RISK ARBITRAGE IN U.S. FINANCIAL MARKETS

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Abstract

This paper analyses risk arbitrage in U.S. financial markets. The study by Mitchell, Mark and Todd Pulvino (2001) has been extended to study the U.S. financial markets scenario from 1963 to 2004. In particular, two research questions are pursued-(1) What are the effects of stock market, business conditions as well as the Merger and Acquisition Trend on risk arbitrage activities in the U.S (2) What is the current trend and effect of the U.S. financial regulatory mechanism on risk arbitrage?

The results of the paper are:

- Returns associated with risk arbitrage are more pronouncedly decreased in down/severely depreciating stock market and business conditions especially when there is possibility of deal failure but remain rather uncorrelated with market returns when the market is flat and appreciating.
- The probability of a merger failing is a decreasing function of market returns in the last two months, indicating that deals are more likely to fail following market downturns.
- There has also been a growing trend in US financial market regulatory mechanism to reduce systemic risk, eliminate legal uncertainty and control regulatory and to have a closer look on derivatives trading which could be potentially used for fraud or manipulation. The current focus of the financial regulatory mechanism is to curb illegal trading in risk arbitrage activities through limits on trading volume and control of regulatory arbitrage opportunities which should continue into the future.

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1 Introduction

With the global financial services scenario having changed in the recent past, there is a growing trend of mergers and acquisitions which has taken place recently in numerous financial institutions. This has been particularly observed in the U.S.A where takeover activity has been most observed in the 1990s. In Risk Arbitrage, large excess returns have been documented in literature i.e. in previous studies. Two reasons can be attributed to this-

a) Transaction Costs and other practical limitations prevent investors from realizing these extraordinary returns.

b) Risk arbitrageurs receive a risk premium to compensate for the risk of deal failure. The risk arbitrage premium is defined as the spread between the current market price and the price to be paid for the shares in the deal at the time of the tender offer announcement. (Koch Johan and Sjöström, Markus (2003)) Another possible explanation for the extraordinary returns to risk as documented in previous studies is that they simply reflect the compensation for bearing extraordinary risk.

The paper by Mitchell, Mark and Todd Pulvino (2001) attempts to understand the effect of stock market and business conditions as well as the M&A trend on risk arbitrage in US financial markets confirms that returns associated with risk arbitrage are said to expect more of a downturn in down stock market and business conditions especially when there is possibility of deal failure. Another important result indicated in the paper is that the probability of a merger failing is a decreasing with of market returns in the last two months also providing evidence that that deals are more likely to fail following market downturns.

1.1 Research Purpose and Contribution

This paper analyses risk arbitrage in U.S. financial markets. The research methodology by Mitchell, Mark and Todd Pulvino (2001) has been extended to the present to reflect a more realistic trend of risk arbitrage activities in U.S. financial markets. A new dimension has been added to the paper by studying the U.S. financial regulatory mechanism and its related impact on risk arbitrage in terms of controlling trading limits as well as illegal trading. In particular, two research questions are pursued-

(1) What are the effects of stock market and business conditions as well as the Merger and Acquisition Trend on risk arbitrage activities in the U.S?
(2) What is the effect of the U.S. financial regulatory mechanism on risk arbitrage?

The contribution of this thesis is three-fold. First, an attempt is made to study the effects till date of stock market and business conditions as well as the Merger and Acquisition Trend on risk arbitrage activities in the U.S Second, a theoretical contribution is made by highlighting the significance of adjusting the target valuation for the takeover premium. Third, a brief outline on future trend in risk arbitrage activities in U.S. financial markets is made. A relative scarcity of information pertaining to the legal machinery of risk arbitrage and corporate governance particularly in the U.S and Europe is observed. (Refer to Appendix 11 for summary of major literature references).

1.2 Definitions

We have used definitions similar to the other researchers in the field (e.g. Mitchell, Mark and Todd Pulvino (2001) and Cornelli, Francesa(1998)). **Risk Arbitrage** otherwise called as merger arbitrage, refers to an investment strategy whereby an attempt is made to profit from what is known as an arbitrage spread. A **Takeover i**n the modern day business world refers to one company (the acquirer) purchasing another company (the target).

1.3 Outline

This paper is organized as follows risk arbitrage in U.S. financial markets. The first section deals with understanding the risk arbitrage mechanism. This is followed by the second section which deals with another genus of risk arbitrage i.e. risk arbitrage in takeovers. The third section analyses and provides a solution to a case study on risk arbitrage. The fourth section deals with understanding the effects of stock market returns and business conditions, merger and acquisition trend and the financial regulatory mechanism on risk arbitrage in U.S. financial markets. The fifth and final section summarises the analysis made in the earlier sections followed by a note on future trends in U.S. risk arbitrage activities.

2 An Overview

Risk Arbitrage otherwise called as merger arbitrage, refers to an investment strategy whereby an attempt is made to profit from what is known as an arbitrage spread. After the announcement of a merger or acquisition, the stock of the target company is typically traded at a discount to the stock of the acquired company. In fact the difference in the price of stock between that of the target company and the acquiring company is known as the arbitrage spread.

In the event of the merger being successful the arbitrageur incurs a profit based on the arbitrage spread. However in the event of a merger failure the risk arbitrageur incurs loss , which is usually much more than the profits he would have earned, had the merger been successful (Mitchell, Mark and Pulvino, Todd (2001)).

2.1 Institutional Background of mergers in the US

With the global financial services scenario having changed in the recent past, there is a growing trend of mergers and acquisitions which has taken place recently in numerous financial institutions. This has been particularly observed in the U.S.A where takeover activity has been most observed in the 1990s.

There was an encouragement for merger activity, due to the removal of geographical restrictions for banks and thrifts under the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994. Also observed was the removal of preferential tax treatment of bad debt reserves under a special provision of the Small Business Jobs Protection Act of 1996 eliminated previous impediments for thrift to bank conversions and mergers. Another significant change observed during that time was the Gramm-Leach-Bliley Act (Financial Modernization Act) of 1999 that permitted the creation of Financial Holding Companies which could practice all functions 'financial in nature' under one umbrella removed further deterrents to bank/thrift mergers.

2.2 Limited Arbitrage in Mergers and Acquisition

Firstly arbitrage is limited to the extent of buying the acquiring firms shares, with a direct purchase and an indirect purchase. While the direct purchase would involve buying the shares from the acquiring firm, an indirect purchase would involve buying the target firm's shares and waiting for the deal to come through, during which the target firm's shares are exchanged for the acquirer's shares. Both the above methods of transacting in shares have identical payoffs if the

merger deal comes through. The arbitrageur also faces an inherent fundamental risk, that of deal failure which could lead to exorbitant losses. The phenomenon of deal failure can be described as any risk arbitrage deal where the arbitrageur loses money.

2.3 Nature of Risk Arbitrage

While understanding the nature of risk arbitrage, it is important to know that it can be categorized into two –

a) Pre-emptive Arbitrage-In this kind of arbitrage opportunity, the arbitrageur buys the shares of the acquired company well in advance. This kind of arbitrage is quite speculative and depends on the success of the merger. In the event of the merger being carried out, the arbitrageur does benefit from the price paid and the tender offer of the share. Pre-emptive arbitrage is guided by instinct and predictions made by the arbitrageur who attempts to forecast potential mergers and acquisitions in the coming weeks and months.

b) Post-Tender Arbitrage-As far as post-tender arbitrage is concerned the acquiring company makes a tender offer about shares and the arbitrage profit is determined by the price differential between the offer price of the share and the selling price of the share on a particular day, post merger. For example say company A is planning to acquire company B in the near future. Company A makes a predictable tender offer of the stock of company B for US$25; however the common stock of company B sells for US$27 in the market. In such a case the arbitrageur seeks to make a profit from the US$2 differential. The process of post-tender arbitrage is very dynamic wherein the investment is held for a very short time with very high potential for profits.

2.4 Risks associated with risk arbitrage

The main risk associated with risk arbitrage is that of deal failure, otherwise called the completion risk. If at some stage the management of either company decides not to go through with the deal, then the benefits of arbitrage accruing to the transaction of shares may not materialise. Some shareholders may wish to insure this risk by selling of their shares. As a result of this selling pressure, the price of the target firm can fall below its efficient market price and lead to a market inefficiency thereby resulting in abnormal profits. Arbitrage is also limited to the extent of supply

of capital which is a prerequisite for its smooth functioning; the lender typically requires 102% of the short position as collateral. (Baker, Malcolm and Savasoglu, Serkan (2002))

2.5 Calculating Annual Return for Risk Arbitrage

The formula for calculating the returns for risk arbitrage, in other words the potential arbitrage commitment, was invested by Benjamin Graham in the book Security Analysis (1951).

Indicated Annual Return = [GC-L (100%-C)] /YP (Rockwood, Richard M (2001))

G=Expected gain in points in the event of success.
L=Expected loss in points in the event of failure.
C=Expected change of success as a percentage.
Y=Expected time of holding of shares, in years
P=Current Price of the security

2.6 A Risk Arbitrage Illustration

On June 14 2000 Qwest (QWST), a telecommunications company was making takeover offers for another communications company Frontier and U.S. West. Both the companies were erecting worldwide fibre-optic cable networks to be able to benefit from the soaring demand for high-speed data, Internet, email and other telecommunications services. However both Qwest and Frontier lacked the necessary customer base to compete with the likes of big players in the telecom market, AT&T and MCI WorldCom.
Qwest offered 1.738 shares of stock for each share of stock of the company US West. For Frontier, Qwest offered US$20 plus 1.181 Qwest shares for each share of stock of Frontier. The risk arbitrage deal so entered into was valued at US$55 bn when it was announced. However after the announcement, the price of Qwest's stock was driven down by 25%, and the value of the deal was reduced to US$41.5 bn, thereby eliminating the premium above Global Crossing's offer. However soon Qwest revised its original terms and offered to pay US$69 a share for stock in US West and US$68 a share in cash and stock for Frontier. This revised deal warranted a 12% premium to Global Crossing. The agreement was revised by both companies and was actually meant to reflect the decline in Global stock's price. Each stock of Frontier was exchanged for

2.05 shares of Global Crossing. After the announcement of the merger, shares of Global became easier to short, and the deal was carried out in a more facilitating manner and the merger closed on September 28 1999.

3 Risk Arbitrage in Takeovers

In the modern day business world a takeover refers to one company (the acquirer) purchasing another company (the target). Though takeovers resemble mergers they are different in the sense that while a merger leads to the formation of a new company, a takeover does not. Corporate takeovers are common in USA and the United Kingdom. However they are a rare occurrence in Germany because of the dual board structure, in Japan because of kereitsu or the interlocking sets of ownerships in the corporate structure and in China because a majority of the publicly listed companies are owned by the state.

Takeovers are of the following kinds-

a) Friendly Takeover-A friendly takeover involves the straight buyout of a company and is observed frequently. In such a takeover the shareholders are the recipients of cash or a number of shares which is contractually agreed upon in advance.
b) Hostile Takeover-In a hostile takeover one company agrees to buy out another company regardless of the consent of the company or otherwise. The mode of conducting a hostile takeover is through publicly traded shares. The rationale behind this mode of performing a hostile takeover is that the acquiring company is actually required to bypass the board the directors and purchase shares from other sources. The process of carrying out a hostile takeover through publicly traded shares is rather difficult unless the shares of the company are otherwise widely available and can be easily purchased.
c) Reverse Takeover-A reverse takeover can take place through either a smaller firm taking over a larger firm, a private company taking over a public company by bypassing a majority of security regulations.

3.1 Rationale behind takeovers

A variety of reasons can be attributed to why one company would like to acquire another company. One reason is profitability, the target company in such a case may be reasonably priced and so the acquiring company may make a decision that within a certain time period purchasing that company would be a profitable move. Takeovers can also strategic in the sense that the acquiring company has motives other than profit to purchase a company. In such a case the company that is to be acquired could be quite profitable on its own but may harbour other

capabilities that could be beneficial to the acquiring firm. For example a target company may have a well developed distribution network or information technology capabilities which could lead to an acquiring company wishing to takeover it. The acquiring company as a result of this takeover will be able to benefit strategically from the capabilities of that company apart from earning a profit. An acquiring company may decide to takeover another company as it enables the company to enter into a new market. In some cases in order to eliminate competition, one company may decide to acquire another and also to be able to defend itself against another competitor. It has very often been the case that very large companies enter into takeovers for the purpose of boosting their reported revenues without much care for the profit involved and the company's profitability does stand a chance of being affected if there are large costs involved. There is a premium involved if the target company is financially healthy which may not always be the case. Following a takeover the stock price of the target company may rise forcing down the price of the acquiring company

3.2 Takeovers and the legal system

In the US takeovers are governed by the Williams Act, which was enacted in July 1968. (Gomes, Armando, 2001)Takeovers are also governed by corporate laws and the state jurisdiction. The purpose of the Williams Act is to enable shareholders of a company to have fair and full disclosure to information and sufficient time to be able to act upon information. US Takeover rules are contained in the in Section 14(d)(1) of the Securities Exchange Act of 1934 and Securities and Exchange Commission (SEC) Rules 14D and 14E.

3.3 Important Facts Concerning Takeovers

1. Takeovers do render benefits to target shareholders. The premiums involved in the case of hostile offers are historically in excess of 30% on an average and have averaged to about 50% in recent times.
2. In hostile takeovers acquiring firms earn on an average 4% compared to 0% in mergers.
3. Takeovers do not lead to wastage in credit or resources and in fact generate larger gains which historically have been 8.4% and in recent times much more.
4. The actions taken by managers to eliminate or prevent mergers and offers are suspected as harmful to shareholders. Actions by managers that eliminate or prevent offers or mergers are most

5. Takeover gains do not arise from the creation of monopoly power.

3.4 Risk Arbitrage in Takeovers: An overview

Arbitrageurs are strategically important in the market for corporate control. Following a tender offer there is often a drastic rise in risk arbitrageur activity. Risk arbitrageurs take long positions in a target stock with the notion that the takeover will go through. Based on the cooperative Nash bargaining game, the idea that blocking of shares may be relevant for pricing of takeovers was first developed by Bergström, Clas, Peter Högfeldt, and Kenneth Högholm (1993).These arbitrageurs are often hedged by taking short positions in the acquirers stock. Factors contributing to a rise in risk arbitrage activity include the emergence of Ivan Boesky(a prominent arbitrageur on Wallstreet who had been involved in an Insiders Trading Scandal) and an increase in the number of corporate takeover deals contributing to its visibility. Due to the large volume of new arbitrage capital in recent times there is a rise in the narrowing of spreads and the increase in share price following a takeover announcement which has on an average reduced profit margins in this activity. Despite the odds that prevail, risk arbitrageurs continue to make profits and are considered as important players in the success of a takeover. Usually in an arbitrage deal the number of risk arbitrageurs contributes to 30-40% of the stock and they are considered an important element in the very many deals that are happening.

3.5 Rationale behind Risk Arbitrage in Takeovers

Risk arbitrageurs enjoy an information advantage which arises from their choice to enter the field of risk arbitrage. (Larcker, D. and T. Lys,(1987)) If the presence of risk arbitrageurs increases the likeliness of a takeover occurring, then one risk arbitrageur buying shares is relevant for the entire value of shares. Risk arbitrageurs expend a large effort in understanding how other risk arbitrageurs would behave. The number of arbitrageurs who decide to take positions, the number of shares that they will purchase and the price of shares are often determined in equilibrium of an endogenous kind. The value of shares in a takeover does depend on the probability of a takeover occurring. Share value should be higher in the event of there being a larger number of risk arbitrageurs in the market. The informational advantage that a risk arbitrageur enjoys enables and makes him willing to pay a price high enough to persuade smaller shareholders to sell their shares. In most cases the risk arbitrageurs do not have any initial private information. The private

information that they enjoy arises endogenously when they start buying shares. However arbitrageurs have to be controlled to ensure that they don't compete away their rent.

3.6 A Risk Arbitrage Model in takeovers

A model has been developed in order to further understand the role of arbitrageurs (Cornelli, Francesa (1998)). It is assumed at the beginning that small shareholders control 100% of the outstanding shares (Grossman and Hart (1980)). At time 0, a cash tender offer of PT for all shares is announced by a bidder announced. In the event of shares in excess of 50% of the total being tendered, all the shares are purchased by the bidder at price PT, else all the tendered shares are returned. It is assumed that PO is the initial share price and both PO and PT are observable to all. Also observable is the value improvement per share that the bidder can bring to the firm ΔP. It is assumed naturally that:

$P0+ \Delta P \geq PT \geq P0$. In addition it is assumed that if the takeover bid proves to be a failure, the stock price goes back to PO. At time 1, arbitrageurs decide whether to enter and speculate and at time 2 actual trading takes place with arbitrageurs taking positions and hiding among small investors. At the beginning of time 3, a revelation of positions is made by the arbitrageurs so that their presence and holdings is known to all.

In the model there are N potential risk neutral arbitrageurs who can choose to take a position. If an arbitrageur A_i makes a decision that he will arbitrage he is entitled to bear a cost c. Such costs could be the cost of interpreting information or the opportunity cost of investment opportunities. If an arbitrageur decides to enter, he will buy a portion δ_i of the total outstanding shares of a firm, where δ is endogenously determined.

Let G(n) be the distribution of n (n being the number of arbitrageurs) which will be endogenously derived in equilibrium. Following a trading session each arbitrageur makes a decision regarding the portion of shares to be tendered. For arbitrageur A_i this tendered portion of shares is defined to be $\gamma_i \in [0,1]$.

The trading volume from noise traders, ascertained as ω, is considered to be random, non-negative, distributed uniformly on the interval [0,1] and independent of both share price and demand of arbitrageurs.

If y be the total trading volume of shares of the firm, then:

$$y = \omega + \sum_{}^{n} \delta_i$$

i=1

Understanding the tendering game

Each arbitrageur A_i makes an announcement that they bought δ_i shares and observes precisely how many other arbitrageurs entered and how many shares they bought. The arbitrageur then chooses how many shares to tender given the total number of arbitrageurs n and the strategies of the other risk arbitrageurs.

In the event of the fraction of equity in the hands of risk arbitrageurs being less than 50%, i.e.

$$\sum_{i=1}^{n} \delta_i < 0.5,$$

then there exists multiple equilibria, since the tendering strategies of the risk arbitrageurs are irrelevant: the takeover will fail in any case and the price of the shares will return to P0.

However in the event of:

$$\sum_{i=1}^{n} \delta_i < 0.5,$$

in equilibrium the risk arbitrageurs tender exactly 50% of the shares. There are multiple equilibria: in all of them and each arbitrageur tenders a fraction δ_i such that

$$\sum_{i=1}^{n} \gamma_i \delta_i = 0.5, \text{ and the takeover is carried out.}$$

4.0 Methodology

4.1 Time Series Regressions of Risk Arbitrage Returns on Common Risk Factors and Piecewise linear regression relating risk arbitrage to market returns

In order to understand the effects of stock market and business conditions as well as the M&A trend on risk arbitrage activities in U.S. financial markets following sequences of regression functions are computed:

4.1 A Time Series Regressions of Risk Arbitrage Returns on Common Risk Factors

$$\mathbf{R_{Risk\ Arb} - R_f = \alpha + \beta_{Mkt}\,(R_{mkt} - R_f)}$$

$$\mathbf{R_{Risk\ Arb} - R_f = \alpha + \beta_{Mkt}\,(R_{mkt} - R_f) + \beta_{SMB} R_{SMB} + \beta_{HML} R_{HML}}$$

Where $R_{Risk\ Arb}$ is the monthly return on a portfolio of risk arbitrage transactions, R_f is the monthly risk free rate, R_{mkt} is the monthly return on the value-weighted CRSP index, R_{SMB} is the Fama-French small minus big monthly return series. In this model two different time series of risk arbitrage returns are used. The first series is based on a risk arbitrage index manager (RAIM) portfolio beginning in 1963 and ending in 2004. The second series ignores transactions costs and is the Value Weighted Average of returns to individual merger investments (VWRA), averaged across transactions. The weighing factor in this regression is the target firms' market capitalization.

4.1B Piecewise linear regression relating risk arbitrage to market returns

$$\mathbf{R_{Risk\ Arb} - R_f = (1-\delta)\,[\alpha_{MktLow} + \beta_{MktLow}\,(R_{Mkt} - R_f)] + \delta\,[\alpha_{MktHigh} + \beta_{MktHigh}\,(R_{Mkt} - R_f)]}$$

Where $R_{Risk\ Arb}$ is the monthly return on a portfolio of risk arbitrage transactions, R_f is the risk-free rate, R_{Mkt} is the monthly return on the value-weighted CRSP index and δ is a dummy variable whose value is equal to 1 in the event of the market return being greater than a threshold and zero otherwise.

For the purpose of ensuring continuity the following restriction imposed:

$$\alpha_{MktLow} + \beta_{MktLow}(\text{Threshold}) = \alpha_{MktHigh} + \beta_{MktHigh}(\text{Threshold})$$

4.2 The following probit model is computed to infer the effects of market returns on probability of deal failure:

$$\text{Fail} = \alpha + \beta_1 R_{Mkt} + \beta_2 R_{Mkt-1} + \beta_3 R_{Mkt-2} + \beta_{4\ LBO} + \beta_{5\text{Cash Dummy}} + \beta_{6\text{Premium}} + \beta_{7\text{Size}} + \beta_{8\text{Tender}} + \beta_{9\ \text{Hostile}}$$

where Fail is a dummy variable whose value is equal to one in the event of the arbitrage return being negative and zero if the arbitrage return is positive. R_{Mkt} is the monthly return on the value weighted (v.w.) CRSP index for the month of the deal resolution date, R_{Mkt-1} is the monthly return on the v.w. CRSP index for the month prior to the deal resolution date, R_{Mkt-2} is the monthly return on the v.w. CRSP index for two months month prior to the deal resolution date
LBO is a dummy variable if the acquirer was private, Cash Dummy is a dummy variable indicating if the acquirer offered to pay cash in 100% for the target, Premium calculated as follows:

Premium =
Takeover premium equal to the target stock price one day after the announcement of the merger
Target Stock Price 30 days prior to the announcement

Size is the logarithm of the target's market equity value. Tender is a stipulated dummy variable whose value is equal to one in the event of the offer being a cash tender. Hostile is a stipulated dummy variable whose value is equal to one in the event of the target management having rejected the bid as indicated in the Dow Jones News Service or Wall Street Journal report.

4.3 Statistical Analysis

Statistic tools such as Skewness, Kurtosis, Standard Deviation Sharpe ratio and Correlation Coefficient will be employed to further understand the trend of the Annual Risk Arbitrage Return series as well as Average Target/Acquirer equity values which are further discussed in Section 8-Conclusions.The t-test will also be employed to evaluate the significance of the regression coefficients so computed.

4.4 Data Source, Period of Study and Data Selection

The data set for this sample includes that of all CRSP (Centre for Research in Security Prices) firms delisted between 1963 and 2004 because of a merger or acquisition and also includes all CRSP firms that received unsuccessful merger and acquisition bids that were covered by the Dow Jones News Service or the Wall Street Journal. The final sample consisted of 5061 firms (Appendix 7 and for graphical representation refer Appendix 10), updating the 1963-1998 sample (Mitchell and Pulvino (2001)) with an addition of 795 new risk arbitrage transactions till the current year under study, 2004. A certain number of observations (4726) had been dropped because of complicated terms as well as inaccurate data used in the Dow Jones News Service articles in which they were referenced. In certain cases the merger agreements might state that target shareholders exchange their shares for a combination of cash, preferred stock and warrants. In such cases determining the value of the hedge is not possible for such transactions is not possible since market values of hybrid securities are generally unavailable .Hence we have restricted our sample to straight forward transactions which include as cash mergers, cash tenders and simple stock swap transactions.

5 Case Study: Abott Inc and Alza Inc: an introduction

Green Circle is a fund that invests in risk arbitrage opportunities arising from mergers and acquisitions and is currently managing the Abbott Inc and Alza Inc merger i.e. the merger of two pharmaceutical companies. There are two kinds of risk arbitrage in this case depending on the type of the merger:

- All Cash deal where the consideration of the merger is paid entirely in cash
- All Stock deal where the stock of the acquired company is exchanged for stock in the acquirer company.

In the case of adopting an all cash deal the mechanism of risk arbitrage is very simple. The risk arbitrageur purchases stock in the acquired company and exchanges the stock for cash on the conclusion of the merger. The returns are given by the difference between the amount of cash received in the event of the merger and the price at which the stock is purchased plus any dividend received in the intermediate period.

In the case of adopting an all stock deal it is essential to purchase the stock of the acquired company just like in a cash deal but additionally going short on the stock of the acquirer firm. The number of shares shorted is given by the exchange ratio fixed in the merger agreement. The returns are given by the difference between the cash flows arising from purchase and sale of stock initially plus the net dividend received on the stocks held plus any interest earned on the short sale proceeds.

Stock deals can be better understood by a simple example. Let us suppose that Company A is acquiring Company B, and the current prices at which their stocks are trading are €100 and €48 respectively. The proposed exchange ratio is 1:2, which means 1 share in Company A will be issued for every two shares held in Company B. There will be small investors in the market who would not like to bear the risk of the merger failure. There will be a selling pressure from them in the market and the Risk Arbitrage Fund will buy these stocks and hedge its position by shorting 1 stock of Company A for every 2 shares bought in Company B. Thus, it locks in this spread of €4 for every stock of Company A and meets its liability of the shorted shares of Company A from the converted shares of Company B.

Let us say that it takes 2 months for the merger to come through. The rate of return generated by the Fund is 4% in two months (if we consider that it has not received a single cent from its shorting proceeds), or an annualized return of 24%.

The main risk associated with this strategy is that the merger deal may not go through. In this event, the arbitrageur has to unwind his position by selling the shares of the acquired company

and buying shares of the acquirer in the market at the prices prevailing at the time of the announcement of the failure of the merger. This risk is especially higher in a depreciating market when many firms may be subject to takeover bids. Another risk arises from the possibility of revision in the terms of the deal. Since the arbitrageur is entering a position based on the exchange ratio, any adverse changes in the ratio could affect his profitability. Since the profits of the arbitrageur depend on the initial spread between the prices of the two companies, he is unaffected by subsequent price movements as long as the merger is finally consummated. This means that the market risk is absent in the risk arbitrage. The opportunity for this kind of strategy arises from the fact that the shares of the acquired company trade at a discount to the value represented by the acquirer's bid. The opportunity is attractive since most of the merger announcements are eventually carried through but the value of the position could vary dramatically in the interim period thus, increasing capital demands from the arbitrageur. The excess returns arise because, unlike in a classic arbitrage where a large number of small investors arbitrage away the price difference, the transaction costs involved in the risk arbitrage limit the number of participants. Also, the assets are not perfect substitutes. While a merger creates two ways of buying a stake in the acquirer company (by purchasing shares of acquirer directly or by buying shares in the acquired company and converting them into acquirer's shares) the two methods are not perfect substitutes since there is a risk that the merger may not materialize. This risk commands a risk premium in the market which is reflected in the excess returns.

Market efficiency is unable to prevent such arbitrage profits from existing since there is a limit on the arbitrageur's capital which prevents him from participating to the full extent. This happens because of information and agency costs. While the arbitrageurs need to invest more funds in order to exploit an increase in spread between the two stocks, the investors do not understand this and want to withdraw their money. This forces the arbitrageurs to unwind their position at a loss and prevents prices from reaching their fundamental values as predicted in market efficiency theory. Part of the excess returns may also be related to transaction costs and other practical limitations like regulatory restrictions on short selling. The strategy will be profitable in the long run if the probability of the success of the announced mergers remains relatively high.

The factors which are found to impact this probability are:

- Acquirer attitude – a hostile attitude leads to use of takeover defense mechanisms reducing the chances of a successful bid

- Size of the firms – a larger firm will find it easier to acquire a smaller firm

- Takeover premium – the higher the premium offered, the better the chances that the deal will be accepted by the shareholders of the acquired firm.

5.1 Determining a profitable strategy

We need to look at the composition of the deals in the above respects and the changes in these compositions over time. Keeping the above factors and potential risks in mind, Green Circle's strategy limited the amount of exposure to a single merger deal to 5% of the total fund capital. Hence, the maximum limit allowed was 5% of $500 million, which is equal to $25 million. Given the uncertainty of the Abbott-Alza merger, Chris only wanted to commit half the allowed position. Thus, the total size of the long position was 12.5/48 or 0.26 million shares of Alza. The conversion ratio was announced as 1.2 shares of Abbot for every share of Alza. Thus, the hedged position in shares of Abbott is given by 260,000 x 1.2 or 312,000 shares short in Abbott.

The potential returns if the merger is successful are given by the difference between the price of 1 Alza share and 1.2 Abbott shares. This is equal to $4.2 per share of Alza. However, after taking into account the costs and other benefits like short sale rebate, the net benefit comes to $1,287,265 (as shown in Appendix 2). If the merger is not completed by the 31st December, and Green Circle decides to settle their position on that date, they will lose an amount equivalent to $260,000 for every $1 increase in the spread over and above $4.2. Empirically, it has been found that the spread increases dramatically with the announcement of the failure of the merger (Mitchell et al, 2001) and thus, the amount of downside may be very high.

The expected returns are a probability weighted amount of the upside and the downside payoffs. Since, the probability of the success of the merger is not clear in this case, it is difficult to quantify the expected returns. Chris is contemplating using put options on Alza shares in order to hedge his position. In order to assess the impact of this option, let us say that we purchase the put options on Alza, at the strike price of $40 at a premium of $3.25 as mentioned in the case. The table (Appendix 1) shows the payoffs in the new position relative to the position without the put. In case the merger is successful, the put is not exercised and relative to the current position, Green Circle loses the premium paid. In case the merger is unsuccessful, the payoff depends on whether the Alza share ends up above or below $40. If the price of the Alza share is x dollars below $40, the put is exercised and saves $(x – 3.25) as compared to the current unhedged position.

We see from the table that the returns have decreased significantly. The following calculation makes it very clear:

No. of Options bought = 260,000

Total cost of options = 260,000 x $3.25

= $845,000

Net Spread as per Appendix 2 (after accounting for the cost of put)

= $1,287,265-$845,000 = $442,265

Potential RoI = 442,265/(13,026,000+845,000)

= 3.188%

Annualized Potential RoI = 3.188% x (365/191)

= 6.09%

The put option reduces the risk to a slight extent since it protects from an adverse movement in the price of Alza in the event of the failure of the merger. However, the corresponding reduction in returns seems to be too high. This is because of two reasons:

- The put option gives a positive payoff only in the case when the merger is unsuccessful and the price of Alza falls below (40 – 3.25) or $36.75. Given the fact that the price of Alza has not fallen to this level in the recent past and the news relating to the company has been generally positive, this scenario looks unlikely.
- While the put option prevents the downside in case of the Alza shares, the position is still vulnerable to adverse movements in the price of Abbott. Also, given the recent news relating to Abbott, the adverse movements in Abbott shares may be a possible scenario.

Thus, we find a decrease in risk but a probably more than proportional decrease in returns from the put option and hence, it is not advisable for Chris to go for the same. Chris also needs to decide whether he should close the position, hold it or increase the exposure given the recent developments. The spreads have widened to 5 thus making it more attractive to invest in the merger. However, even the risks have increased due to recent developments some of which are outlined below:

- Abbott is facing serious problems with the FDA who have threatened to cut down Abbott's operations due to non-compliance with standards. This could potentially lead to huge decline in the revenues of Abbott, thus reducing its share price. In such an event, the shareholders of Alza may not agree to the merger or may ask for larger number of shares in exchange. This may not be acceptable to Abbott shareholders since it dilutes the value of their holding.

- Some Alza shareholders have claimed that material information about the ongoing FDA investigation of Abbott was concealed from them while voting on the merger proposition. This would have led to division of opinion among the Alza shareholders and loss of trust in the management's recommendations for the merger.
- Viadur, a competitor for TAP Pharmaceuticals, which is an Abbott subsidiary and provides Abbott with a large share of revenue and income, was being developed by Alza. However, a decision to divest it has been taken and this augurs well for the merger.

In order to decide the course of action Green Circle should take, we observe that despite some negative events, positive happenings pointing to the possibility of the merger have also taken place in the recent past. Moreover, in spite of the FDA issue, both the managements still seem to be working together to make the merger happen. The merger is known to make tremendous strategic sense and the complimentary expertise of the two companies makes them almost a perfect match.

There is a possibility, however, that the terms of the merger may be revised. This revision might happen if the prices of Abbott fall drastically in which case the number of shares to be issued per share of Alza would go up. Green Circle would only stand to gain from this and thus, we recommend that they invest the rest of the allowed funds in the merger deal without going for the put options.

6 Hypothesis Testing

Risk arbitrage is commonly associated with huge risks as well as profits. Numerous articles have been written in the press documenting the rich profits earned by famous arbitrageurs such as Ivan Boesky and so on. The current trend as evidenced by existing academic research is that risk arbitrage generally earns substantial excess returns. Research by Dukes, Frohlich and Ma (1992) as well as Jindra and Walking (1999) which concentrate on cash tender offers thereby documenting related returns in excess of 100%. In a study on a large sample of U.S. cash and stock mergers done by Baker and Savasoglu (2002) a conclusion has been drawn that risk arbitrage generates annual excess returns to the tune of 12.5%. According to Karolyi and Shannon (1998), they conclude that a portfolio consisting of Canadian stock and cash merger targets announced in 1997 has a beta of 0.39 with an annualized return of 26%, almost twice which noticed in the Toronto Stock Exchange. This section is devoted to understanding the effect of stock market conditions, trend of merger & acquisition (deal failure) on US risk arbitrage activities as well as the financial regulatory mechanism related to risk arbitrage in US financial markets.

6.1 Hypothesis 1: Returns associated with risk arbitrage are more pronouncedly decreased in down /severely depreciating stock market and business conditions but remain rather uncorrelated with market returns in flat and appreciating markets.

In order to further understand the effect of stock market returns and business conditions on risk arbitrage in US financial markets we employ the following regression models as discussed earlier in the paper “Characteristics of Risk and Return in Risk Arbitrage” by Mitchell and Pulvino (2001). The VWRA portfolio returns are calculated by taking the weighted average of returns from all active merger deals where transaction costs are ignored. RAIM returns are inclusive of transaction costs and other practical limitations associated with risk arbitrage investments.(Appendix 8 and for graphical representation of VWRA and RAIM refer Appendix 10)

Time Series Regressions of Risk Arbitrage Returns on Common Risk Factors

The following two regression functions of risk arbitrage returns on common risk factors are employed:

$$R_{\text{Risk Arb}} - R_f = \alpha + \beta_{Mkt}(R_{mkt} - R_f)$$

$$R_{\text{Risk Arb}} - R_f = \alpha + \beta_{Mkt}(R_{mkt} - R_f) + \beta_{SMB}R_{SMB} + \beta_{HML}R_{HML}$$

Where $R_{\text{Risk Arb}}$ is the monthly return on a portfolio of risk arbitrage transactions, R_f is the monthly risk free rate, R_{mkt} is the monthly return on the value-weighted CRSP index, R_{SMB} is the Fama-French small minus big monthly return series. In this model two different time series of risk arbitrage returns are used. The first series is based on a risk arbitrage index manager (RAIM) portfolio beginning in 1963 and ending in 2004. The second series ignores transactions costs and is the Value Weighted Average of returns to individual merger investments (VWRA), averaged across transactions. The weighing factor in this regression is the target firms' market capitalization.

The results as depicted in Appendix 4 for the entire period of 504 months or 42 years. Results from the first regression indicate that the alpha value is a positive and statistically significant at 0.01% level 34 basis points indicating that irrespective of difference between the monthly risk free rate R_{mkt}-$R_{f,}$ the difference between the monthly return on the portfolio of risk arbitrage transactions concerned and the risk free rate is indeed positive. The estimated market beta is only 0.07 indicating that over a broad range of market environments, risk arbitrage returns are independent of overall market returns.

Also when the second regression model, Fama and French (1993) is computed a positive alpha value of 37 basis points is computed. The market beta in this case is 0.15 and statistically significantly different from zero .The SMB coefficient is statistically different from zero indicating a high correlation between RAIM returns and SMB because the arbitrage trade in a stock transaction consists of a long position in a relatively small target and a short position in a relatively large acquirer.

Piecewise Linear Regressions: Risk Arbitrage Returns versus Market Returns

The following is the piecewise linear regression relating risk arbitrage to market returns:

$$R_{\text{Risk Arb}} - R_f = (1-\delta)[\alpha_{MktLow} + \beta_{MktLow}(R_{Mkt} - R_f)] + \delta[\alpha_{MktHigh} + \beta_{MktHigh}(R_{Mkt} - R_f)]$$

Where $R_{Risk\ Arb}$ is the monthly return on a portfolio of risk arbitrage transactions, R_f is the risk-free rate, R_{Mkt} is the monthly return on the value-weighted CRSP index and δ is a dummy variable whose value is equal to 1 in the event of the market return being greater than a threshold and zero otherwise.

For the purpose of ensuring continuity the following restriction imposed:

$$\alpha_{MktLow} + \beta_{MktLow}(\text{Threshold}) = \alpha_{MktHigh} + \beta_{MktHigh}(\text{Threshold})$$

(Refer to Appendix 9 for the diagrammatic representation of this model)

A problem with implementing this model is determining the location of the threshold i.e. kink point. For the purpose or avoiding the usage of an ad hoc value of threshold, results are presented by setting the threshold equal to -4.0%, the value that maximizes the adjusted R^2. The results from this model as depicted in Appendix 4 indicates that risk arbitrage produces a return that is statistically significant at 0.001% level and 67 basis points per month greater than the risk free rate of return and a beta with value close to zero. However in the event of the market return being more than 4% below the risk free rate, the risk arbitrage market beta increases to a statistically significant at 0.001% level value of 0.74.This helps to establish a link between risk arbitrage returns which lessen in relation with market returns in down stock markets conditions. The returns associated with risk arbitrage are more pronouncedly decreased in down stock market and business conditions especially when there is deal failure. Hence we do not reject the hypothesis that **Returns associated with risk arbitrage are more pronouncedly decreased in down /severely depreciating stock market and business conditions but remain rather uncorrelated with market returns in flat and appreciating markets.**. The phenomenon of deal failure can be described as any risk arbitrage deal where the arbitrageur loses money. According to Mitchell and Pulvino (2001), probability of deal failure is more frequently observed in downturn stock markets, in the case of cash deals and also often in the case of hostile takeovers and leveraged buyouts which will be further discussed in the next section.

6.2 Hypothesis 2:The probability of a merger failing is a decreasing function of market returns in the last two months, indicating that deals are more likely to fail following market downturns.

Probit model infer the effects of market returns on probability of deal failure:

$$\mathbf{Fail=\alpha + \beta_1 R_{Mkt} + \beta_2 R_{Mkt-1} + \beta_3 R_{Mkt-2} + \beta_{4\ LBO} + \beta_{5Cash\ Dummy} + \beta_{6Premium} + \beta_{7Size} + \beta_{8Tender} + \beta_{9\ Hostile}}$$

where Fail is a dummy variable whose value is equal to one in the event of the arbitrage return being negative and zero if the arbitrage return is positive. R_{Mkt} is the monthly return on the value weighted (v.w.) CRSP index for the month of the deal resolution date, R_{Mkt-1} is the monthly return on the v.w. CRSP index for the month prior to the deal resolution date, R_{Mkt-2} is the monthly return on the v.w. CRSP index for two months month prior to the deal resolution date
LBO is a dummy variable if the acquirer was private, Cash Dummy is a dummy variable indicating if the acquirer offered to pay cash in 100% for the target, Premium calculated as follows:

Premium =
Takeover premium equal to the target stock price one day after the announcement of the merger
Target Stock Price 30 days prior to the announcement

Size is the logarithm of the target's market equity value. Tender is a stipulated dummy variable whose value is equal to one in the event of the offer being a cash tender. Hostile is a stipulated dummy variable whose value is equal to one in the event of the target management having rejected the bid as indicated in the Dow Jones News Service or Wall Street Journal report.
The results in the model as indicated in Appendix 4 indicate that the probability of a merger failing is a decreasing function of market returns in the last two months, indicating that deals are more likely to fail following market downturns, denoted by negative value of co-efficients $R_{Mkt,}$ R_{Mkt-1} and R_{Mkt-2} . The results also indicate that hostile deals have a 14.2 % higher probability of failure than friendly deals. (The summary of hypotheses testing and results can be found in Appendix 6) Hence we do not reject the hypothesis that **The probability of a merger failing is a decreasing function of market returns in the last two months, indicating that deals are more likely to fail following market downturns.**

7 The Financial Regulatory mechanism and its impact on risk arbitrage in US Financial Markets

Foreign investment and participation has a major impact on the macro-economic well being of the US economy and it necessary that US Policy makers take account of foreign shareholders. In the US economy prices of agricultural and other basic commodities is fixed so changes in the exchange rate should have an impact on these prices or rather these prices indeed do oscillate in response to changes in the exchange rate. The dominance of the US economy as the largest creditor (net supplier of savings to other world countries) has ended. The US economy however still is one of the largest, if not the largest market for equity, bonds and derivatives.

How the US economy views risk and arbitrage opportunities should be taken into account when analysing the prevalent risk arbitrage mechanism. The monetary policy of the US economy and changes in corporate regulations as well propounded by the financial regulatory mechanism and necessitated by changes in the financial market structure should have an impact on the risk arbitrage mechanism in US.

The Financial Services Committee of the US Government has agreed that the current regulatory capital framework should be updated to reflect modern risk management practices and to eliminate regulatory arbitrage opportunities that the existing rules stand to create. The Basel Committee, a subsidiary group of the financial services committee, also attempts to reduce regulatory arbitrage opportunities under the current framework (Basel II) (Presentation by Committee on Financial Services to the federal banking regulators, Board of Governors of the Federal Reserve System).In accordance with this strategic move the regulators seek to prevent firms from shifting assets within the balance sheet, though the instruments are not specifically covered by Basel I. For the curbing of regulatory arbitrage opportunities it has been suggested that the Pillar I treatment of operational risk is not necessary to prevent this activity. On the other hand Pillar I treatment could instead create new regulatory opportunities for e.g. fraud in the event of incentives existing for institutions to characterize certain operational losses rather than credit risks for the purpose of obtaining more lenient regulatory capital treatment.

It has also been recommended that certain regulatory or legislative changes may be necessary which could help reduce systemic risk, eliminate legal uncertainty and control regulatory and to have a closer look on derivatives trading that could be potentially used for fraud or manipulation. For the smooth flow of risk arbitrage activities across countries there is a growing need for technological progress which has led to integrated financial services across sectors and countries.

In addition to regulation by the Federal Reserve Board, stock exchanges (e.g. NYSE) and self-regulatory organizations (NASD) have established margin rules which are to be followed after an initial transaction. For example in order to regulate arbitrage activity, the NYSE and NASD state a requirement of investors maintaining a minimum margin of 25 percent for long positions and 30 percent for short positions. In the event of security prices moving such that the investor's position has less than the required maintenance margin, he will be subject to a margin call as per which he will at a minimum be required to post additional collateral or reduce his position in order to satisfy the maintenance margin requirements.

Apart from the above there has also been a growing trend in US financial markets to curb illegal trading in risk arbitrage activities. Also while risk arbitrageurs exist as a small but powerful minority yet there are legal measures to ensure than there is no illegal concentration of activities by them and that the management boards of respective companies entering into risk arbitrage maintain high standards of corporate governance.

8 Conclusions

Risk Arbitrage usually follows the announcement of a merger or acquisition or a takeover where the stock of the target company is typically traded at a discount to the stock of the acquired company at what is known as a price differential called arbitrage spread. It is generally accepted that based on the success or failure of a risk arbitrage activity there will be resultant profits or losses respectively.

After the announcement of a risk or merger the target firm faces a completion risk. Some of the shareholders may want to ward of this risk by selling their shares which creates a selling pressure as a result of which the price of the target firm falls below its efficient market price. This results in a market efficiency which according to Shleifer and Vishny(1997) is called market inefficiency leaving behind abnormal returns. The other risks faced in risk arbitrage are that of deal failure, that is the deal resulting in losses. Apart from that Risk Arbitrage is also limited to the extent of supply of capital which is a prerequisite for its smooth functioning; the lender typically requires 102% of the short position as collateral. (Baker, Malcolm and Savasoglu, Serkan (2002)).In previous literature large excess returns have been documented in literature pertaining to risk arbitrage because transaction costs and other limitations have prevented individuals from realising such huge profits. Also there is a risk premium attached to risk arbitrage deals thereby enabling arbitrageurs to earn a huge profit.

There has been an encouragement for merger activity, due to the removal of geographical restrictions for banks and thrifts under the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994. The removal of preferential tax treatment of bad debt reserves under a special provision of the Small Business Jobs Protection Act of 1996 eliminated previous impediments for thrift to bank conversions and mergers. During that time was the Gramm-Leach-Bliley Act (Financial Modernization Act) of 1999 that permitted the creation of Financial Holding Companies which could practice all functions 'financial in nature' under one umbrella removed further deterrents to bank/thrift mergers.

The section on risk arbitrage in takeovers reveals that risk arbitrageurs enjoy an information advantage which arises from their choice to enter the field of risk arbitrage. In the event of the presence of risk arbitrageurs increasing the likeliness of a takeover occurring, then one risk arbitrageur buying shares is relevant for the entire value of shares.

Risk arbitrageurs expend a large effort in understanding how other risk arbitrageurs in the takeover process would behave. In an endogenous equilibrium is determined the number of

arbitrageurs who decide to take positions, the number of shares that they will purchase and the price of shares. In the event of there being a larger number of risk arbitrageurs in the market so will the value of shares rise. Owing to the informational advantage that a risk arbitrageur enjoys he is willing to pay a price high enough to persuade smaller shareholders to sell their shares. Observed in most cases is that risk arbitrageurs do not have any initial private information. The private information that they enjoy arises endogenously when they start buying shares. It is however necessary that arbitrageurs be controlled to ensure that they don't compete away their rent.

In the computed regression model (Refer to section 4.1A Time Series Regressions of Risk Arbitrage Returns on Common Risk Factors and results in Appendix 4) the estimated market beta is only 0.07 indicating that over a broad range of market environments, risk arbitrage returns are independent of overall market returns. The SMB coefficient is statistically different from zero indicating a high correlation between RAIM(Risk Arbitrage Index Manager)returns and SMB because the arbitrage trade in a stock transaction consists of a long position in a relatively small target and a short position in a relatively large acquirer.

However in the event of the market return being more than 4% below the risk free rate, the risk arbitrage market beta increases to 0.60.This helps to establish a link between risk arbitrage returns which lessen in relation with market returns in down stock markets conditions (Refer to regression model in section 4.1B Piecewise Linear Regressions: Risk Arbitrage Returns versus Market Returns and results in Appendix 4.) The returns associated with risk arbitrage are more pronouncedly decreased in down/severely depreciating stock market conditions especially when there is possibility of deal failure but remain rather uncorrelated with market returns in flat and appreciating markets. The probability of a merger failing is a decreasing function of market returns in the last two months, indicating that deals are more likely to fail following market downturns, denoted by negative value of the co-efficients of $R_{Mkt,}$ R_{Mkt-1} and R_{Mkt-2} . The results also indicate that hostile deals have a 14.2 % higher probability of failure than friendly deals. (Refer to regression model in section 4.1C Effect of Market Returns on Probability of Deal Failure and results in Appendix 5 and Summary of the hypotheses testing and results in Appendix 6).The standard deviation for VWRA and RAIM returns (8.092870337 and 9.484632258) respectively have been experiencing quite a downward trend compared to the higher average values (17.384 and 13.056) indicating that the values have not deviated as much as the average values themselves. The VWRA has been positively skewed but not that much as RAIM indicating that most VWRA values are located below the mean value but not as much as RAIM. Also the VWRA curve when plotted is more pointed and normal than the RAIM curve as indicated by the

Kurtosis values. Returns to risk arbitrage as compared to risk have been more on the higher side with reference to VWRA returns as compared to RAIM as indicated by the Sharpe Ratio values (Refer Appendix 7). The average target market equity value has deviated more positively from the mean over the time period as compared to the average acquirer market equity value which has negative deviation as indicated by the standard deviation values(666.29 and 6445.067) compared to the average values(538.22 and 12073.25). The correlation coefficient between mergers announced and average target market equity value average acquirer market equity value respectively have been weak yet positive. (Refer Appendix 8).(Refer to Appendix 12 for summary of statistical analysis)

The Financial Services Committee of the US Government and the Federal Reserve Board play an important role in capital and banking regulation which does impact on risk arbitrage activity.For the curbing of regulatory arbitrage opportunities it has been suggested that the Pillar I treatment of operational risk is not necessary to prevent this activity. On the other hand Pillar I treatment could instead create new regulatory opportunities for e.g. fraud in the event of incentives existing for institutions to characterize certain operational losses rather than credit risks for the purpose of obtaining more lenient regulatory capital treatment.

It has also been recommended that certain regulatory or legislative changes may be necessary to reduce systemic risk, eliminate legal uncertainty and control regulatory and to have a closer look on derivatives trading which could be potentially used for fraud or manipulation. In addition to regulation by the Federal Reserve Board, stock exchanges (e.g. NYSE-New York stock Exchange) and self-regulatory organizations (NASD-National Association Of Security Dealers) have established margin rules which are to be followed after an initial transaction such that in the event of security prices moving such that the investor's position has less than the required maintenance margin, he will be subject to a margin call as per which he will at a minimum be required to post additional collateral or reduce his position in order to satisfy the maintenance margin requirements. Risk arbitrageurs exist as a small but powerful minority yet there are legal measures through limits imposed and other regulatory measures as discussed above to ensure than there is no illegal concentration of activities by them and that the management boards of respective companies entering into risk arbitrage maintain high standards of corporate governance.

The future scope for the risk arbitrage practice in US financial markets is vast. There is a growing amount of literature pertaining to the same in terms of research and media coverage of M&A deals. While the risks associated with this financial market activity are large profits are nevertheless commensurate with risks and remain an attractive incentive to arbitrageurs (Fama,

Eugene and Ken French, 1993). There is also a burgeoning need for regulation for risk arbitrage to prevent fraud and exploitation of the banking system for risk arbitrage activities. The Federal Reserve Board, Basel Committee and Financial Services Committee remain for ever vigilant in their efforts to ensure the regulation of capital flow, monetary policy, banking system and arbitrage opportunities all relevant to the domain of risk arbitrage.

On the current agenda of the Financial Services Committee and Basel Committee is to control regulatory arbitrage opportunities e.g. fraudery and that should help ensure a more stringent, just network for risk arbitrage. It is necessary that the trading limits stipulated by the NYSE and NASD pertaining to arbitrage positions be strictly enforced currently and the trend be continued in the future to ensure that each arbitrageur trade in an adequate, regular and orderly manner.

In an era where corporate scandals are observable, it is necessary that the legal system help circumvent this problem by ensuring that strict laws are enacted enabling high standards of corporate governance and corporate ethics observable by companies. This is in particular reference to the operational procedures pertaining to risk arbitrage followed by a target and acquiring companies in a merger or takeover to ensure that the highest standards of legality and fairness are maintained especially in the case of a hostile takeover

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10 Appendices

Appendix 1

10.1 THE PAYOFFS IN THE NEW POSITION RELATIVE TO THE POSITION WITHOUT THE PUT

		With Put
Successful		-3,25
Unsuccessful		
	Alza<40	x - 3,25
	Alza>40	-3,25

Appendix 2

10.2 CALCULATION OF POTENTIAL ANNUALIZED RETURN ON GREEN CIRCLE'S ABOTT-ALZA INVESTMENT

Maximum Position Size (Half Position):	US$ 12.5 million
Date of Investment:	June 23, 1999
Anticipated Close of Merger:	December 31,1999
Announced Exchange Ratio:	1.2 ABT:1.0ALZA
Price of Abbott shares shorted:	43 ½
Number of Abbott Shares Shorted:	312,000 shares
Basis of Alza Shares Acquired:	48

Number of Alza Shares Acquired:	260,000 shares
Collateral Require.ments: Long Position Short Position	 50% 50%
Margin Interest Rate:	6.2%
Short Sale Rebate	5.6 %

Calculation:

Gross Spread (Per Share) = Value to be received in transaction-Stock Price of Target
=Value of Abbott Shares to be Received-Price of Alza
=(43.50 x 1.2)-48.00
=4.20

Gross Spread (Total) = Value to be Received in the Transaction-Stock Price of Target
=Value of Abbott Shares to be Received-Price of Alza
=(43.50 x 312,000 shares)-(48 x 260,000 shares)
=US$ 1,092,000

Net Spread =Gross Spread $+_{or}-$ All other Cash Flows from the Investment
=Gross Spread-Margin Interest + Short Sale Rebate
= $1,287,265-$845,000 = $442,265

Potential ROI =Net Spread/Total Capital Employed
= 442,265/(13,026,000+845,000)
= 3.188%

Annualized Potential ROI = Potential ROI x (365/Number of Days Until Completion)
= 3.188% x (365/191)
= 6.09%

Appendix 3

10.3 RESULTS OF TIME SERIES REGRESSIONS OF RISK ARBITRAGE RETURNS ON COMMON RISK FACTORS

$$R_{\text{Risk Arb}} - R_f = \alpha + \beta_{Mkt}(R_{mkt} - R_f)$$

$$R_{\text{Risk Arb}} - R_f = \alpha + \beta_{Mkt}(R_{mkt} - R_f) + \beta_{SMB}R_{SMB} + \beta_{HML}R_{HML}$$

Dependent Variable	A	β_{Mkt}	β_{SMB}	β_{HML}	Adj R^2	Sample Size
RAIM Portfolio returns	0.0034 (0.0015)**	0.0743 (0.0456)***			0.078	504
RAIM Portfolio returns	0.0037 (0.0015)*	0.1455 (0.0894)***	0.1743 (0.0567)	0.0567 (0.0891)**	0.087	504
VWRA Portfolio returns	0.0080 (0.0026)***	0.0678 (0.0456)			.026	504
VWRA Portfolio returns	0.0073 (0.0045)***	0.0192 (0.0556)	0.0978 (0.0546)	-0.0345		504

*,** and *** denote statistical significance at the 0.05,0.01 and 0.001 levels respectively.

Appendix 4

10.4 RESULTS OF PIECEWISE LINEAR REGRESSIONS: RISK ARBITRAGE RETURNS VERSUS MARKET RETURNS

$$R_{\text{Risk Arb}} - R_f = (1-\delta)[\alpha_{MktLow} + \beta_{MktLow}(R_{Mkt} - R_f)] + \delta[\alpha_{MktHigh} + \beta_{MktHigh}(R_{Mkt} - R_f)]$$

For the purpose of ensuring continuity the following restriction imposed:

$\alpha_{MktLow} + \beta_{MktLow}$ **(Threshold)** $= \alpha_{MktHigh} + \beta_{MktHigh}$ **(Threshold)**

Dependent Variable	$\alpha_{MktHigh}$	β_{MktLow}	$\beta_{MktHigh}$	Adj R^2	Sample Size
RAIM Portfolio returns	0.0067 (0.0017)***	0.7448 (0.0567)***	0.0256 (0.0456)	0.256	504
VWRA Portfolio Returns	0.0345 (0.0023)***	0.6789 (0.1123)***	-0.0567 (0.0456)	0.089	504

*** denotes statistical significance at the 0.001 level.

Appendix 5

10.5 RESULTS OF PROBIT MODEL TO ANALYSE THE EFFECT OF MARKET RETURNS ON PROBABILITY OF DEAL FAILURE (M&A TREND)

The following probit model was computed to infer the effects of market returns on probability of deal failure:

$$Fail = \alpha + \beta_1 R_{Mkt} + \beta_2 R_{Mkt-1} + \beta_3 R_{Mkt-2} + \beta_{4\ LBO} + \beta_{5Cash\ Dummy} + \beta_{6Premium} + \beta_{7Size} + \beta_{8Tender} + \beta_{9\ Hostile}$$

Independent Variable	Coefficient Estimate	Marginal Effect
R_{Mkt}	-1.987 (0.7891)	-0.6541
R_{Mkt-1}	-1.234 (0.4512)	-0.3456
R_{Mkt-2}	-0.8761 (0.2341)	-0.2345
LBO	0.2345 (0.0561)	0.0567

Cash Dummy	0.1342 (0.0812)	0.0345
Takeover Premium	0.0078 (0.0302)	0.0034
Size	-0.0667 (0.0123)	-0.0234
Tender Dummy	-0.3456 (0.0512)	0.0567
Hostile Dummy	0.6775 (0.0451)	0.1423
Constant	-0.7781	
R^2	0.056	
Number of observations	4726	

Appendix 6

10.6 SUMMARY OF THE HYPOTHESES TESTING AND RESULTS

Hypothesis	Result	Decision
Hypothesis 1: Returns associated with risk arbitrage are more pronouncedly decreased in down stock market and business conditions.	In the event of the market return being more than 4% below the risk free rate, the risk arbitrage market beta increases to a statistically significant at 0.001% level value of 0.74.This helps to establish a link between risk arbitrage returns which lessen in relation with market returns in down stock markets conditions.	Do not reject
Hypothesis 2: The probability of a merger failing is a decreasing function of market returns in the last two months, indicating that deals are more likely to fail following market downturns.	The results in the model indicate that the probability of a merger failing is a decreasing function of market returns in the last two months, indicating that deals are more likely to fail following market downturns, denoted by negative value of co-efficients R_{Mkt}, R_{Mkt-1} and R_{Mkt-2} .	Do not reject

Appendix 7

10.7 MERGERS ANNOUNCED AND ACQUIRER/TARGET EQUITY VALUE

The final sample consisted of 5061 firms, updating the 1963-1998 sample (Mitchell and Pulvino (2001)) with an addition of 795 new risk arbitrage transactions till the current year under study, 2004. A certain number of observations (4726) had been dropped because of complicated terms as well as inaccurate data used in the Dow Jones News Service articles in which they were referenced. In certain cases the merger agreements might state that target shareholders exchange their shares for a combination of cash, preferred stock and warrants. In such cases determining the value of the hedge is not possible for such transactions is not possible since market values of hybrid securities are generally unavailable .Hence we have restricted our sample to straight forward transactions which include as cash mergers, cash tenders and simple stock swap transactions. Target and acquirer equity market values are measured on the day after the merger announcement.

Year	Number of Mergers Announced	Average Target Market Equity Value(in Millions(US$)	Average Acquirer Market Equity Value (US$ Millions)
1963	30	55.9	585.9
1964	25	80.2	357.5
1965	29	66.1	279.7
1966	31	88.2	583.7
1967	40	132.4	466.4
1968	58	147.2	426.6
1969	31	107.1	563.8
1970	32	86.3	581.9
1971	24	111.1	725.2
1972	28	82.2	853.3
1973	89	44.9	374.5

1974	99	58.2	411.5
1975	82	71.2	513.7
1976	110	60.6	679.3
1977	182	83.7	409.9
1978	191	81.3	473.4
1979	214	98.3	501.9
1980	158	143	1047.8
1981	151	513.8	713.9
1982	147	167	383.9
1983	168	151.2	450.2
1984	249	529.4	494.3
1985	221	596.9	1071.9
1986	333	354.5	755.4
1987	306	404.9	1199.3
1988	428	696.6	900.5
1989	284	543.3	1031.6
1990	115	349	1888.7
1991	91	437.7	2728.8
1992	80	261.2	2000
1993	89	335.9	1831.1
1994	119	521.5	3116.9
1995	157	734.6	5139.3
1996	129	808.7	7278.9
1997	114	801.4	5696.1
1998	116	1175.8	9504.7
1999	128	1198.2	10000.5
2000	122	1184.5	12239.5
2001	119	2004.2	14500
2002	124	2234.8	15004
2003	157	2434.9	16789
2004	145	2567.3	17986
Total	5061		

Average		538.22	12073.25
Standard Deviation		666.29	6445.067

CORRELATION COEFFICIENT between Number of mergers announced and Average Target Market Equity Value is .178

CORRELATION COEFFICIENT between Number of mergers announced and Average Acquirer Market Equity Value is .093

Appendix 8

10.8 ANNUAL RISK ARBITRAGE RETURN SERIES

The VWRA portfolio returns are calculated by taking the weighted average of returns from all active merger deals where transaction costs are ignored. RAIM returns are inclusive of transaction costs and other practical limitations associated with risk arbitrage investments.

Year	Value Weighted Risk Arbitrage Return(VWRA) (In %)	Risk Arbitrage Index Manager Return (RAIM)(In %)
1963	14.51	6.64
1964	10.27	4.44
1965	9.09	3.30
1966	11.46	-4.03
1967	14.45	9.06
1968	-8.65	-2.88
1969	22.10	3.18
1970	14.18	5.70
1971	19.93	5.79
1972	16.65	3.52
1973	20.38	-7.45
1974	12.95	12.93
1975	12.83	12.29
1976	19.93	19.20

1977	28.56	8.27
1978	20.40	18.03
1979	17.15	13.85
1980	29.30	38.54
1981	38.44	35.15
1982	38.41	31.99
1983	17.35	12.67
1984	21.45	8.13
1985	15.65	15
1986	13.32	20.61
1987	13.81	3.81
1988	27.23	27.63
1989	6.83	5.36
1990	6.69	4.38
1991	18.19	12.13
1992	9.12	4.48
1993	14.16	12.31
1994	17.07	12.58
1995	12.57	10.96
1996	11.32	15.39
1997	9.48	11.64
1998	12.64	4.09
1999	13.08	12.87
2000	13.97	14.56
2001	14.56	15.67
2002	14.89	13.62
2003	15.42	14.78
2004	15.80	16.34
Standard Deviation	8.092870337	9.484632258
Sharpe Ratio	1.12	0.16
Skewness	0.481	0.866
Kurtosis	3.147	1.502
Average	17.384	13.056

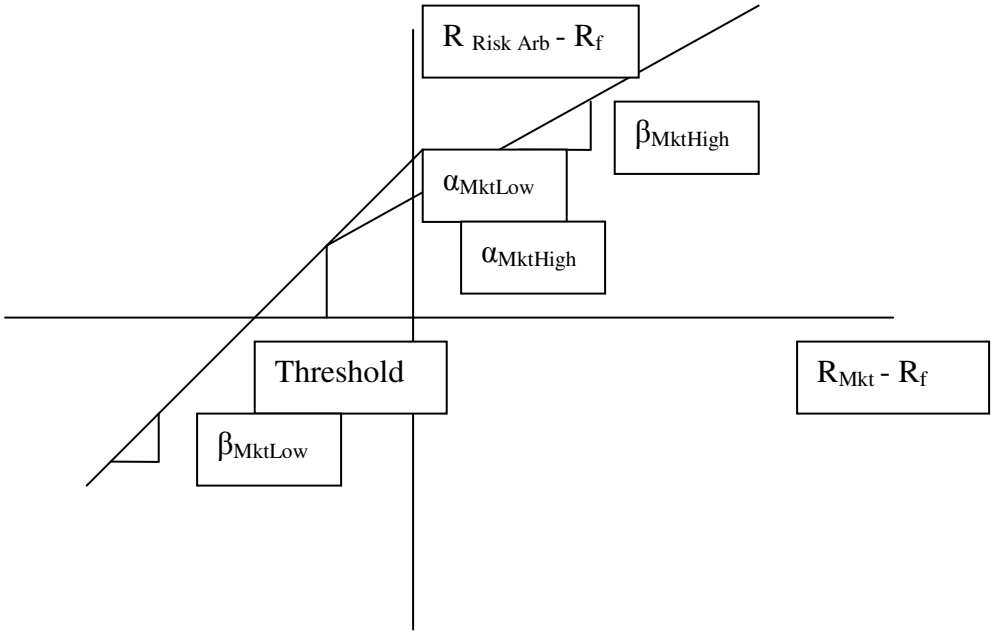
Appendix 9

DIAGRAMMATIC REPRESENTATION OF PIECEWISE LINEAR REGRESSIONS: RISK ARBITRAGE RETURNS VERSUS MARKET RETURNS

$$R_{\text{Risk Arb}} - R_f = (1-\delta)\,[\alpha_{MktLow} + \beta_{MktLow}\,(R_{Mkt} - R_f)] + \delta\,[\alpha_{MktHigh} + \beta_{MktHigh}\,(R_{Mkt} - R_f)]$$

For the purpose of ensuring continuity the following restriction imposed:

$$\alpha_{MktLow} + \beta_{MktLow}\,(\text{Threshold}) = \alpha_{MktHigh} + \beta_{MktHigh}(\text{Threshold})$$

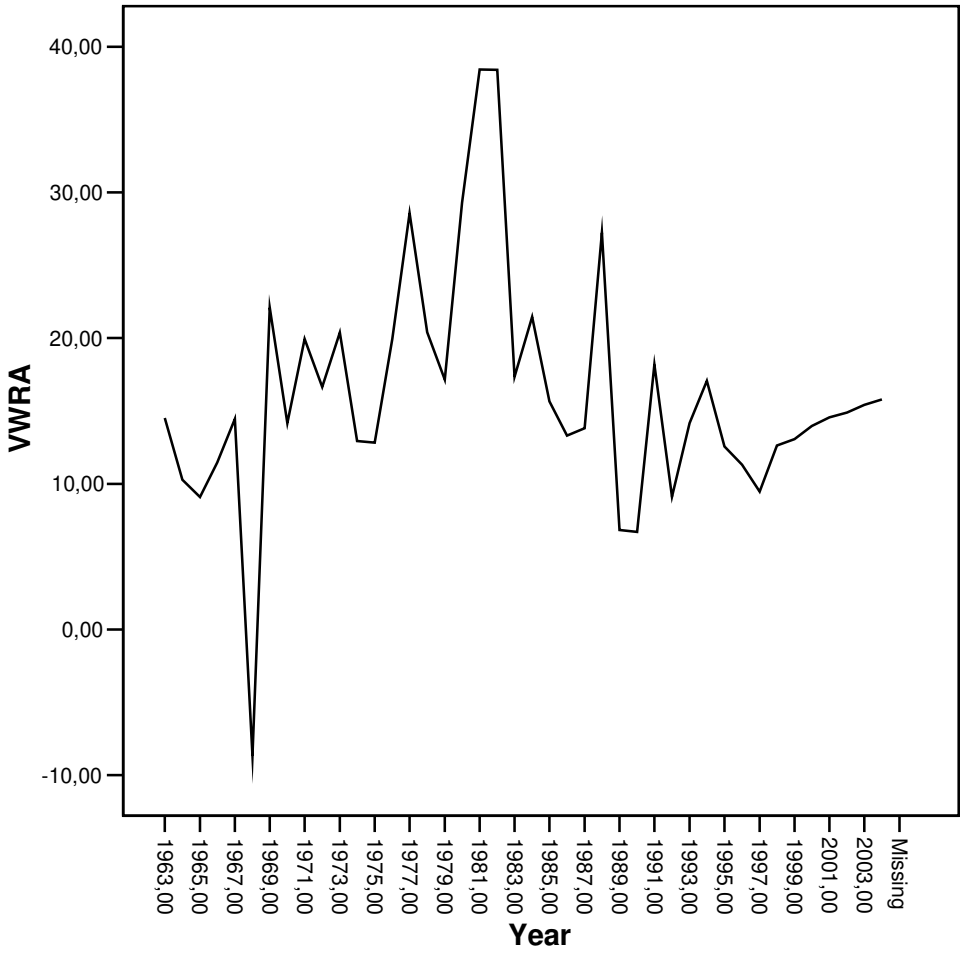


Where $R_{\text{Risk Arb}}$ is the monthly return on a portfolio of risk arbitrage transactions, R_f is the risk-free rate, R_{Mkt} is the monthly return on the value-weighted CRSP index. The market beta is permitted to vary depending on market returns. β_{MktLow} is considered the slope coefficient when the difference between the market return and risk free rate is less than the threshold. $\beta_{MktHigh}$ is considered the slope coefficient when the difference between the market return and the risk free rate is greater than the threshold.

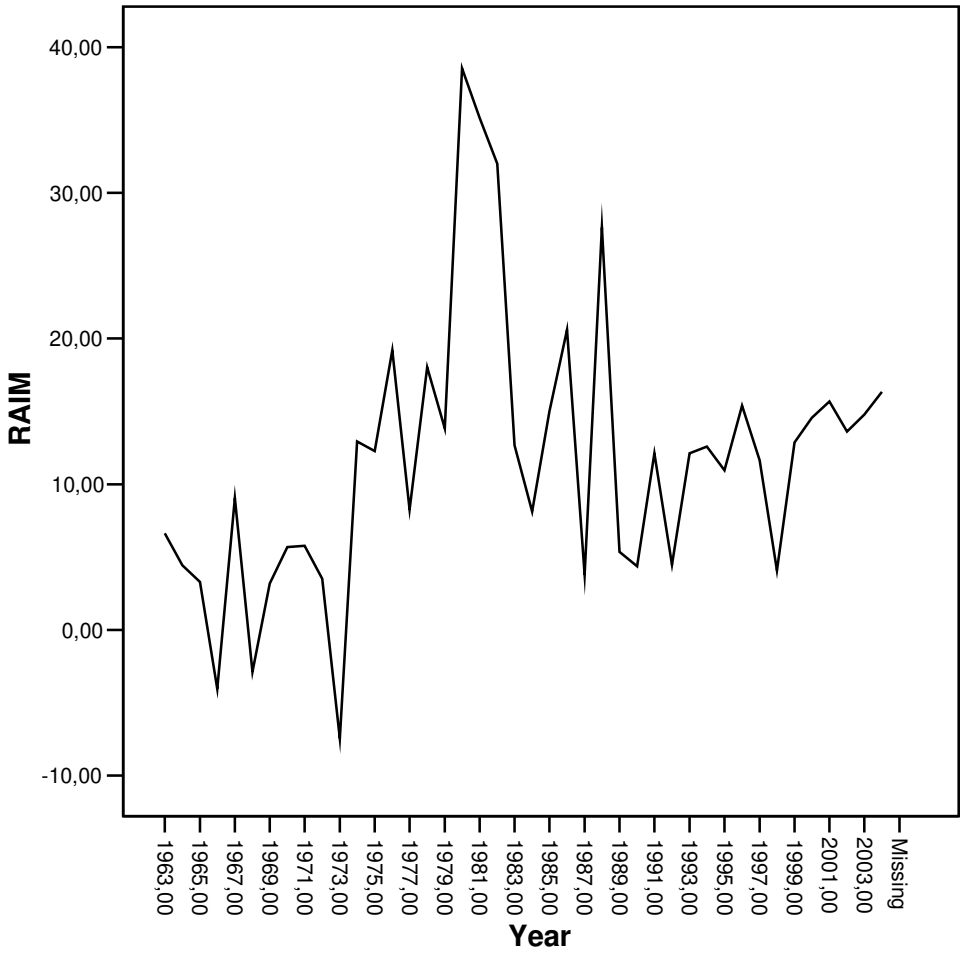
Appendix 10

10. Graphs

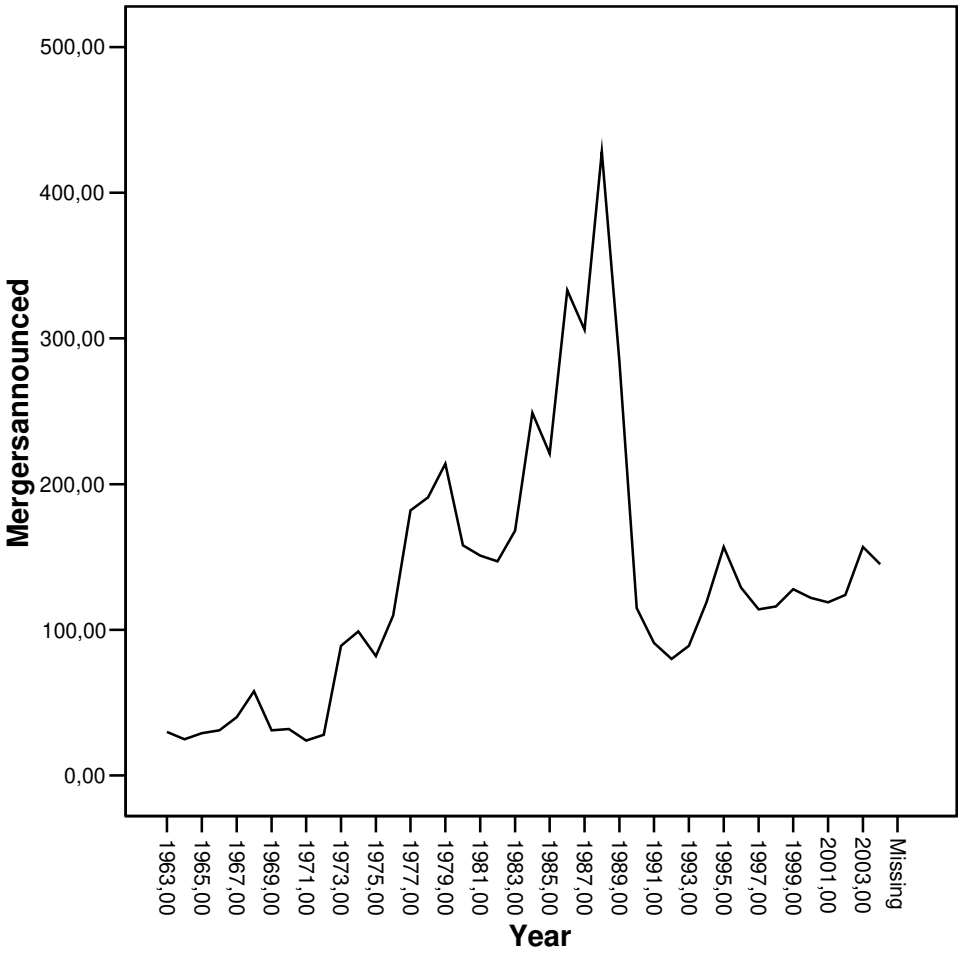
VALUE WEIGHTED RISK ARBITRAGE RETURNS (VWRA)(1963-2004)



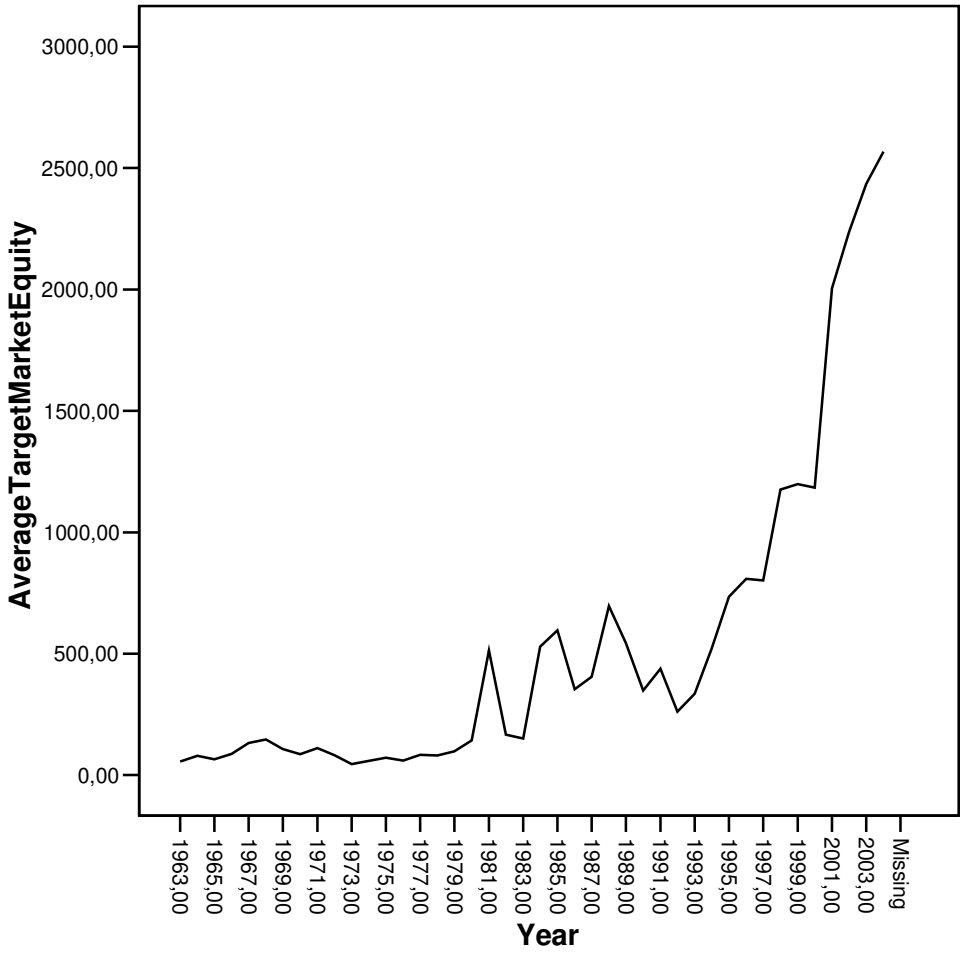
RISK ARBITRAGE INDEX MANAGER RETURNS (RAIM-1963-2004)



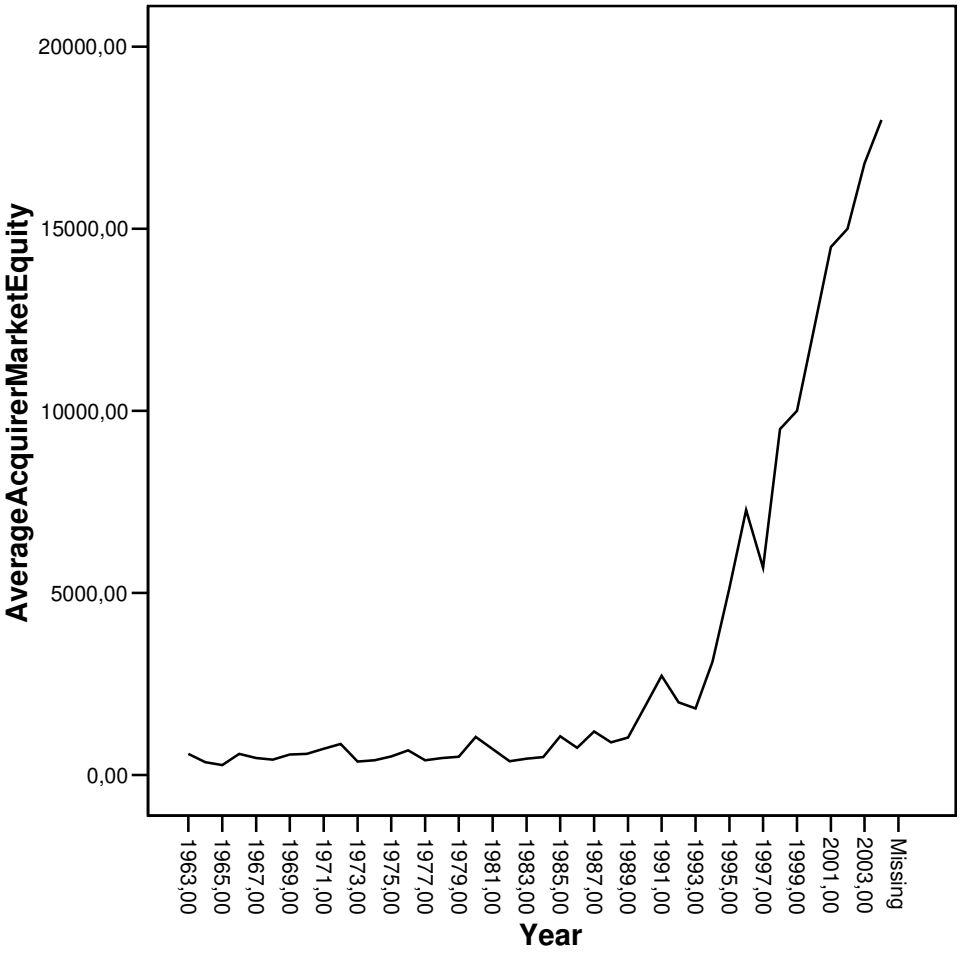
NUMBER OF MERGERS ANNOUNCED (1963-2004)



AVERAGE TARGET MARKET EQUITY (1963-2004)



AVERAGE ACQUIRER MARKET EQUITY (1963-2004)



Appendix 11

11.1 Selected papers analysing risk arbitrage issues in recent times

Author(s) and year of publication	Country and study period	Results
Baker, Malcolm and Serkan Savasoglu,2002	US, 1981-1986	Returns to risk arbitrage increase in an ex-ante measure of completion risk and target size.
Karolyi, G Andrew, and John Shannon, 1998	Canada,1997	Not only does risk arbitrage earn higher returns than for a conservative buy-hold strategy ,but also the magnitude of their excess returns are insensitive to a number of deal-specific attributes, such as number of days to close, payment method, size of the deal and the pre-announcement share price run-up.
Liu, Jun and Francis Longstaff, 2000	USA, 2000	Even when the optimal policy is followed, the returns from the risk arbitrage strategy can be mediocre when there is an underperformance of the riskless asset or low Sharpe ratio. The arbitrage portfolio may experience frequent capital losses at some point before the final convergence date of the arbitrage.
Shleifer, Andrei and R.W. Vishny, 1997	USA,1997	Arbitrage becomes ineffective in extreme circumstances when prices diverge from fundamental values.
Koch, Johan and Markus Sjöström , 2003	Sweden, 1981-1986	The main factors influencing the success of a tender offer are the reaction of the target's board, method of payment and the size of the largest owner in the target company. Moreover the event risk in Swedish markets is priced.
Mitchell, Mark	U.S. 1963-	Risk arbitrage returns are positively correlated with market

and Todd Pulvino, 2001	1998	returns in severely depreciating markets but uncorrelated with market returns in the case of flat and appreciating Markets.

11.2 Selected Papers analysing risk arbitrage issues in takeovers

Author(s) and year of publication	Country and study period	Results
Cornelli, Francesa , 1998	USA,2001	Risk Arbitrageurs have an incentive to accumulate non-trivial stakes in the company target of a takeover. Each arbitrageur with the knowledge of his presence has an informational advantage which guarantees scope for trade with other arbitrageurs. The number of arbitrageurs and shares that they trade in equilibrium are determined endogenously.
Gomes, Armando, 2001	USA,2001	There is a positive relationship between the takeover premium and the arbitrageurs' accumulation of shares before a takeover announcement, and the less liquid the target stock, the stronger is the relationship. The takeover premium is largely unrelated to the bidders' ability to dilute the targets shareholders after the acquisition.
Bergström, Clas, Peter Högfeldt, and Kenneth Högholm, 1994	Sweden, 1994	Large incumbent shareholders with the option to block a takeover attempt exercise a strategic influence on the tender offer prices, and, thereby, on the distribution of the gain. Initially, the concentrated target ownership structure is assumed to be exogenously given, but the presumption is later partially endoginised by considering the effects of potential arbitrageurs
Bergström, Clas, Peter Högfeldt, and Kenneth Högholm, 1993	Sweden, 1993	The blocking of shares may be relevant for pricing of takeovers in Sweden based on the Nash cooperative bargaining game.

Appendix 12

12.1 Summary of descriptive statistics pertaining to VWRA, RAIM, Mergers Announced, Average Target Market Equity Value and Average Acquirer Market Equity Value

tistical Measure and application	Value	Inference
ndard Deviation of Value Weighted Risk Arbitrage urns	8.093	The standard deviation of VWRA returns indicates a downward trend from the average VWRA returns.
ndard Deviation of Risk Arbitrage Index Manager urns	9.485	The standard deviation of RAIM returns indicates a downward trend from the average RAIM returns.
rpe Ratio of Value Weighted Risk Arbitrage Returns	1.12	Returns to risk arbitrage are relatively higher with relevance to risk Associated with VWRA returns.
rpe Ratio of Risk Arbitrage Index Manager Returns	0.16	Returns to risk arbitrage are relatively lower with relevance to risk Associated with VWRA returns.
wness of Value Weighted Risk Arbitrage Returns	0.481	A reasonable number of VWRA values are located below the mean VWRA.
wness of Risk Arbitrage Index Manager Returns	0.866	A relatively larger number of RAIM values are located below the mean RAIM
tosis of Value Weighted Risk Arbitrage Returns	3.147	A more pointed and normal VWRA curve
tosis of Risk Arbitrage Index Manager Return	1.502	A less pointed and normal RAIM curve
relation Coefficient between Number of mergers ounced and Average Target Market Equity Value	.178	A positive but rather weak correlation between number or mergers and average target market equity value
relation Coefficient of Number between mergers ounced and Average Acquirer Market Equity Value	.093	A positive but rather weak correlation between number or mergers and average acquirer market equity value