcement date, and has positive relation with the bid premium. Besides, *Run-up* is the cumulative abnormal return to the target firm's stock for trading days (-30, -1) before the announcement day. Hsieh & Walkling (2005) reported that *Run-up* is a good instrument variable for bid premium. In addition, we split the whole sample into successful and failed observations to test again the relationship between spread returns and variables.

5.2 Regression analysis

The relationship between spread returns and variables is shown in equation 3. Within the OLS and GLS frameworks, we obtained the regression results shown in the Table 9. In addition, we split our observations into successful and failed deals, to ensure the effect of spread returns on variables (equation 4). Considering the potential endogenous problem, bid premium is an endogenous variable in equation 3; as a result, we also use 2SLS models (equations 5 and 6) to do our analysis. A targets firm's size and *Run-up* are the instrument variables for bid premiums.

$$SR_i = \beta_0 + \beta_1 RR_i + \beta_2 BP_i + \beta_3 Dur_i + \beta_4 P/B_i + \beta_5 Risk_i + \beta_6 Spread_i + \beta_7 D_i + \varepsilon_i$$
$$D_i = 1, successful\ deal;\ D_i = 0, otherwise \quad (4)$$

$$BP_i = \beta_0 + \beta_1 Size_i + \beta_2 Runup_i + \sum_{i=1}^{4} \beta_j X_{ij} + u_{1i} \quad (5)$$

$$SR_i = \beta_0 + \beta_1 BP_i^{'} + \beta_2 RR_i + \sum_{i=1}^{4} \beta_j X_{ij} + u_{2i} \quad (6)$$

In equation 4, i is ith deal offer, *SR* is spread returns. *RR* is revision returns; *Dur* is duration for every deal. *BP* is bid-premium; *P/B* is measure as the ratio of total market equity to equity book value; *Risk* is the idiosyncratic (unsystematic) risk in the market model, and *Spread* is the bid-ask spread ratio. D is dummy variable (D=1, the deal is successful, D=0, the deal is failed). In equations 5 and 6, *Size* is the market value of target firms; *Runup* is the cumulative

abnormal returns to the target firm's stock for trading days (-30, -1) before the announcement day, BP' is the predicted values of BP in the equation 4, and X are *Dur, P/B, Risk,* and *Spread*, individually (j=0~5, Xo is the intercept).

5.3 The predicting of stock reversal

LBOs are different from general mergers and acquisition: most of them are successful. There is also a unique attribute in our sample, which some target firms with higher spread returns would result in larger revision returns. The Table 1 shows that most of the observations tend downward. This fact inspired us to investigate the target firms' stock movement during the deal period. Unlike most previous risk arbitrage research which developed models for predicting acquisition outcomes, we investigated whether the reversal of stock during the period of deals resulted from variables in the deals, and developed a predictive model using logistic regression analysis. We also used the alternative of bid-ask spread ratios with different periods to check whether liquidity could affect the reversal of stock. The model is:

$$g(X_{ij}) = \ln\left(\frac{\pi(Y_i = 1)}{1-\pi(Y_i = 1)}\right) = \beta_j X_{ij} + u_i$$

$$if\ Y = 1,\ downward\ ;\quad Y = 0,\ non-downward \qquad (6)$$

where i is ith deal offer; X is *Dur, P/B, Risk, BP* and *Spread*, individually (j=0~5, Xo is the intercept); *Dur* is the duration for every deal; *P/B* is price-to-book ratio; *Risk* is the idiosyncratic (unsystematic) risk in the market model; *BP* is the bid premium, and *Spread* is the bid-ask spread ratio. $\pi(Y_i = 1) = \frac{\exp(\beta_j X_{ij})}{1+\exp(\beta_j X_{ij})}$ is the probability of stock downward movement.

6. Empirical results

6.1 Results of multi regression analysis

The objective of our tests was to investigate the relationship between spread returns and two crucial variables: bid premium and liquidity. We first used OLS and GLS to estimate the

regression coefficients. We addressed the potentially endogenous relationship among spread returns, bid premium and duration by conducting a 2SLS analysis. The results, shown in Tables 8 and 9 verify the first hypothesis. Furthermore, we found that bid premium is the most important factor of spread returns, so we split bid premiums into two kinds to test further whether liquidity in targets firms with higher bid premium could generate higher risk arbitrage returns (the second hypothesis).

The results supported our first hypotheses. First, spread returns are inversely related to revision returns. The results in Table 9 are consistent with the first hypothesis. It also asserts that spread returns increase with offer duration. In addition, the regression analysis shows that bid premiums can significantly affect spread returns, and that it corresponds to evidence reported by Baker and Savasoglu (2002). This result implies that when private equity funds are willing to pay more than the market price prior to the announcement date, the deal would lead to both higher bid premium and spread returns. Table 10 also shows that bid premiums play an important role in determining spread returns for both successful and failed deals.

However, there is little difference between the results for successful and for failed deals. In a successful deal, revision returns are negatively relative to spread returns. Longer duration would lead to greater spread returns. It is self-explanatory that if investors buy shares at a lower market price (more spread returns), they expect the stock price to go up for a successful deal, and to hold until the completion day. However, we also found that the greater spread returns of failed deals could lead to shorter durations. This was quite distinct with successful deal. Investors would probably not hold onto shares if they anticipated that a deal would fail.

The liquidity of target firms has a negative but not significant effect on spread returns. We know that more liquid target firms may lead to larger spread returns. Therefore, we do not support the argument that the higher the bid-ask spread will be, the greater the proportion of informed investors (Agrawal et al., 2004). To explore this unexpected finding, we divided bid

premium into two groups. Table 11 shows another new implication, that lower price-to-book ratio (P/B) could result in higher spread returns for some target firms with larger bid premiums. Most target firms' ownership may consist of less informer investors, because these firms have lower price-to-book ratio and higher liquidity. As a result, we understood the P/B instead of liquidity could be a crucial factor, and P/B could be a factor that previous research did not investigate.

Finally, unsystematic risk did not affect spread returns. This evidences shows that the relationship between stock unsystematic risk and risk arbitrage performance is weak. It was inconsistent with the finding that idiosyncratic risk is a determinant of expected returns on limited risk arbitrage (Baker & Savasoglu, 2002). But we still found that unsystematic risk is significantly positive relation with spread returns with higher bid premium.

6.2 Results of prediction of stock reversal

Table 12 shows our test results. We were surprised that the bid-ask spread ratio did not affect the reversal of stock. This result does not support our third hypothesis. Liquidity is positive but has no significant relationship with the probability of stock downward movement. We know that increasing duration, lower unsystematic risk and P/B can decrease the probability of stock revising down, but unsystematic risk was not significant. We found those firms with were lower P/B and higher unsystematic risk tend to move up or remain unchanged. This evidence indicated that more arbitrageurs engaged in lower P/B target firms in the bidding process, and these target firms' stock prices may easily exceed the offer price. In fact, this was consistent with our previous findings that lower P/B could create spread returns and total risk arbitrage returns. In addition, we understood that duration had a positive link with the probability of upward stock movement. Therefore, we did not support our third hypothesis but still found that P/B and duration are two key factors for stock reversal.

7. Conclusions

Past research on buyouts in recent years concentrated on the performance of shareholders of buyers (private equity funds) through leveraged buyouts, but much about speculative activity of shareholders or investors of target firms remains unknown. This paper investigates whether investors could still earn acceptable returns after the bursting of Interest bubble in March 2000. Even if investors finally paid less than the offer price to acquirers for shares, they would eventually sell the target shares at the offer price or at the market price in the public market. We also found that LBO portfolios did not necessary outstrip greatly market returns before 2000 but rose after 2001 and bettered the NASDAQ Composite Index by several percentage points.

We also found that observable "spread returns" largely affect risk arbitrage returns. We follow Jindra & Walkling (1999) by splitting total risk arbitrage returns into two components: the spread return, which is immediately observable, and any subsequent revision returns. Spread returns (the percentage difference between the offer price and market price one day after an initial announcement) actually dominate total risk arbitrage returns, and constitute profitability for investors. We discern what determinants affect spread returns.

We examined 299 leveraged buyouts that took place in the U.S. between 1990 and 2006, to test the relationship between spread returns and duration, and the characteristics of target firms. Consistent with other evidence from research on risk arbitrage on acquisitions, we found that spread returns relate negatively to revision returns and positively to durations. Spread returns were also found to be significantly related to bid premiums, which mean that if private equity funds were willing to pay more than the price asked prior to the announcement date, the deal would lead to earn higher spread returns. Finally, regression analysis indicated that some target firms with longer duration and lower price-to-book ratio (P/B) tend to have higher risk arbitrage returns during a deal.

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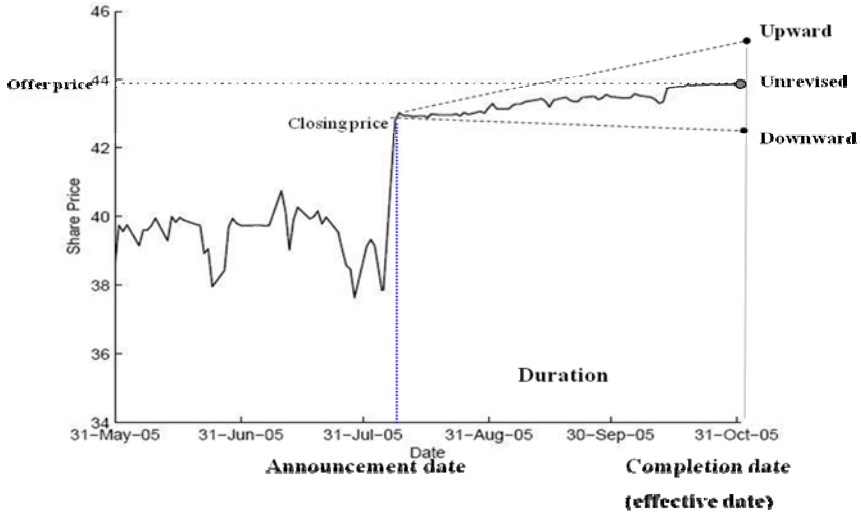

Figure 1 Three possible movement of a target price during a deal period

Table 1 Transaction values and numbers of LBOs (1991-2006)

Provided here is a comparison of the number of mergers and acquisitions in the SDC database and in the final sample. The first columns show annual leveraged buyouts announced between 1991 and 2006 and recorded by SDC. The sample contains only deals where the target firm was a public company and listed in the CRSP database. We use the SDC description of the consideration to identify deals that are pure cash offers or pure stock offers. The parts of right side are successful and fail deal that is gained from initial sample become to our final samples.

	Complete SDC data		Sample (cash offer)			
	Cash offer		Success		Failure	
Year	Numbers	Values(mm$)	Numbers	Values (mm$)	Numbers	Values (mm$)
1991	85	6119	4	53	1	39
1992	98	10,098	3	208	1	8
1993	93	8,592	5	367	1	48
1994	85	7,816	4	440	4	256
1995	105	13,179	3	2,514	7	1158
1996	95	18,770	7	1,967	4	136
1997	105	21,802	21	8,773	4	591
1998	105	20,234	22	6,572	14	3,160
1999	131	32,381	37	13,253	11	2,508
2000	187	35,020	37	11,804	12	7,537
2001	86	10,786	15	3,530	5	259
2002	78	23,655	11	1,084	4	448
2003	76	22,004	10	2,442	2	3,313
2004	138	64,584	15	17,741	5	1,521
2005	163	113,679	28	52,012	4	11,407
2006	186	295,582	27	85,471	4	5,466
Total	1816	704,303	249	666,458	82	37,845

Table 2 Statistics for spread returns across with direction of revision and durations

Provided here is a relationship of duration and state of revision. We split duration into three sub-period: short period (<90days), medium period (90-180days) and long period (>180 days).

Spread returns and total returns (%)		Duration			
		Short	Medium	Long	Total
Upward	Mean(SR)	3.04	6.57	14.20	7.94
	Mean (R)	12.51	14.21	33.65	20.12
	Numbers	15	25	30	70
Unrevised	Mean(SR)	9.08	11.41	5.74	8.74
	Mean(R)	9.08	11.41	5.74	8.74
	Numbers	7	13	6	26
Downward	Mean(SR)	10.39	13.37	12.90	12.22
	Mean(R)	1.15	3.14	-1.61	0.89
	Numbers	54	107	42	203
Total	Mean(SR)	8.82	12.02	12.85	11.42
	Mean(R)	4.12	5.79	12.52	7.12
	Numbers	76	145	78	299

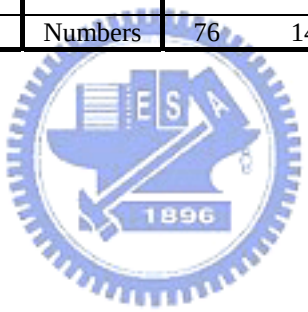

Table 3 Distribution of the spread returns, revision returns and total risk arbitrage returns

(%)	Mean	Min	Q1	Median	Q3	Max	Standard Dev.
Spread returns	11.46	-18.28	2.61	6.03	14,11	275.00	20.51
Spread returns (Annualize)	41.71	-109.5	8.14	17.40	35.17	946.93	96.23
Revision returns	-4.34	-137.5	-2.58	-0.37	0.00	61.85	21.59
Revision returns (Annualize)	-21.87	-137.3	-8.88	-1.01	0.00	371.85	109.28
Total returns	7.12	-65.26	0.65	4.24	12.32	261.36	25.55
Total returns (Annualize)	19.84	-683.7	1.91	13.51	33.47	899.98	93.52
Offer duration	141	14	87.5	127	181	425	75.43
Panel A: successful deal							
Spread returns	9.22	-18.28	2.48	5.05	12.50	80.00	12.24
Spread returns (Annualize)	28.14	-104.3	7.10	15.76	31.47	300.21	42.33
Revision returns	1.05	-29.27	-1.08	-0.21	0.00	53.27	8.75
Revision returns (Annualize)	0.85	-111.3	-3.93	-0.61	0.00	191.56	22.96
Total returns	10.27	-40.08	2.05	5.08	14.05	86.67	15.27
Total returns (Annualize)	28.99	-146.3	6.53	16.31	33.46	300.21	46.22
Duration	141	22	91	126	173	425	71.51
Panel B: Failed deal							
Spread returns	19.34	-6.88	6.19	11.34	20.76	275.00	36.23
Spread returns (Annualize)	89.60	-109.5	12.97	28.77	99.69	946.93	181.85
Revision returns	-23.35	-137.5	-38.44	-21.62	-0.26	61.85	37.32
Revision returns (Annualize)	-102.1	-137.5	-136	-77.76	-0.33	371.85	210.91
Total returns	-4.01	-65.26	-26.17	-9.39	7.61	261.36	44.69
Total returns (Annualize)	-12.48	683.71	81.52	-19.16	37.70	899.98	176.38
Duration	135	14	63	128	185	405	88.5

Table 4 Distribution of durations in whole sample

Range (days)	Numbers of obs	Proportion (%)	Cumulative Proportion	Downward	Unrevised	Upward
<30	7	2.00	2.0	5	0	2
[30,60)	29	10.03	12	24	2	3
[60,90)	40	13.38	25	26	4	10
[90,120)	58	19.40	49	41	9	8
[120,150)	51	17.06	62	40	2	9
[150,180)	36	12.04	74	26	2	8
[180,210)	23	7.69	82	13	4	6
>210	55	18.39	100	28	3	24
Total	299			203	26	70

Table 5 Descriptive statistics of target firms' characteristics and variables

	Mean	Min	Q1	Median	Q3	Max	Standard Dev	Observations
Panel A: Target firms' characteristics								
Value of Transaction(mm$)	741.65	0.261	53.23	173.07	533.11	32919	2451.08	299
Offer prices	17.68	1.65	7.25	15.00	24.50	100	13.52	299
Stock prices (1 day prior to Ann date)	14.30	0.45	5.38	11.38	20.47	74.75	11.31	299
Before ownership (%)	40.19	1.50	25.75	40.00	53.75	78.40	20.24	47
After ownership (%)	100	100	100	100	100	100	0	47
Net sales growth rate (%)	12.33	-74.05	-0.19	7.76	20.14	196.63	25.94	239
D/E	1.15	-0.19	0.27	0.57	1.12	28.06	2.41	239
ROE(%)	12.36	0.05	5.83	11.19	15.22	95.51	10.31	233
Panel B: Variables								
P/B	1.59	0.51	1.23	1.85	2.86	33.3	2.38	229
Unsystematic risk (%)	0.23	0.00	0.06	0.12	0.25	7.14	0.50	299
Bid-ask ratio(-42~-1)	1.06	0.11	0.89	0.98	1.09	7.56	0.58	299
Bid-ask ratio(-1~1)	0.92	-2.24	0.48	0.76	1.01	9.71	0.98	299
Bid premium (%)	29.09	-60	12.93	26.84	41.29	266.60	26.15	299
Size (mm$)	654.5	2.8	64.9	183.9	512.2	21219	1809.4	299
Run-up (%)	31.59	-66.87	14.23	25.50	38.88	539.77	41.13	299

Table 6 The industry of target firms

	Numbers	%
Primary industry	7	2
Secondary industry(Manufacturing)	94	31
Tertiary sector (services)	112	38
Quaternary	86	29

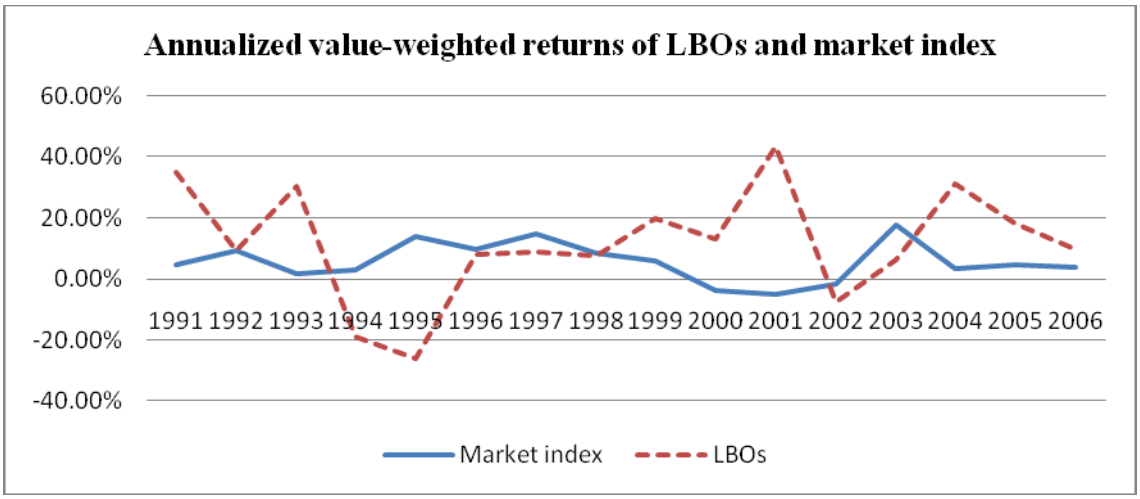

Figure 2 Comparisons of valued-weight returns between LBOs and market index

Table 7 LBOs returns vs. market index returns (1991-2006)

Arbitrage returns I is the value-weighted returns, and arbitrage returns II is the equal-weighted returns. Market index is S&P 500 NYSE/AMEX/NASDAQ value-weighted market index.

Year	Arbitrage Returns I (%)	Arbitrage returns II (%)	Bid Premiums (%)	Market index returns (%)
1991	34.83	40.32	13.61	4.50
1992	9.31	25.11	28.20	9.15
1993	39.34	49.86	38.47	1.83
1994	-18.64	51.41	32.97	2.94
1995	-25.96	-37.56	25.66	13.98
1996	7.91	13.43	23.03	9.82
1997	8.90	6.56	18.56	14.88
1998	7.59	52.53	32.44	8.34
1999	19.60	47.77	31.09	5.75
2000	12.89	52.34	36.18	-3.71
2001	43.32	70.57	55.25	-5.13
2002	-7.41	19.20	24.32	-1.80
2003	6.19	13.56	37.31	17.69
2004	31.23	58.94	16.95	3.42
2005	17.97	31.92	27.38	4.52
2006	9.92	52.13	22.20	3.64
Average returns	11.75	34.26	28.98	5.61
Risk(Stdev)	18.53	26.79	10.14	6.48

Table 8 Endogeneity test for spread returns, bid premiums and durations

An endogeneity test checks whether a variable assumed to be exogenous in the equation is endogenous. Under the null hypothesis, each variable is exogenously determined. The spread returns equals $SR_i = (P_i^F - P_i)/P_i$, where P^F is the offer price; P is market price one day after announcement of the leveraged buyouts. Duration of the deal measures the number of the date between the announcement date and the completion date which are able to be acquired from SDC. The bid premium is $(P_i^O - P_b)/P_b$, where P^o is offer price, and P_b is the closing price one day prior to the announcement day. The p-values are shown in parentheses.

Endogenous variables as regressors	Dependent variables		
	Spread returns	Bid premiums	Duration
Intercept	-0.0498* (0.0255)	0.2167** (<0.000)	142.2236** (0.0000)
Spread returns		0.8045** (<0.000)	33.0193 (0.2296)
Bid premiums	0.4933** (0.0000)		-17.4743 (0.4172)
Duration	0.0001 (0.2296)	-0.0001 (0.4172)	

*Results significant at 0.025 (one-tailed)

**Results significant at 0.005 (one-tailed)

Table 9 Results of regression analysis

The spread returns equals $SR_i = \left(P_i^F - P_i\right)/P_i$, where P^F is the offer price; P is market price one day after announcement of the leveraged buyouts. Duration (Dur) is the numbers of the date between the announcement date and the completion date. RR is revision returns. The bid premium (BP) is $\left(P_i^O - P_b\right)/P_b$, where P^o is offer price, and P_b is the closing price one day prior to the announcement day. Price-to-book ratio (P/B), where the book value is the target equity value at the end of the most recent fiscal year prior to the announcement, and the market value is the target equity market value on the announcement day. Risk is the idiosyncratic risk in the market model. The Spread is bid-ask spread ratio (abnormal spread divided by normal spread), calculated $\frac{\left(P_{ask} - P_{bid}\right)}{\frac{1}{2}(P_{ask} + P_{bid})}$, where P_{ask}, P_{bid} are ask price and bid price on transaction day. (The abnormal spread for this measurement is the average ratio in the interval of t = -42 to t = +2, normal spread is the average ratio in the interval of t = –50 to t = –25; t is the announcement date).

$$SR_i = \beta_0 + \beta_1 RR_i + \beta_2 BP_i + \beta_3 Dur_i + \beta_4 P/B_i + \beta_5 Risk_i + \beta_6 Spread_i + \varepsilon_i$$

	OLS	*GLS*	*2SLS*
Intercept	-0.0465 (0.1117)	-3.8293** (<0.000)	-1.7877** (<0.000)
RR	-0.0221 (0.5831)	-0.7576* (0.0127)	-0.3276** (0.0000)
BP	0.3001** (<0.000)	1.9492** (<0.000)	0.9902** (<0.000)
Duration	0.0004** (0.0012)	0.0046** (<0.000)	0.0022** (<0.000)
P/B	0.0017 (0.5660)	-0.0051 (0.8159)	-0.0012 (0.9092)
Risk	1.7352 (0.5789)	6.0558 (0.7098)	12.8845 (0.0910)
Spread (t=-42,+2)	0.0043 (0.8560)	-0.0849 (0.4246)	-0.0027 (0.9275)
p-value of F	<0.00**	<0.00**	<0.00**
Adj-R^2	0.1983	0.2581	0.1829
Durbin-Watson	2.02	1.95	1.98
White heteroscedasticity	<0.00**	0.87	0.38
Normality test	<0.00**	0.06	0.06

*Results significant at 0.05 (two-tailed)

**Results significant at 0.01 (two-tailed)

Table 10 Results of regression analysis for successful and failed deals

$SR_i = \beta_0 + \beta_1 RR_i + \beta_2 BP_i + \beta_3 Dur_i + \beta_4 P/B_i + \beta_5 Risk_i + \beta_6 Spread_i + \beta_7 D_i + \varepsilon_i \quad D_i = 1, success\ D_i = 0, failure$

	Success			Failure		
	OLS	GLS	2SLS	OLS	GLS	2SLS
Intercept	0.0083	-1.6978**	-2.0365	0.0031	-1.3215	0.2462
	(0.7134)	(<0.000)	(<0.000)	(0.9792)	(0.0001)	(0.8648)
RR	-0.2655**	-0.6669**	-0.5027**	0.8844**	1.7762**	0.8591
	(0.0000)	(<0.000)	(0.0021)	(<0.000)	(0.0002)	(0.2702)
BP	0.1194**	0.4550**	1.2171*	0.0517*	0.6681*	0.8740
	(0.0020)	(0.0038)	(0.0255)	(0.0123)	(0.0181)	(0.5131)
Dur	0.0003**	0.0020**	0.0022**	-0.0003	0.0012	0.0023
	(0.0027)	(<0.000)	(<0.000)	(0.9241)	(0.1044)	(0.1148)
P/B	-0.0001	-0.0031	-0.0054	-0.0171	-0.0962	-1.2247
	(0.8051)	(0.7655)	(0.6052)	(0.8688)	(0.7219)	(0.3055)
Risk	1.5898	4.7187	12.4628	27.6627**	2.2109	-0.2240
	(0.9456)	(0.8311)	(0.1055)	(<0.000)	(0.9506)	(0.2745)
Spread	-0.0041	0.0129	0.0425	0.0056	-0.0841	-1402
(t=-42,+2)	(0.5780)	(0.6518)	(0.5126)	(0.9006)	(0.3956)	(0.0492)
p-value of F	<0.00**	<0.00**	<0.00**	<0.00**	<0.00**	<0.00**
Adj-R^2	0.2963	0.1883	0.1980	0.7121	0.4778	0.3743
Durbin-Watson	1.94	2.05	2.16	2.04	2.02	2.02
White heteroscedasticity	<0.00**	0.68	0.78	<0.00**	0.71	0.07
Normality test	<0.00**	0.02	0.03	<0.00**	0.72	0.56

Table 11 Results of regression analysis for different bid premiums

To test the hypothesis 2, we have two kinds of bid premiums. The observations with small and large bid premium have lower and higher premium than average bid premium (29 %).

	Small bid premium		Large bid premium	
	OLS	GLS	OLS	GLS
Intercept	0.0641**	-1.4959**	-0.0779	-1.2881**
	(0.0006)	(<0.000)	(0.4113)	(<0.000)
RR	-0.1500**	-0.7882**	-0.2524**	-0.5524**
	(0.0003)	(0.0024)	(0.0001)	(0.0002)
Dur	<0.0001	0.0009	0.0004	0.0017**
	(0.9490)	(0.1538)	(0.0971)	(0.0002)
P/B	-0.0019	-0.0048	-0.0046*	-0.0024
	(0.4099)	(0.7311)	(0.0299)	(0.8661)
Risk	1.8183	24.5034	28.6299**	14.8424**
	(0.5938)	(0.2439)	(<0.000)	(0.0035)
spread (t=-42,+2)	-0.0051	-0.0262	0.0912	-0.0109
	(0.5582)	(0.6252)	(0.4503)	(0.9516)
p-value of F	0.0095**	0.0304*	0.0001**	<0.0001**
Adj-R^2	0.0883	0.0832	0.5746	0.2333
Durbin-Watson	1.90	1.76	1.95	1.72
White heteroscedasticity	0.36	0.55	<0.001**	0.68
Normality test	<0.00**	0.01*	<0.0001**	0.05

Table 12 Results of predicting of stock reversal

X are duration (dur), P/B, idiosyncratic risk (Risk), bid premium (BP) and bid-ask spread ratio (spread), individually (j=0~5). The bid premium (BP) is $\left(P_i^O - P_b\right)/P_b$, where P^o is offer price, and P_b is the closing price one day prior to the announcement day. Price-to-book ratio (P/B), where book value is target equity value at the end of the most recent fiscal year prior to the announcement, and market value is target equity market vaule on the announcement day. Risk is the idiosyncratic risk in the market model. The Spread is bid-ask spread ratio (abnormal spread divided by normal spread), calculated $\frac{\left(P_{ask} - P_{bid}\right)}{\frac{1}{2}(P_{ask} + P_{bid})}$, where P_{ask}, P_{bid} are ask price and bid price on transaction day.

$$g(X_{ij}) = \ln\left(\frac{\pi(Y_i = 1)}{1 - \pi(Y_i = 1)}\right) = \beta_j X_{ij} + u_i$$

$$if\ Y = 1,\ downward\ ;\quad Y = 0, non - downward$$

	Model 1	Model 2 (Robustness)
Intercept	0.1941 (0.6250)	0.5609* (0.0163)
Dur	-0.0031** (0.0032)	-0.0030** (0.0043)
P/B	0.0743* (0.0484)	0.0716* (0.0433)
Risk	7.9821 (0.7040)	8.6588 (0.9116)
BP	0.0230 (0.9499)	0.0405 (0.9116)
Spread (t=-42,+2)	0.5131 (0.1341)	
Spread (t=-1,+1)		0.1627 (0.1367)
P-value of LR statistic	0.0039**	0.0064**
McFadden R^2	0.0472	0.044
Correlogram-Q test (lag=2)	0.394 0.307	0.403 0.452