

NHH



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## Merger Arbitrage

*Opportunities left for financial mavericks in the  
new millenium?*

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## **Abstract**

This paper analyses 2 005 mergers and acquisitions in the period from 2000 to 2012 in order to investigate merger arbitrage excess return. Merger arbitrage is an investment strategy that takes advantage of the difference between the share price and the offer price of a target share after the announcement of a merger or an acquisition bid. The analysis is based on a methodology of creating merger arbitrage portfolios to realistically replicate the returns possible to achieve for merger arbitrage professionals. To test the significance of the results, the returns are tested with the linear regression models CAPM and Fama-French. Finally, the paper also investigates the notion that a piecewise linear model might be a better tool for performance measurement of merger arbitrage.

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# Part I

## Introduction

This paper aims to provide some new insight into the subject of merger arbitrage. Specifically, it will be a new and updated look on the excess return generated from merger arbitrage in the period of 2000 to 2012 for the U.S market. To the best of the authors knowledge there have not been any peer-reviewed studies into this subject to analyze the recent decennial period. The paper walks a well trotted path laid down by former studies on merger arbitrage and has drawn much on the works of Mitchell and Pulvino (2001) and Baker and Savasoglu (2002). The authors are still hopeful in all modesty that the paper might have some value, both as an introductory guide into the subject matter and as an update for the research field.

Merger arbitrage is an investment strategy that takes advantage of the difference between the share price and the offer price of a target share after the announcement of a merger or an acquisition bid. The share price will react to a takeover bid by nearing the bid offer, but because of deal completion risk there remains a small premium in the share price called the arbitrage spread. The practitioners of this trade are the arbitrageurs who take positions after a takeover announcement to harvest the arbitrage spread. Merger arbitrage is not like classical arbitrage in the sense of the absolute risk free trade of similar assets at different prices, it does entail the risk that the merger fails and share price falling to pre-announcement levels.

This paper follows the methodology of Mitchell and Pulvino (2001) and Baker and Savasoglu (2002) in a time-series analysis of the returns given by merger arbitrage. These studies found U.S. annual merger arbitrage returns respectively in the scale of 4 % to 11% above the market index when utilizing linear regression models such as CAPM and Fama-French. The basic premise of the method is to construct “passive” merger arbitrage portfolios and compare the performance of these against the market. The term “Passive Portfolio” entails that all the M%A events are included; there is no selection or picking of events.

The first part of this paper is a comprehensive discussion around the topic of merger arbitrage. Major concepts, different deal types, the risks involved, a brief history of the market for M&A in the U.S., and a run-through of the efficient market hypothesis. Then follows a review of the major academic work on the subject of excess return and a summary of the results from the field. The first part ends with a discussion on why there exists excess returns and how that might be connected to the role of the arbitrageur. The next part of the paper is the data and research methodology section, all aspects of the data gathering and portfolio construction is then accounted for. The last

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part of the paper details the time-series analysis of the merger arbitrage returns, which is divided into three major sections. Section one is an analysis of the overall return and risk characteristics of merger arbitrage portfolios. Section two benchmarks the portfolio return against linear asset pricing models. Section three investigates the possibility of a piecewise linear function.

The results of the paper partially confirm the work of previous research on this field for the new millennium. Using a sample of 2 005 completed or attempted takeover deals in the U.S market from the period 2000 to 2012 a merger arbitrage strategy is able to generate some excess return. All the constructed portfolios achieve higher Sharpe ratios than the market index. 3 out of 4 portfolios are able to generate excess return (alpha) when benchmarked against the CAPM and Fama-French factor models. However, not all the alpha values are statistically significant within a 10% limit. The final research section of the paper investigating a piecewise linear relationship is not able to neither confirm nor falsify such a relationship for the sample period.

Although not all of the research present the statistical significance needed to constitute evidence the paper still invites the notion of excess return. That is in itself an achievement for an investment strategy in the age of efficient microsecond global financial trade.

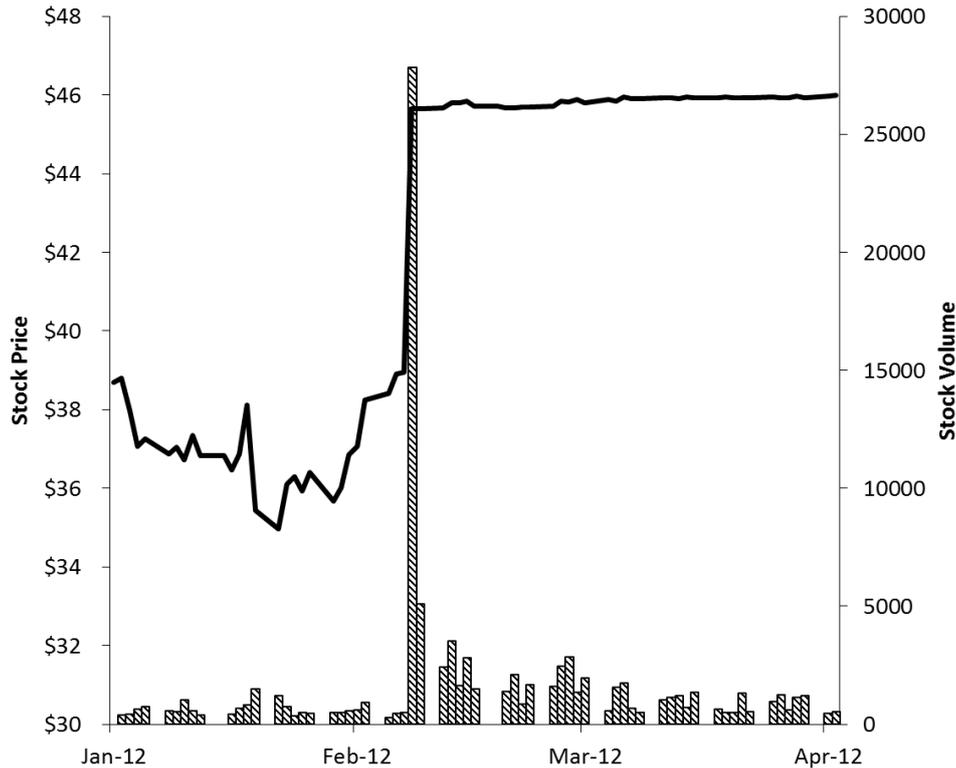
## Part II

# Merger Arbitrage

These first two parts provides a discussion on merger arbitrage. The first part describes the concept of merger arbitrage and its basis as an investment strategy. It provides a run-down of the basic concepts of merger arbitrage, the different deal types, the general market for mergers and acquisitions, and the risks of merger arbitrage. The second part is a review of the academic evidence on excess returns from merger arbitrage and the reasons for this premium.

### 1 Merger Arbitrage as an Investment Strategy

On February 9th 2012 a takeover is announced on the Bloomberg news service. Oracle Corporation (ORCL) is one of the largest suppliers of business software in the world and they have entered into an acquisition agreement with the public software company Taleo Corporation (TLEO). Oracle has offered to buy out all the Taleo shareholders with a cash bid of \$46 per share, valuing the entire acquisition at about \$1.9 billion for the entire company. This is Oracles second acquisition in the last three months and industry experts believe Oracle is doing this to position itself in the emerging area of “Cloud Computing”. Almost instantly after the acquisition is publicized there is a big jump in Taleo share price, in a matter of minutes the share price has increased about 17% from about \$39 per share to a new trading price at \$45.64. The daily trading volumes of this share has never been as high as the day of this announcement. For the next two months the share price stabilizes at about \$45.5 before Taleo is delisted in a successful tender offer on April 5th.



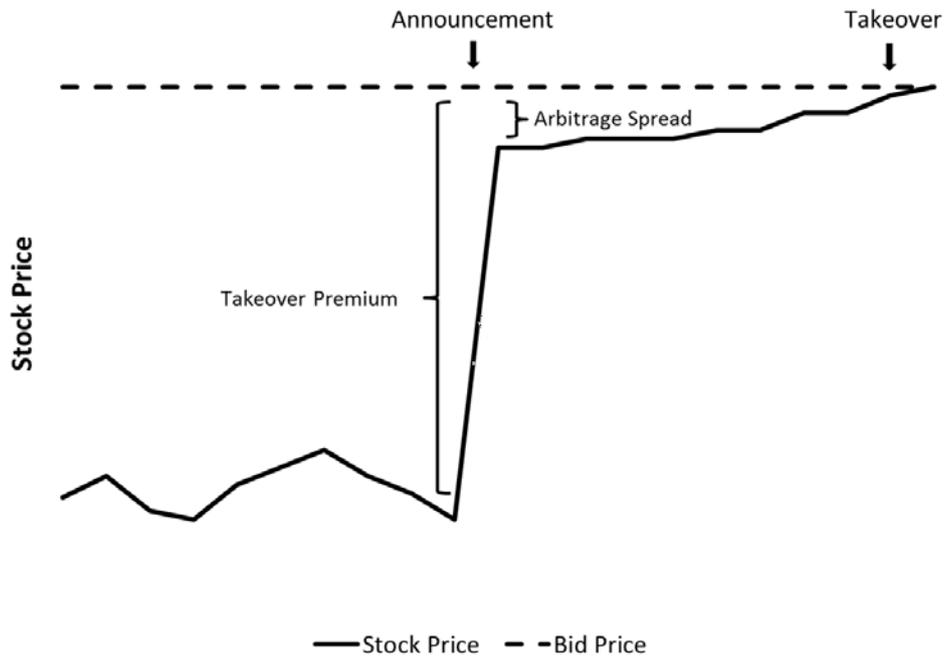
**Figure 1:** Taleo Stock Price & Volume During Takeover  
Taleo stock price “jumps” immediately after takeover announcement

This acquisition was a success for both Oracle and the existing Taleo shareholders, but there was another group of investors who also benefited from this deal. The arbitrageurs who bought into Taleo stock on February 9th after the deal was announced were able to buy Taleo stock for \$45.5 and two months later sell the shares for \$46 to Oracle. The return from this two month investment was about 1.10%; not as impressive as the 18% premium for the existing shareholders but still an annualized return of about 7%. There is on average several hundred transactions like this every year in the U.S. financial markets, making traders who practice this kind of Merger Arbitrage very successful. Merger arbitrage is an investment strategy that takes advantage of the difference between the share price and the offer price of a target stock after the announcement of a merger or an acquisition bid.

It is important to differentiate between normal merger and acquisition (M&A) activity and merger arbitrage. M&A activity is everything that goes into the restructuring of businesses; the management of deals, the financial structures, the legal processes, the takeover tactics, the practical implications for workers, the negotiations, the valuations, the tax issues and all the other processes involved with merging or acquiring businesses. The reasons for and the practice of M&A is a huge area of business and academia, and it is global in its scope. Jensen (1988) include the following factors that might motivate takeover activity: deregulation, synergies, economies of scale, taxes, managerial improvement, increasing globalization and agency costs related to cash

flow payout for shareholders.

Merger Arbitrage on the other hand is a bit more limited in definition; it is the speculation in stocks belonging to the parties that is undergoing an M&A process. It can then be seen as an exogenous effect of M&A, rather than an integral part of such transactions. This however, does not diminish its importance. When a company decides to perform an M&A transaction it will have to pay a premium above the current market price, if not the shareholders will earn a greater return by just selling at the prevailing market price. The price an acquirer pay above the prevailing market price ,pre-announcement share price, is the *takeover premium*.



**Figure 2:** Takeover Premium & Arbitrage Spread

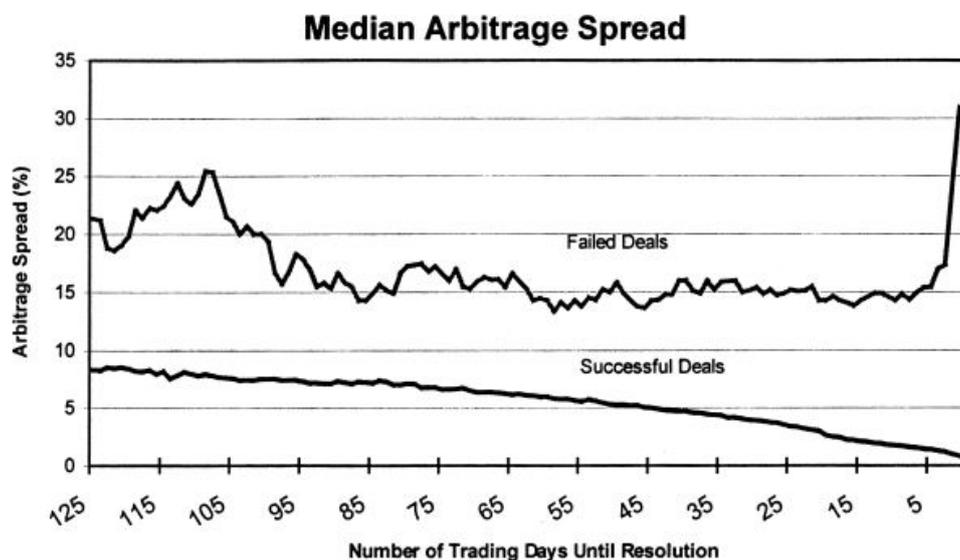
The *takeover premium* is the difference between pre-announcement stock price and bid price, while the *arbitrage spread* is the difference between post-announcement stock price and share price

When an announcement is made the target shares will instantly jump to a level close to, but usually not exactly to, the offer price. Due to uncertainty regarding the ultimate success of the takeover, uncertainties that will be dutifully explained further on in this paper, there is a risk of deal failure. This is why there is a difference between the initial offer price and post-announcement stock price. The difference between what the stock price jumps to, the post-announcement share price, and what the acquirer has proposed to pay for the target stock is called the *arbitrage spread*.

The size of this spread depends on the probability of success for the deal. It tends to diminish with time left to complete the deal and with positive signals from shareholders and regulators. Figure 3 is very revealing about the nature of the arbitrage spread.<sup>1</sup> The successful deals displays an arbi-

<sup>1</sup>Figure 3 is copied from Mitchell and Pulvino (2001)

trage spread that steadily shrinks as resolution nears, while the unsuccessful deals swerve a lot higher from the offset, bearing a higher risk premium, and skyrocketers from the second it is known that the deal will fail.



**Figure 3:** Arbitrage Spread & Time to Deal Resolution  
Mitchell and Pulvino (2001)

Merger arbitrage is a bet about whether a transaction will be successful. The group of traders and investors who uses merger arbitrage as an investment strategy is called *arbitrageurs*. Arbitrageurs can be financial institutions, hedge funds, banks or specialists that create portfolios of stocks that are undergoing takeovers. Arbitrageurs have played an important part in many of the great success stories from capital markets. They have also been involved in some of business history's most epic collapses and failures.

Much anecdotal material exists on the subject of merger arbitrage, such as the quintessential character Ivan Boesky who truly embodied both the successes and downfalls. The biggest merger arbitrageur in the 1980s and was at his peak responsible for trading a fund worth \$3 billion USD and he served as the inspiration for Gordon Gecko in Oliver Stone's *Wall Street* with his famous speech about how "Greed is good". He was able to achieve superior profits and make his investors rich, but it turned out that he did so by using insider information. In 1986 he was arrested for buying insider information from several different brokerage firms, and in the process almost singlehandedly ending the leveraged buyout era of the 1980s. He went from being among the *Forbes* 400 wealthiest people to serving time in jail and paying a \$100 million fine to the people he had swindled and forever being known as "Ivan the terrible".<sup>2</sup>

It is very doubtful whether most merger arbitrageurs lead as exciting

<sup>2</sup><http://www.businessinsider.com/meet-ivan-boesky-the-infamous-wall-streeter-who-inspired-gordon-gecko-2012-7?op=1>

lives as Ivan Boesky, but there is no doubt that they play a very important part in the world of Merger and Acquisitions. The arbitrageurs take the risks other investors do not want using supposedly superior industry knowledge, having a better insight into the bet that the merger will be successful.

Several cross-sectional studies have been done into what makes a merger or an acquisition successful. First of all, most deals end up being a success. Branch and Yang (2010) note success rates of above 80% for both stock and cash offers. This is a fairly high percentage of successful mergers and it follows that M&A deals are very important processes for any company and is always the result of thorough due-diligence and analysis. However, deals can fail and for arbitrageurs it is of paramount importance to grasp the factors that contribute to success.

Branch and Yang (2010) further investigates the variables that have an impact on merger arbitrage returns and find that the takeover premium, payment method and deal type are all correlated with higher returns and higher probability of success. A higher takeover premium increases the success rate; this result is also confirmed by Hsieh and Walkling (2004). When cash is the transaction consideration it is more likely to be successful than in stock transactions. Other studies point to further factors that increase the possibility of takeover success; Jindra and Walkling (2002) finds that for cash tender offers in the period 1981 to 1995 the most important variables for successful deals were positive target management attitude (no hostile takeovers), low offer duration and a large arbitrage spread. This paper goes on to suggest that a large arbitrage spread attracts arbitrageurs which in turn help the takeover process.

The notion that arbitrageurs and arbitrage capital help facilitate takeovers have been further investigated Baker and Savasoglu (2002) and Hsieh and Walkling (2004). They find that increases in arbitrage capital improve probability of deal success, implying the importance of merger arbitrage activity for the takeover markets. Further variables include debt-to-equity ratio where Harris and Raviv (1988) find a correlation between the leverage of a target firm and probability of success, higher leveraged firms are harder to buy out for an acquirer. It has also been found by Branch et al. (2003) that smaller firms with lower equity value have a higher probability of success than larger firms.

## 1.1 M&A deal types

There are several different methods of acquiring a target company, and hence there are several different ways of achieving merger arbitrage. The most common deal types are either cash offers or stock offers.

*Cash offers:* The cash consideration offer is the simplest form of a takeover bid. The acquirer announces that they want to buy out a target

company and its shareholders, to do that they simply provide a cash offer. An arbitrageur will in that case take long positions, buy stock, in the target company and bet that the deal will be successful. The arbitrageur profit is in that case the arbitrage spread between the stock price at the time of announcement and the offer price if the deal goes through.

*Stock offers:* In this case the acquiring company will offer its own shares in exchange for target shares. In this case an arbitrageur will buy target stock, as in a cash offer. But there is also a short position, borrowing to sell, in the acquirer stock. An arbitrageur does this because when the deal is successful he receives in return for the target share the promised number of acquirer shares, which is used to cover the short position. The profit for the arbitrageur will be the combination of the increasing target price and the possibly falling acquirer stock. The exchange ratio can be fixed, but it can also be floating depending on the acquirer stock price. A collar transaction is a version of the stock offer with an exchange ratio interval for acquirer stock instead of a fixed ratio. The dollar value of the deal is instead fixed for a given range of acquirer stock price. About 20% of stock swap takeovers are collar transactions (Officer (2006)). Branch and Wang (2008) did a time-series study on collar transactions and found excess annual returns of 23% for the period 1994 to 2003.

*Mixed offers:* In many cases the acquisition takes the form of a mix between cash and stock consideration. The terms often involve several caveats; financial derivatives and stock options. These kinds of mixed transactions are much harder to analyse due to the increased complexity of the deal terms; it is certainly harder to use these in empirical studies since each transaction must be handled independently. Therefore this paper will leave such complicated transactions alone and focus exclusively on pure cash and pure stock offers.

Many successful M&A cases are initially unsuccessful following the first bid, but end up closing after all. These transactions are called revision bids. The revision bids can come from the same company that initially bid on the target company or they can come from rivalling acquirers. There have been several incidences of bidding wars throughout the years and this will of course benefit target shareholders and arbitrageurs. The famous leveraged buyout of RJR Nabisco by the private equity firm KKR that took place in 1988 is a good example of how target shareholders gain from a bidding war. The CEO of RJR Nabisco wanted to buy out the shareholders at \$75 per share when the stock price was at about \$50, but after a fierce bidding war the final offer went to KKR at \$109 per share valuing the company to \$25 billion and making it the largest buyout in history.<sup>3</sup>

The choice of payment method is an area of substantial academic re-

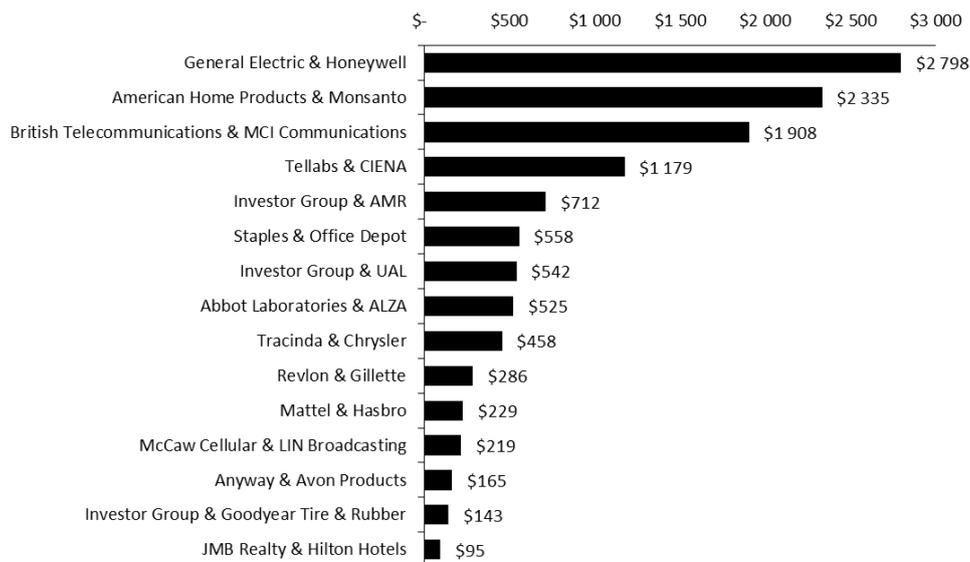
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<sup>3</sup>For a great account of the events transpired in the hostile takeover of RJR Nabisco, Bryan Burrough and John Heylar's *Barbarians at the Gate: The Fall of RJR Nabisco* is a fantastic read

search. Several hypotheses exist as to what drives the choice of payment method for a bidding firm. Betton, Eckbo, and Thorburn (2008) provide a complete overview of the different hypotheses regarding the choice of payment method. And the main theories on the subject is that; (i) The beneficiary capital gains tax rules in the U.S. might motivate bidders to use stock payment. (ii) The payment method is motivated by asymmetric information, such as investors reacting negatively to stock deals because of the fear of adverse selection. (iii) The payment method is part of a broader capital structure choice for the bidder. (iv) Behavioural finance suggest that the choice of stock payment might be motivated by informational asymmetry and the wish of a bidder to cash in on overvalued stock. But this notion of opportunistic bidder activity is controversial and in a recent empirical study Eckbo et al. (2013) strongly refute such a view.

## 1.2 Merger arbitrage risk

Merger arbitrage, or the alternative and slightly paradoxical name *risk arbitrage*, is not arbitrage in the pure sense of the word. Classic arbitrage is when identical assets have different prices, such that an investor can instantly buy the asset for a low price in one market then sell the same asset in another market for a higher price. This form of pure arbitrage is in most financial markets instantly arbitrated away as a result of efficient supply and demand. There are certainly risks involved with merger arbitrage and not only for the dishonest arbitrageurs as Mr. Boesky. Arbitrageurs face an asymmetrical payoff in their profession. If a deal goes through they profit from the relatively small arbitrage spread, but if the deal collapses the potential loss can be huge.



**Figure 4:** Merger Arbitrage Disasters, losses for arbitrageurs in \$million *Officer (2007)*

*Officer (2007)* shows how big the risks faced by arbitrageurs is in an analysis of the biggest merger arbitrage disasters between 1985 to 2004, disas-

ters being big deals that did not successfully complete. The study takes into account the arbitrageurs holdings of the failed deals and estimates arbitrage loss, 15 of the biggest failures all incur a loss exceeding \$100 million for the arbitrageurs. The most spectacular disasters, such as the failed merger between General Electric and Honeywell in 2001, range in the multi-billion dollar loss category. The average holdings by merger arbitrageurs in these disasters were 35% of the total target equity, implying that arbitrageurs have substantial exposure to the losses involved with merger disasters.

The most important risk involved with merger arbitrage is the risk of deal failure. This deal failure occurs when the merger fails to be consummated. The reason why this is a big risk and why arbitrageurs face big losses related to deal failure (Officer (2007)) is that if a deal is unsuccessful the target stock will most likely fall to pre-announcement prices or even further. The arbitrageurs will in that case incur a big loss on their investment and in addition they usually have transactions costs and short selling costs (in stock offers) that will go uncovered. However, the risk of deal failure is why there exists an arbitrage spread. If there had not been any uncertainty related to mergers and acquisitions there wouldn't be any risk premium to harvest from these deals.

There are many risk factors that can cause an M&A deal to fail:

*Shareholder problems:* Any merger or acquisition is dependent on the shareholders of the target company to approve the offer by the acquirer. When an offer announcement is made, it is up to the majority of the shareholders to approve the offer in a vote. If they approve of selling their shares to the bidder, they "tender" their shares successfully. If the offer bid is too low in the minds of the shareholders; the merger will be unsuccessful. Clearly these deal offers are not made on a whim, and there is often years of preparation and due diligence work done before an offer is made. But it is still a factor any arbitrageur must take into account when investing in a deal.

*Regulatory problems:* In many instances, a merger will need approval from certain government agencies in order to be completed. This is often agencies that are tasked with monitoring and regulating market competition in a country. The Federal Trade Commission and the U.S. Department of Justice Antitrust Division are the main regulatory agencies in charge of ensuring fair competition and consumer protection in the U.S. If one of these agencies sees a merger between two companies as "anticompetitive" and fear that the result of the merger will be monopolistic power, unfair competitive advantages and increased consumer prices they might step in and stop the merger. In fact, all mergers between listed public companies in the U.S. require the explicit consent from the Federal Trade Commission to be valid.

*Funding problems:* Funding risk is the risk that the necessary funding required to complete a transaction will not be available. Due to changing fac-

tors such as market and deal conditions; the acquirer might lose the financing required to complete a deal. Overall market conditions might change, making what once seemed a profitable investment unprofitable. Such things as changing interest rates can sometimes reduce the net present value of merger projects.

*Internal target resistance:* Not all mergers are “happy marriages” between consenting parties. If the merger is in fact a hostile takeover the acquirer might face stale resistance from within the target company. There are several defenses against hostile takeovers, such as “poison pills” that can stand in the way of a merger. Jindra and Walkling (2002) found that the attitude of the target management is an important determinant for takeover success.

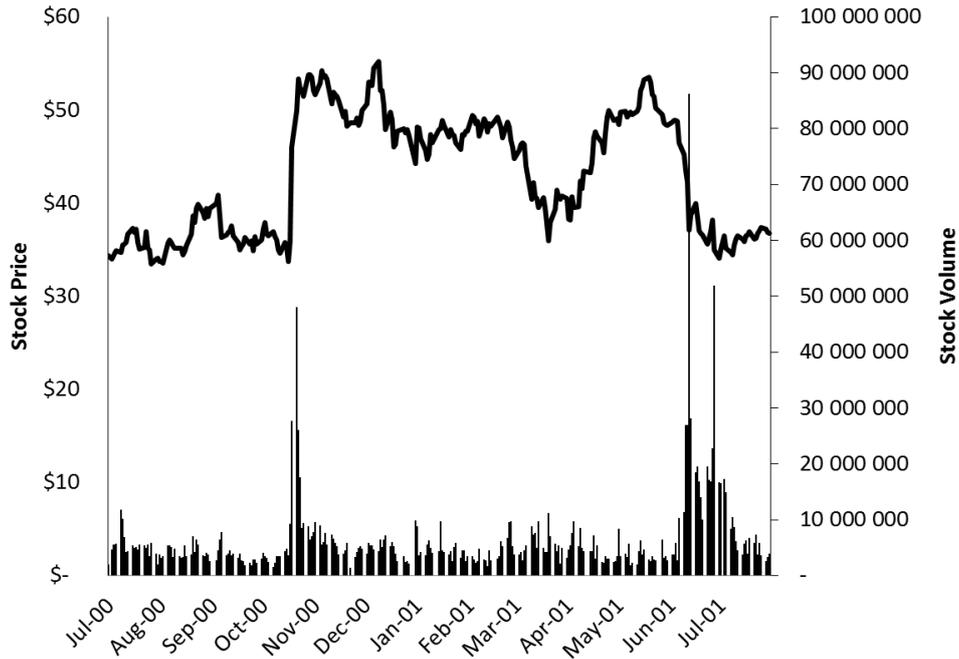
*Material Adverse Change (MAC):* There is a contingency found in most M&A contracts stipulating the terms in which the acquirer may legally terminate the deal in the event of certain occurrences in the deal process. The clauses usually regard the surfacing of aspects of the target company during the due diligence that drastically changes the valuation of the company. The rationale for these kinds of contracts is the protection of the acquiring firm from shady business practices. In general, judicial expertise is a necessity for arbitrageurs to understand the highly sophisticated deal terms of tender offers.

### 1.2.1 Case study: The failed merger between GE and Honeywell

What could have been the largest merger in history was announced on October 23, 2001. Two giants of American industry were however stopped by European bureaucrats headed by the future prime minister of Italy. Both GE and Honeywell were giant conglomerates with diversified divisions spanning everything from consumer products to aerospace systems. It was a deal valued at \$42 billion when GE announced their bid for Honeywell, an exchange of 1.055 of GE shares would be given for each Honeywell share. This was equivalent of a share price at \$55 per share for the Honeywell shareholders. At a time when Honeywell stock was trading at \$35 per share it seemed to be a great offer, a premium of 44%.

Honeywell seemed very pleased with the deal; this was not a hostile takeover. The legendary CEO of GE, Jack Welch, had even decided to postpone his retirement for 14 months to make sure that this important deal went through. After six months of review at the U.S. Department of Justice the deal was given a heads up with Honeywell share price once again going up after a lot of doubt towards the deal. The joy was unfortunately short lived, because on July 3, 2001 the European Council headed by Mario Monti vetoed the deal. The EU council decided that a merger between the two would have been damaging to competition and therefore decided to reject the merger.

The reason for this deal failure was then a regulatory obstacle, and it killed what could have been the largest merger in the history of industry. The



**Figure 5:** Honeywell Stock Price & Trading Volume

Honeywell stock price “jumps” in October 2000, but during the course of the takeover the stock price follows the news surrounding the deal until it fails after EU votes no in July 2001

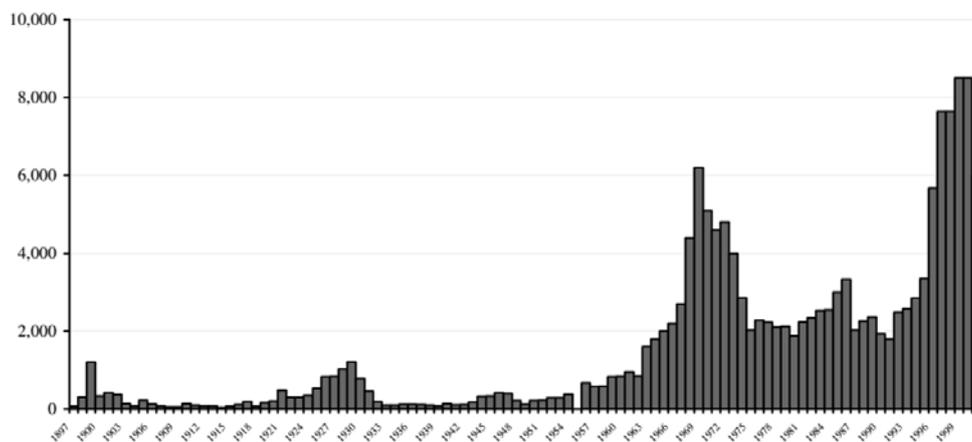
arbitrageurs who bought Honeywell stock after announcement at \$53 per share and sold after deal failure at \$35 per share could possibly lose 34% of their investment. A huge loss for any investor. This is not an unrealistic scenario, the trading volumes were in the tens of millions shares traded on the most busy days during the deal.

### 1.3 The market for Mergers and Acquisitions

To better understand merger arbitrage it is necessary to understand how the overall market conditions affect portfolio returns. There is academic work that shows a connection between merger activity and merger arbitrage return. Baker and Savasoglu (2002) finds a clear connection between arbitrage capital and merger arbitrage return, and if there are more mergers there will be more merger arbitrage capital available. Mitchell and Pulvino (2001) finds that there is a big difference between merger arbitrage returns with respect to economic cycles. Merger arbitrage return is correlated with market returns in depreciating markets, but in flat and appreciating markets there is no correlation. Further, Edmans et al. (2012) confirms the link between the financial markets and takeover activity by documenting that the direction of mutual fund cash flows are correlated with the takeover market. I.e. they show that during stressed markets when mutual funds have large net outflows of capital there is a decreased amount of takeover attempts in the market for M&A.

There have been large variations in M&A activity over the years, an effect that has led researchers to coin the expression “Merger Waves”. Figure

6 show the number of M&A transactions in the U.S market from 1897 until 2000, and it is evident that activity varies across the years. Six periods of these high activity merger waves have taken place in the history of the United States. Every wave has been defined by its period own set of economic, regulatory and technological conditions.



**Figure 6:** U.S. Merger Wave History 1897 - 2000 *Martynova and Renneboog (2008)*

Gaughan (2010) describe the main features of the first five “waves”. The first wave of 1897 to 1904 was a concentration of industrial companies with horizontal integration being the defining feature. However; U.S. regulatory antitrust laws were put in place to limit the monopolization of industries and the wave ended. The second wave of 1916 to 1929 came as a result of high economic activity during a period which also has been known as “the roaring twenties”. The second wave of mergers was distinctly more focused on vertical integration, and saw the creation of conglomerates and cartels where all the value creation was collected under the same company. This period of merger activity fell victim to the great depression that halted economies across the world after the stock market crash of 1929. The third wave of 1965 to 1969 took the market for M&A to new heights with hitherto unseen scale and transaction sizes. Diversification was a key argument for doing a merger in this period, there was a lot of businesses that expanded into other industries with their merger activity. The fourth wave of 1984 to 1989 was fuelled by the financial innovations of the time. It was the era of leveraged buyouts and hostile takeovers. The fourth wave of mergers was special because of the size and prominence of its targets. A big increase in +\$100 million mergers made the M&A markets a very important one for the financial world. It was also a time defined by deregulation and eased interference by regulators. As in earlier merger waves the era ended with the economy going into a recession during the early 1990s. The fifth wave of 1992 to 2000 was inspired by globalization, technological development (the personal computer, telecommunication and the internet) and banking deregulation. Mega-mergers like the AOL Time Warner multi-billion dollar deal were plentiful. It was a grand decade for the U.S. in

general with the fall of the USSR and their rise to prominence as the only true global superpower. But in 2000 to 2001 there was a collapse in the technology industry that led to the inevitable end of this wave.

The sixth wave of 2003 to 2007 is the final wave of its kind in the history of the capital markets of the United States of America. Alexandridis et al. (2011) point to the main drivers of this wave being the “availability of abundant liquidity”. The source of this liquidity being historically low interest rates and strong acquirer cash balances. Deregulation led to sophisticated financing from derivatives and corporate bond markets, in turn you got large cash flows and “abundant liquidity”. The era ended in the worst economic recession since The Great Depression of the 1930s and the effects are still being felt across the world.

The common feature of all these merger waves are that they have coincided with “boom-periods” for the economy as a whole, and that they almost invariably end as the markets fall into a recession. Harford (2004) documents that economic, regulatory and technological shocks drives the merger waves. But that in order for the appreciating economy to drive a merger wave it is necessary with sufficient capital liquidity. The relevance of merger waves to our subject of merger arbitrage is that merger activity leads to more arbitrage capital, and arbitrage capital has been shown to affect merger arbitrage returns (Baker and Savasoglu (2002)). It is therefore important to know which periods had higher activity when reviewing the empirical studies about merger arbitrage.

#### 1.4 Efficient market hypothesis (EMH)

In the context of this paper it is of paramount importance to understand the principles of efficient markets and how they can be violated. Arbitrage is by nature the anti-thesis of efficiency and one cannot know the one without the other. The theory of efficient markets is one of the most established and respected theories in academic circles, especially within economics and finance, across the world. It became an essential building block for the emerging field of finance when it was introduced during the early 1970s, and it has been the object of huge amount of work and analysis during the following 50 years. In its most extreme form the efficient market hypothesis can be defined as

*“A market in which prices always fully reflect all available information is called efficient” - Fama (1970)*

In sufficiently competitive markets, an investor cannot expect to achieve superior profits from their investment strategies. The concept of merger arbitrage in which this paper is concerned is exactly that; an investment strategy to achieve superior profits over the market. If the efficient market hypothesis holds true in its stronger forms, true arbitrage without taking on extra risks

cannot exist. If there exists a strong form efficiency in the capital markets, returns from stocks would be impossible to predict. This form of efficiency is connected with the notion of stock prices displaying a “random walk”, making any sort of forecasting a fools errand. Fama (1965) argues in an empirical review that the evidence shows great support for a model of random walk.

However; during the course of the last half century's work on this topic no conclusive empirical findings have neither confirmed nor dismissed the notion of random walk completely. In a review of the efficient market hypothesis Dimson and Mussavian (2000) sees a market that generally moves in a random walk but with certain exceptions, noting that the

*“The efficient market hypothesis is simple in principle, but remains elusive”*

In the case that there exist exceptions from the model of random walk, any investor would be extremely interested in exploiting these. Some examples of commonly known exceptions to the efficient market hypothesis and random walk are:

*Momentum:* The performance of a stock in the past is a precursor to its performance in the future. That is; if a stock has given positive returns in the past, it is more likely than other stocks to give positive returns in the future and vice versa. Jegadeesh and Titman (1993) found that buying well-performing stocks and selling bad-performing generated significant excess returns over both 3-month and 12-month periods.

*Reversal:* A theory based in behavioural finance where stock prices seem to overreact to relevant news, so that the overreaction will reverse itself over time. The empirical study by DeBondt and Thaler (1985) is the magnum opus on this strategy, but there is a large body of more recent studies that further confirm the same findings.

*Post-earnings announcement drift:* Bernard and Thomas (1990) showed that investors tend to under-react to earnings announcements. When a company announces unexpected earnings (positive or negative) the share price does not immediately capture the news. Instead there is a period of “drifting” towards a more final equilibrium price. This is a phenomenon in the same sphere as reversal, but it's a matter of under-reaction instead of over-reaction.

*Fama-French factors:* Fama and French (1993) found that certain stocks continually outperformed the market; these were often smaller stocks and stocks with high book-to-market ratios. These violations are especially important for this paper because they have been formalized by Fama and French into a model of capital assets, rivaling the CAPM. In this paper we measure our merger arbitrage portfolios against both CAPM and Fama-French models.

It is doubtful whether merger arbitrage can be classified as a proven exception of EMH like these because merger arbitrage is far from riskless, as

evidenced by the previously referenced list of risk factors. Therefore it will never fall into the definition of pure arbitrage, but for a long time it seems as though arbitrageurs were able to harvest fairly large excess returns. To state with certainty that merger arbitrage is an exception from the EMH would be perilous and reckless, even though one might find large excess returns. Nevertheless, the evidence on excess returns is important to gain a better understanding of this phenomenon.

## Part III

# Merger arbitrage profitability

There exists a large amount of academic work on the excess return generated by merger arbitrage. Earlier academic studies provide good insights into the nature of merger arbitrage and methodical choices done by the leading experts in the field. Published articles in the field of merger arbitrage have provided the main inspiration for this paper. This part is an overview of the main academic findings on merger arbitrage.

## 2 Studies on Merger Arbitrage

Empirical studies have shown for many years that stock prices of target companies rise substantially after the announcement of a takeover bid. Dodd and Ruback (1977) found excess returns to target shareholders of about 1% for each transaction. Similarly, when Jensen and Ruback (1983) summarized the literature on corporate takeovers they found that both target and acquirer shareholders gained from a takeover. Surely there has been knowledge of the premium rewarded to target shareholders during takeovers in academia for a long time. However, this paper has focused on the studies where merger arbitrage is seen as an investment strategy used by arbitrageurs. And since merger arbitrage was a field unknown to most except the secretive practitioners of arbitrage trading until the late 1970s (Wyser-Pratte (2009)) the studies most relevant to our paper is from the 1980s and onward.

This section provides a comprehensive look at the studies that are necessary to understand in order to follow the methodology of this paper. It is a presentation the two studies by Mitchell and Pulvino (2001) and Baker and Savasoglu (2002) on excess return from merger arbitrage, studies where a deeper understanding is important as context and background for this paper. Thereby, the section ends with a summary of selected studies on the subject of excess return, in fact most of the academic work available. Such a summary is useful to gauge the general level of excess return that previous academic research has found.

### 2.1 Characteristics of Risk and Return in Risk Arbitrage – Mitchell and Pulvino (2001)

Mitchell and Pulvino (2001) is a very comprehensive study of the returns generated from merger arbitrage. In a departure from the earlier studies focus on average transaction return, the study takes the point of view of an arbitrageur that continuously invests in all takeovers that is announced. The study calculates the monthly returns from following this “passive” portfolio

strategy, continuously updating and rebalancing the portfolio as mergers are taking place. By using a very large data sample of 4570 U.S. mergers from the period 1963 to 1998 merger arbitrage returns is analysed over several merger waves and economic cycles. It is the largest data sample of all the academic body of work on merger arbitrage and therefore it carries a lot of weight. The researchers construct two portfolios to find the excess return over the sample period; one normal value weighted portfolio and one portfolio that also accounts for transaction costs. The hypothesis is that a lot of the reported excess return from merger arbitrage is in practice difficult to realize due to practical limitations such as transaction costs. And after benchmarking against CAPM and Fama-French factor models the result is that:

*“Transaction costs have a substantial effect on risk arbitrage returns”*

The normal merger arbitrage portfolio generated annualized excess returns against CAPM of 7.4% over the sample period, while the portfolio accounting for transaction costs was reduced to annual excess returns of only 2.9%.

Another main finding is how merger arbitrage returns correlate with the overall market conditions. Mitchell and Pulvino (2001) looks at the beta during the different states of *the market conditions* and they find that even though there is no correlation during flat and appreciating markets, there is a substantial correlation during falling markets. This is a notion mirrored by Bhagat et al. (1987) who found that the market beta for stocks changes during the different states of *a takeover*. Previous studies have thought merger arbitrage returns to be uncorrelated with the market, but Mitchell and Pulvino (2001) discover that to be wrong. In fact, the market beta of the merger arbitrage portfolio increases from practically zero to 0.5 in months when markets fall more than 4%. Consequently; even though merger arbitrage on average generate good returns there is a risk of large losses during falling markets. These results are robust and significant over a large period spanning several economic cycles. Mitchell and Pulvino (2001) uses the discovery of changing market betas to support the claim that CAPM and linear pricing models is lacking when evaluating the risk-reward characteristics associated with merger arbitrage. A claim also as put forth by Bhagat et al. (1987). And that option-pricing theory is a better tool to compute the abnormal returns associated with merger arbitrage.

## **2.2 Limited Arbitrage in mergers and acquisitions – Baker and Savasoglu (2002)**

The paper by Baker & Savasoglu from 2002 traces the abnormal profits generated to a model of limited merger arbitrage. In a process very similar to that of Mitchell and Pulvino (2001) the study construct merger arbitrage portfolios

that include all the pure cash and pure stock transactions that took place in the U.S. between 1981 and 1996. It does however extend the portfolio construction by having two sets of weighting techniques. The two techniques for weighing stocks are; *equal weighted* where each stock in the portfolio have the same weight, and *value weighted* where the weight of each stock in the portfolio is determined by its market capitalization.

Baker and Savasoglu (2002) finds even higher abnormal returns for their sample; with monthly excess returns reported between 0.6% and 0.8% each month depending on the weighting and what benchmark model is used. That is in the range of 7% - 10% excess return each year, on average. Of the two weighting methods it is found that equal weighted portfolios perform better with a higher Sharpe ratio (risk-reward ratio). The results when it comes to transaction costs is however contrary to that of Mitchell and Pulvino (2001). Baker & Savasoglu find that when using the same methodology to account for transaction cost the reduction in excess return is marginal and below 0.1% monthly. The authors offer no further explanation or discussion on this topic other than the fact that the studies use different time periods.

What sets this particular paper apart is the extensive research done in explaining why returns are not arbitrated away, as opposed to many other papers that simply identifies the excess return. In a regression analysis they find a correlation between deal completion risk, target size, the amount of arbitrage capital available and merger arbitrage returns.

*“We find evidence that supports a model where undiversified investors sell to avoid completion risk. Arbitrageurs, limited in capital and number, require a premium for bearing this risk.”*

The supply and demand of arbitrage capital is then a strong determinant of merger arbitrage returns; with less arbitrage capital available to the market they find significantly higher merger arbitrage returns and vice versa. Arbitrageurs is rewarded with risk premiums because of the liquidity they provide in the form of merger arbitrage capital.

### **2.3 A note on cross-sectional and time-series analysis**

One aspect of these studies is very important to recognize; the use of time-series analysis. Earlier cross-sectional studies measure the return from single merger events, *event-time*, and average this across deals. Cross-sectional analysis is used to explore deal-specific variables such as deal size, deal type and so on to explain variation in the arbitrage spread. This provides very good returns for a merger arbitrage strategy; however, it is unrealistic to assume that one can earn these returns continuously. The studies use the average number of transaction days and average number of transactions throughout a year to annualize their event-time returns. Using such a method gives high

excess returns ranging from 25% to 100% annually, but it might be unrealistic. Mitchell and Pulvino (2001) states:

*“The problem with this approach is that it assumes that the risk arbitrage portfolio can earn event-time returns continuously. Particularly for transactions that are consummated quickly, this assumption can lead to large annualized returns”*

The alternate time-series method of calculating merger arbitrage returns is used by both Mitchell and Pulvino (2001) and Baker and Savasoglu (2002), it involves the construction of merger arbitrage portfolios and analyzing returns across time, *Calendar time*. It allows a more thorough investigation into abnormal returns and risk factors, and it provides a far more realistic estimate of the excess returns achievable from merger arbitrage.

## **2.4 Summary of empirical evidence on merger arbitrage excess return**

Table 1 gives a summary of all the studies this paper have found on abnormal returns from merger arbitrage. All these studies find that merger arbitrage gives abnormal returns for its investors. It is reasonable to claim that merger arbitrage have provided investors with strong returns. Some of the studies investigate a very beneficial time-period that might explain the change of abnormal returns across studies. Larcker and Lys (1987) and Branch and Wang (2008) both use periods of merger waves, and that can be a bias. This paper has put a lot of weight on Mitchell and Pulvino (2001) partly because of the large sample period. Even in that study the excess returns are substantial. In the research conducted for this paper there has not been a single instance of an academic and peer-reviewed source that finds anything other than positive excess returns from merger arbitrage. The evidence on excess return from merger arbitrage is then supported by a fairly strong set of academic work. For a further summary of the academic evidence on excess return in particular and corporate takeovers in general Betton, Eckbo, and Thorburn (2008) is a great source for empirical studies.

**Table 1: Litterature Overview**  
 The table shows a summary of selected studies on the subject of merger arbitrage excess return. \*Estimation

<b>Authors</b>	<b>Country</b>	<b>Sample Period</b>	<b>Sample Size</b>	<b>Excess returns</b>	<b>Description</b>
Larcker & Lys (1987)	USA	1977 - 1983	131 stock and cash offers	5% over holding period	A paper investigating the incentives for arbitrageurs to collect costly information. The result shows that arbitrageurs are involved in more successful deals and that they generate excess risk-adjusted returns of 5%.
Bhagat, Brickley & Loewenstein (1987)	USA	1962 - 1980	295 cash offers	11% over holding period	Option pricing theory used to measure excess returns. Market correlation changes over the course of deals, a fact that makes the use of CAPM to gauge abnormal returns less optimal because it assumes linearity.
Karolyi & Shannon (1998)	Canada	1997	37 stock and cash offers	33.9% per year	Study that looks at transactions with large market capitalizations in Canada over the course of one year. Returns average 33.9% above the TSE index on an annual basis
Mitchell & Pulvino (2001)	USA	1963 -1998	4 750 stock and cash offers	3% - 7% per year	This paper investigates merger arbitrage returns and market conditions. The study traces a large portion of abnormal returns to transaction costs incurred by the arbitrageurs. The study also finds that returns display higher market betas during recessions, that supports the use of option pricing theory as a measure of abnormal returns.
Baker & Savasoglu (2002)	USA	1981 - 1996	1 901 stock and cash offers	7% - 11% per year*	A time-series analysis constructing diversified merger arbitrage portfolios. Shows monthly risk-adjusted excess returns of 0.6% - 0.9% per month. The excess returns are traced back to the limited supply of arbitrage capital available.
Branch & Wang (2004)	USA	1994 - 2003	187 stock offers	6% - 22% per year*	Study that analyses returns from stock offers with collars, the results is highly positive abnormal returns. The study also finds that the use of collar transactions has increased over time.

### 3 The sources of excess return

As the academic evidence shows, there is a quite clear consensus as to the excess return harvested by merger arbitrageurs. In varying degrees of magnitude, all the academic studies point to the generation of abnormal returns. However, although the descriptive side of simply *confirming* excess return is interesting on its own merit, discovering the *reasons* why the abnormal returns are not arbitrated away is of even larger importance. Excess return from merger arbitrage is generally believed to come from two separate sources; *transaction costs* and from *the role arbitrageurs* take in relieving shareholders of unwanted risks.

#### 3.1 Transaction costs

Mitchell and Pulvino (2001) argues that transaction costs severely limits the profit from merger arbitrage. Transaction costs is a general term to describe the monetary fees involved in the process of performing merger arbitrage; such as brokerage fees, holding costs, short selling costs and constraints, and the cost of the capital required to take positions. The other part of transaction costs is the limitations faced by arbitrageurs when taking positions in illiquid stocks and the market impact of large trades.

These “nuts-and-bolts” practical limitations make up a large part of the excess return generated by merger arbitrage according to Mitchell and Pulvino (2001). When they construct their portfolios, as previously stated, they find large differences in excess return when accounting for transaction costs. Over their sample period they find transaction costs to reduce abnormal returns by 3.54% annually. Earlier studies on arbitrage also put a substantial weight on the effect of transaction costs, such as the model developed by Garman and Ohlson (1981) where the notion of “perfect, free and frictionless trading” is abolished. However, the effect and magnitude of transaction costs is a debated topic. Baker and Savasoglu (2002) does not find nearly the same effect of transaction costs, even after applying the same methodology as Mitchell and Pulvino (2001). Most studies seem to suggest that a much more important source of excess return stems from the part played by arbitrageurs in taking on unwanted idiosyncratic risks.

#### 3.2 The role of the arbitrageur

Even after considering the transactions costs involved (Mitchell and Pulvino (2001)) merger arbitrageurs are able to beat the market and the risk adjusted benchmark models with substantial margins. These superior results from merger arbitrage as an investment strategy is either a violation of the efficient market hypothesis, that was reviewed earlier, or there is some other aspect of this trade giving arbitrageurs abnormal profits.

Baker and Savasoglu (2002) found an aspect of merger arbitrage returns related to the supply and demand of arbitrage capital to be important for excess returns. It is then very appropriate to investigate the role of the arbitrageur a bit further, because the practical role of the merger arbitrageurs in takeover processes might explain the excess return.

Larcker and Lys (1987) studied the incentives provided to merger arbitrageurs during the takeover process. They build upon the work of Grossman and Stiglitz (1980) where the assumption that security prices are sufficiently noisy for traders to engage in costly information acquisition is explored. The study is in part an analysis of the probability for merger success when arbitrageurs are involved and an analysis of the profitability of arbitrageur investments. The result from this research is a confirmation on both accounts. The arbitrageur investment had an actual success rate of about 97 %, while the average probability of success for a takeover was about 81 %. This leads Larcker and Lys (1987) to state that “*arbitrageurs are able to acquire superior information regarding the ultimate success or failure of an acquisition proposal*”. They also find that merger arbitrageurs achieve excess returns on their investment equity positions during takeovers. Combined; these results imply that prices are sufficiently noisy to create incentives for the arbitrageurs to gather costly information about takeovers (Industry reports, networking and analysis). The much cited paper of Larcker & Lys shows that merger arbitrageurs are able to, and incentivized to, gather private information that gives them an advantage during takeover events. It does suggest, however, a quite passive role for merger arbitrageurs; a role where a circle of industry professionals have superior knowledge about transactions and gain a profit from this *informational advantage*.

Cornelli and Li (2001) argue that there might be a different explanation as to why merger arbitrageurs are so successful. Merger arbitrageurs might not have a clear informational advantage about transactions before the fact, but that they rather increase the probability of takeover success by getting involved. They postulate the theory that “*the presence of arbitrageurs affects the value of the target shares, since arbitrageurs are more likely to tender*”. When an arbitrageur takes a position in a target company it is with a clear intent to sell, tender, his shares at consummation of the deal. The arbitrageur might try to hold on to the stock in an effort to raise the bid and generate a larger profit, but in the end there is a definite intent to sell. The market knows this and the arbitrageur knows that the market knows this. The information advantage for the arbitrageur is the knowledge that he has bought shares, an advantage of private information. Cornelli and Li (2001) shows, with a series of theoretical proofs, that the arbitrageur is able to generate profits as long as his presence in the market is not completely revealed. If large scale arbitrage activity is revealed, thereby increasing probability of deal success,

the market will react and buy stock in the target company. This will in turn raise the price and reduce the arbitrage spread. The paper shows that there is a positive relationship between trading volume and a probability of success for a takeover. Also, if the stock is more liquid it is easier for arbitrageurs to hide their trading; this increases returns for the arbitrageurs if they decide to invest.

For the sake of the main issue in this part, the role of the arbitrageur, the most central proposition of this paper is that merger arbitrageurs help to facilitate successful takeovers. That the arbitrageurs are far from free-riders looking for an easy profit, instead they often take the role of large shareholders that champion takeovers through and in turn increase the company value.

In an effort to merge the opposing view on arbitrageurs as either passive (Larcker & Lys) or active (Cornelli & Li) players in the market for takeovers, Hsieh and Walkling (2004) did an empirical study that supports both arguments. By using a sample of 608 offers over the 1992 to 1999 period they found that arbitrage holdings are more prevalent in successful deals than unsuccessful ones. This is the same result as Larcker and Lys (1987) and supports the view of passive arbitrageurs. However, they also found that the actual change in arbitrage holdings were correlated with bid premium, bid success and arbitrage returns. This is mirroring the predictions made in the model by Cornelli and Li (2001). In other words, Hsieh and Walkling (2004) found that arbitrageurs seem to pick the deals that eventually turns out to be successful thus implying a superior knowledge and insight into the market for M&A consistent with the passive role. And they also found that arbitrageurs seem to affect important deal outcomes like bid revisions, bid premium and arbitrage returns. This is more consistent with the active role where the arbitrageur influencing the terms and the outcomes of the offer with his presence. Then the opposing views on the role of arbitrageurs is not necessarily mutually exclusive, rather it is a possibility that arbitrageurs play different roles at different times. The conclusion of the paper is however quite difficult to ignore:

*“Overall, we find that merger arbitrageurs play an important role in the market for corporate control.”*

Further supporting the argument that arbitrageurs take on the risks not wanted by other investors, Pontiff (2006) conclude that the *“single largest impediment to market efficiency”* is the idiosyncratic risk that arbitrageurs take off the shoulders of average investors.

In the context of this paper these results are important in understanding the excess returns generated from merger arbitrage. Arbitrageurs provide large amounts of liquidity, they can provide an exit strategy for risk-averse shareholders, they are specialists in their own field, and they can actually influence the outcome and terms of takeover transactions. This makes it doubtful as to

whether the excess return generated from merger arbitrage in reality can be seen as a violation of the efficient market hypothesis. Rather it seems as a fair premium rewarded to the arbitrageurs for their part in transactions.

## 4 The declining trend in arbitrage spreads

Even though it is safe to say that merger arbitrage has empirically generated excess return in the past, there is another topic in this sphere of academia that seems hard to refute. The fact that the excess returns generated by hedge funds, who uses merger arbitrage extensively in their portfolio strategies, seems to be declining over time. The topic of hedge fund research is a slight departure from the core of this paper, but it still has enough relevance to grant a bit of further investigation.

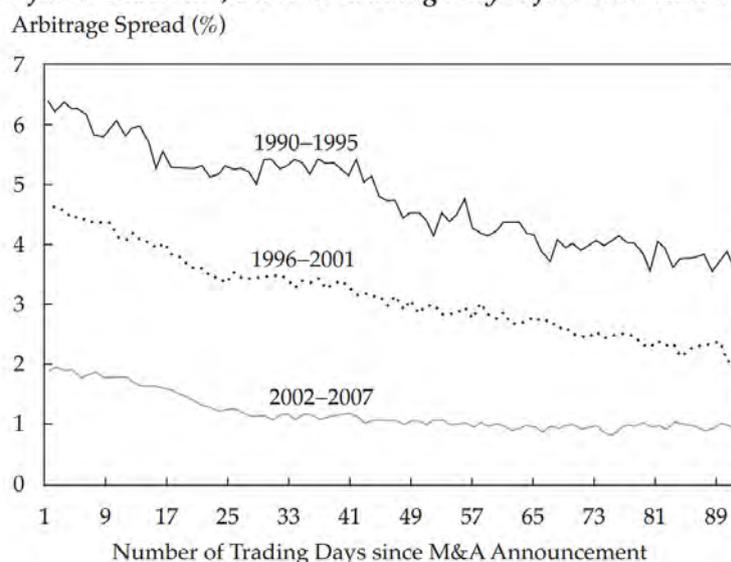
Many hedge funds use merger arbitrage as a strategy for creating risk neutral portfolios and there is a fairly large group of hedge funds that specialize exclusively in this form of trading as well. Ackermann et al. (1999) compares the performance of several known hedge fund strategies and find that “Event-driven risk arbitrage” generates substantial returns and display very beneficial risk characteristics. The paper concludes by establishing merger arbitrage as a superior strategy for most hedge funds. In a similar investigation of hedge fund strategies, Agarwal and Naik (2000) show that event-driven arbitrage funds harvest monthly alpha of about 1 percent. These and other studies then confirm the dependency of hedge fund returns, from merger arbitrage, and general merger arbitrage returns.

The interesting aspect of hedge fund returns from merger arbitrage, in the context of this paper, is that they seem to be declining. Fung et al. (2007) notes in a study of hedge fund performance that returns have declined over the period of 1998 to 2004. The sample results show this to be true for hedge funds in general but also find a specific decline in alphas for event-driven merger arbitrage funds. The explanation for this, the authors argue, is that increased capital into the hedge fund industry adversely affects the funds ability to generate excess return. Zhong (2008) has also found declining alphas for hedge funds specializing in merger arbitrage.

In a comprehensive and fairly recent study, Jetley and Ji (2010) investigates this phenomenon of merger arbitrage spreads over the course of the period 1990 to 2007. They document a *“substantial decline in the arbitrage spread since the 1990s”*. The study show, with statistical significance, that the first-day arbitrage spread on average is 4.8% lower for transactions in the period from 2002 to 2007 than for transactions in the preceding decade of the 1990s.

The large decline in arbitrage spreads for successful transactions over different periods is striking, see figure 7. The explanation for this phenomenon is probably multi-faceted. Increasing interest in the strategy of merger arbitrage may force spreads down due to efficiency. Increasing number of hedge funds and hedge fund capital may as well have similar effects. Jetley and Ji (2010) also adds the changing characteristics of deals as a contributing factor, such as higher number of cash deals and fewer hostile bids.

## A. Successful M&amp;A Deals, First 90 Trading Days after M&amp;A Announcement



**Figure 7:** The Declining Arbitrage Spread from the 1990s to the 2000s, *Jetley and Ji (2010)*

In summary of this part, according to academic literature, excess return is generated from merger arbitrage. This excess return originates from several sources; it is a premium for the risks involved with deal failure, it has to do with the limited supply of arbitrage capital, it includes an element of transaction costs, and finally the role of the arbitrageurs is also a factor. This knowledge is based on studies done on mergers and acquisitions done in the 1980s and 1990s. More recent studies focused on hedge fund performance show that margins are falling, this tendency could perhaps apply to general merger arbitrage as well. This paper then set forth to see if anything has changed during the last ten years, and it will analyse merger arbitrage from 2000 to 2012. The structure in the process of analysing merger arbitrage in the U.S. over this period is as follows: Part IV covers the gathering and structuring of data, and the construction of merger arbitrage portfolios for time-series analysis. Part V is the analysis and benchmarking of the merger arbitrage portfolio returns. Part VI provides the final conclusion, and practical implications of merger arbitrage.

# Part IV

## Data and Method

This paper uses data provided by Thomson Reuters Security Data Corporation (SDC) Mergers and Acquisitions database.<sup>4</sup> The data cover all M&A transactions in the U.S. during the period between 2000 and 2012. The attention is restricted to transactions between U.S. public companies. As the U.S. stock market is considered among the most efficient<sup>5</sup>, and provides sufficient data for the analysis. A *public company* is in this paper defined as a publicly held company of which securities are listed on the stock exchange. This section will in the following parts cover the data description, data selection and the data sample.

### 5 Data Description

In practice, arbitrageurs typically invest in a broad range of M&A transactions including different methods of consideration offers. However, not all of these transactions are handy to analyse because of the enormity of the data. This paper will use a data sample consisting of pure cash and pure stock deals. Mixed offers and offers including other financial instruments are not included in the data sample.<sup>6</sup>

Cash deals include all deals where the acquirer bids for a fixed amount of dollar in payment. Note that these deals do not necessarily mean that the payment must be in cash. As long as the consideration is in fixed dollar terms the deal is classified as cash deal. Stock deals include all deals where both parties of an M&A deal consider stock-swaps to a predetermined ratio for stock exchange. Including both types of deals provides a sound basis for the data analysis, and it captures some of the features of possible investment strategies that are used by the arbitrageurs.

#### 5.1 Data selection

In total, SDC provides 3 671 cash and stock deal transactions for this period. The SDC database provides a customized report with summaries of all deals, specifying announcement date, and effective or withdrawal date to each deal. It also contains information on exchange ratio, firm identifications, and market capital to both target and acquirer firm. The information of the companies from SDC is matched up with The Center for Research in Security

<sup>4</sup>SDC is the foremost financial database which practitioners and researchers often use and rely on.

<sup>5</sup>Low transaction costs and low costs related to obtaining information and trading contribute to liquidity and efficiency in the U.S. stock market.

<sup>6</sup>The complexity in those deals makes it difficult to generalize into certain categories, which is problematic for the evaluation of such large data samples.

Prices (CRSP) database to retrieve stock price data.<sup>7</sup> The match up of both databases lead to exclusion of 1 666 transactions. The elimination of deals is caused by insufficient information; company identifications do not match with the CRSP database, missing stock price information of either the acquirer or the target or both, missing completion date, or missing exchange ratios.<sup>8</sup> The remaining 2 005 transactions make up the sample used in the main analysis of this paper.

## 5.2 Sample

**Table 2:** Data population and sample statistics

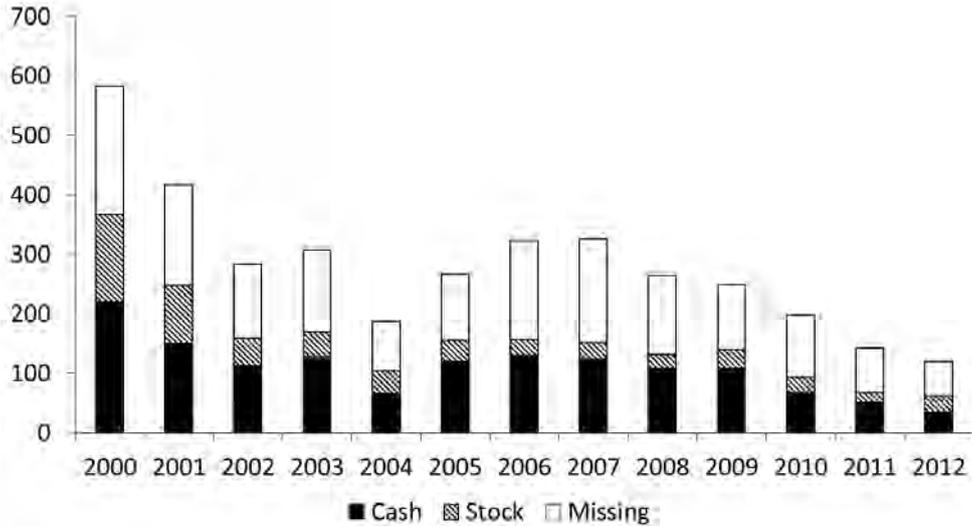
Year	Complete SDC data (Population)					Sample					Sample / population %
	All	Cash	Stock	Cash %	Stock %	All	Cash	Stock	Cash %	Stock %	
2000	584	318	266	54 %	46 %	368	221	147	60 %	40 %	63 %
2001	418	240	178	57 %	43 %	248	151	97	61 %	39 %	59 %
2002	284	203	81	71 %	29 %	159	113	46	71 %	29 %	56 %
2003	307	227	80	74 %	26 %	170	128	42	75 %	25 %	55 %
2004	187	116	71	62 %	38 %	104	66	38	63 %	37 %	56 %
2005	267	129	138	48 %	52 %	155	120	35	77 %	23 %	58 %
2006	324	218	106	67 %	33 %	156	130	26	83 %	17 %	48 %
2007	326	193	133	59 %	41 %	152	124	28	82 %	18 %	47 %
2008	265	177	88	67 %	33 %	131	108	23	82 %	18 %	49 %
2009	249	150	99	60 %	40 %	140	108	32	77 %	23 %	56 %
2010	198	127	71	64 %	36 %	93	67	26	72 %	28 %	47 %
2011	142	85	57	60 %	40 %	68	51	17	75 %	25 %	48 %
2012	120	67	53	56 %	44 %	61	34	27	56 %	44 %	51 %
<b>Total</b>	<b>3671</b>	<b>2250</b>	<b>1421</b>	<b>61 %</b>	<b>39 %</b>	<b>2005</b>	<b>1421</b>	<b>584</b>	<b>71 %</b>	<b>29 %</b>	<b>55 %</b>

Table 2 is split into two sections. The first section depicts data received from SDC, while the second section shows the sample data. Each section is broken into five columns of the following categories: all deals, cash deals, stock deals, and the proportions of each deal type. In total the sample accounts for 55% of all deals from SDC. Both data from SDC and the sample reveals clear preferences to cash payments in M&A deals during this period. Cash transactions dominate every year, except from 2005 when cash payments accounts for 48%. The table also shows that activity in mergers and acquisitions have decreased throughout the period, starting off with 584 mergers and acquisition transactions in 2000, and reduced to only 120 transactions in 2012.

The final sample of mergers and acquisitions in this paper is illustrated in Figure 8. It shows a histogram spanning all the years in the sample from 2000 to 2012. The histogram is broken into three parts; black represents number of cash transactions, stripes represents stock transactions, and white represents the missing transactions which do not satisfy the requirements in the match-up between SDC and CRSP database. The trend in mergers and acquisitions activity reveal similarities with the economic developments during

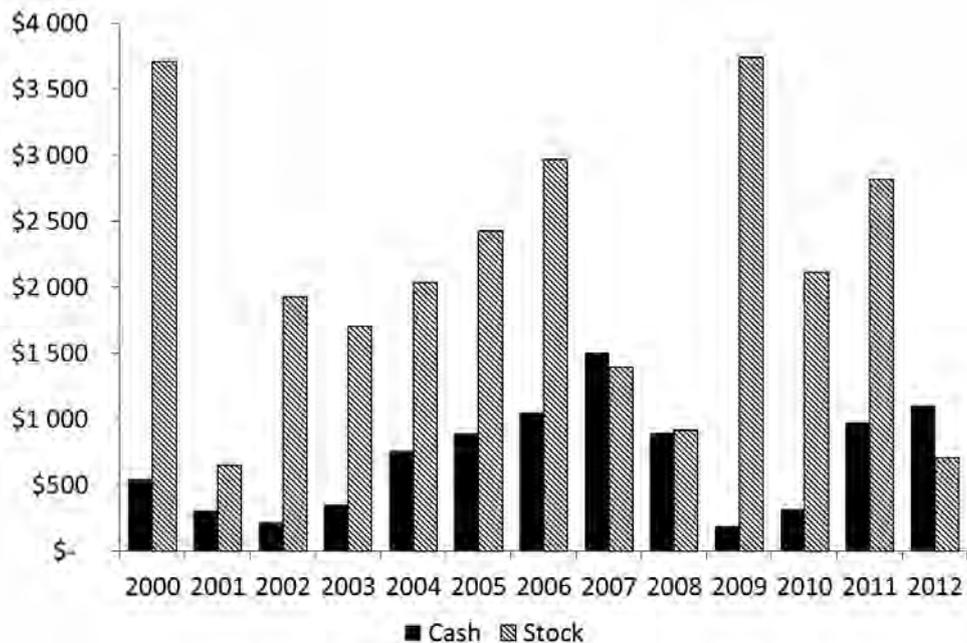
<sup>7</sup>CRSP maintains one of the largest and most comprehensive historical databases in stock market research. The database contains historical stock price data on all common stocks on NYSE, AMEX and NASDAQ.

<sup>8</sup>Additional research into SEC-files (Securities and Exchange Commission) and in historic announcement news was performed to add to the missing exchange ratios. But not all were found.



**Figure 8:** Mergers & Acquisitions Sample, 2000 - 2012

this period. As the discussion on merger waves showed that M&A activity historically correlate with economic cycles, so does the M&A activity for this sample. Good times in the economy drive up the activity in mergers and acquisitions. Slowdowns in the economy will lead to decrease the activity. The number of transactions peaked in both year of 2000 and 2007, followed by a significant decrease in the following years. 2000 was the year prior the burst in dot-com bubble in 2001. 2007 was the final year of the sixth merger wave with a boom in the economy still ongoing in the minds of most investors, just right before the financial crisis of 2008. The sample shows a clear overweight of cash transactions for all the years.



**Figure 9:** Average Market Capitalizations for M & A Transactions

An important distinction between stock and cash transactions is that

often stock deals is more comprehensive both in terms of size and duration. Figure 9 illustrates that stock deals on average are substantially larger than cash deals. The annual average market capitalization of target firms has been up to 10 times larger than the average market capitalization of cash deals. The comprehension of stock deals is also reflected by the average duration of the deals, illustrated in Figure 10. During the period between 2000 and 2012, the average duration of stock deals is 106 days, while cash deals has an average duration on 60 days. The duration of stock deals peaked in 2004 with an average on 138 days. Cash deals on the other hand had the lowest average duration in 2012 on 46 days.

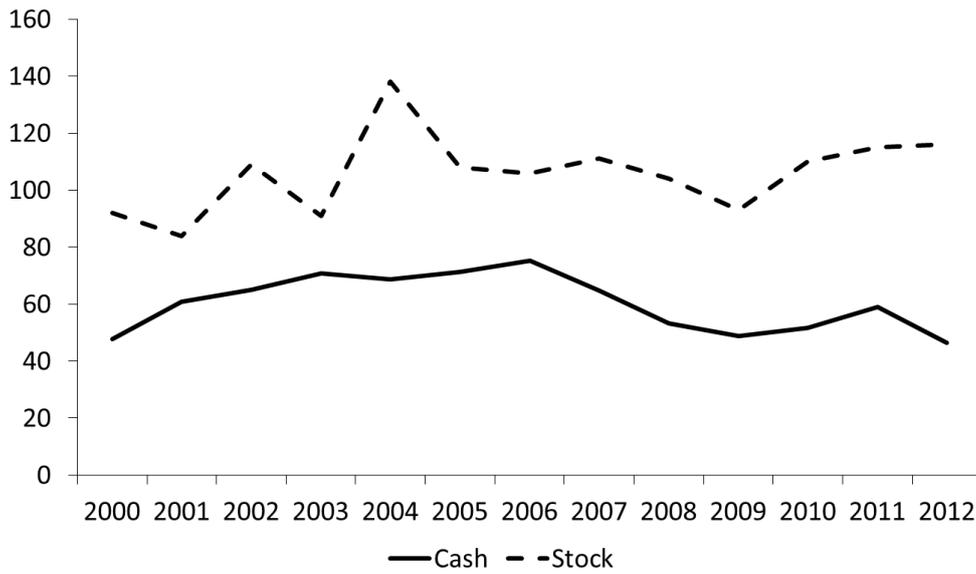


Figure 10: Average Transaction Duration

## 6 Modeling Merger Arbitrage Return

This paper measures merger arbitrage return by constructing time-series portfolios of M&A deals. All the deals in the sample is put in portfolios that rebalance monthly as new deals take place and old ones are completed across the time period. The purpose of this paper is to explore if merger arbitrage generally is a profitable passive investment strategy. A passive investment strategy entails that all merger and acquisition events are included; there is no selection or picking of events. This is also the reason for investigating the US stock market, because it provides a largest possible sample of the M&A universe in the analysis in order to derive significant conclusions. The method of constructing the merger arbitrage portfolios is based on the assumption that the arbitrageurs have access to unlimited capital.

The deals in the portfolios may vary in size, transaction duration, and level of risk. The study distinguishes between *cash* and *stock* portfolios. Both portfolios are also assigned two different weighing methods, *value weighted* and *equal weighted* portfolios. In total, four portfolios are created, which all will contribute to a robust analysis. Since each portfolio contains multiple deals with different durations, and start or end dates, the returns of all deals are assembled into monthly portfolio returns. Portfolio performances will then only be determined by the monthly returns. Since this is a time-series analysis, the risk related to the portfolios will be measured by the variations of monthly portfolio returns. To limit the scope of the analysis and for the sake of simplicity, transaction costs are not accounted for. Several previous studies find the impact of transactions costs on the abnormal returns to be negligible.<sup>9</sup> Keeping this in mind is however important as the effect of transaction costs may reduce the magnitude of modelled returns.

In the following sub-sections the paper presents the calculation of cash and stock deals returns, a calculation of monthly and annualised returns, and finally the construction of value weighted and equal weighted portfolios.

### 6.1 Calculating Cash and Stock Deal Returns

Returns to cash and stock portfolios are calculated differently due to the different characteristics related to the investment strategies. For cash deals the returns of each position is rather easy to construct; taking a long position in the target firm and hold the position until the terminating date. Holding this position gives two sources for the return. The primary source comes from the change in the stock price during the holding period. The second source comes from the dividend payment received for holding the target stock. The total

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<sup>9</sup>Baker and Savasoglu (2002) argues that the impact of transaction costs is rather small in the period from 1981 to 1996 even after applying the methodology of Mitchell and Pulvino (2001)

returns for the holding period can be calculated in the following equation:

$$R_{it} = \frac{P_{it}^T + D_{it}^T - P_{it-1}^T}{P_{it-1}^T}$$

$R_{it}$  is the daily return at the close of market day  $t$ , for holding stock  $i$ .  $P_{it}^T$  is the target stock price at the close of market day. In this equation  $T$  refers to target.  $D_{it}^T$  is the dividend paid from target on day  $t$  for holding the stock  $i$ . The subscript  $t - 1$  refers to the closing day prior to  $t$ .

Returns for stock deals are more complicated. In stock deals the target receives acquirer stock to a pre-specified ratio as payment. Hence, the returns for holding the target stock equals to the appreciation of target stock and the depreciation of acquirer stock. To measure the holding period return it is necessary to replicate this stock-swap transaction by taking two positions simultaneously after announcement: a long position in the target and a short position in the acquirer. The ratio between these two positions corresponds to the pre-specified exchange ratio given in the deal. Stock deals generate three sources for returns. The primary source of the return comes from the changes in stock prices of the target and the acquirer. Appreciation of target stock price and depreciation of acquirer stock price contribute to profit for the holding period. The secondary source for return comes from dividend payments. Dividends paid by target give positive return, while dividends paid by acquirer have a negative impact on the return. The third source for return comes from risk-free return received on the proceeds from the short sale of the acquirer stock. The return for stock deals is described in the following formula:

$$R_{it} = \frac{P_{it}^T + D_{it}^T - P_{it-1}^T - \Delta(P_{it}^A + D_{it}^A - P_{it-1}^A - r_f P_{it-1}^A)}{PositionValue_{t-1}}$$

In this equation  $R_{it}$  is the sum of both of returns from the long position in target and short position in acquirer.  $P_{it}^A$  is the acquirer stock price at the close of market day  $t$  for holding stock  $i$ .  $A$  refers to acquirer.  $D_{it}^A$  is the dividend paid from acquirer on day  $t$  for holding stock  $i$ .  $R_f$  is the daily risk-free return from the short sale proceed.  $\Delta$  is the hedge ratio, which equals to the exchange ratio between target and acquirer. Position value is the total value of both positions for same up-front investment in target and acquirer. It is worth noting that an investment in both firms is required because the proceeds of shorting the acquirer stock cannot be used to buy the target stock. Even if the formula above is theoretically correct, the arbitrageur will in practice often receive less than risk-free rate on short sale proceeds. In addition, the proceeds also face additional risk, e.g. the lender recalls the short position prior to the completion of the merger (Baker and Savasoglu (2002)), or the deal fails to complete on the expected date. These factors lead to an approximately zero

gain on the short sale proceeds when discounting for uncertainties and risks. In this paper it is assumed that the arbitrageur will have zero return on short sale proceeds. The total returns for stock deals can then be formulated in the following equation when short sale proceeds are removed:

$$R_{it} = \frac{P_{it}^T + D_{it}^T - P_{it-1}^T - \Delta(P_{it}^A + D_{it}^A - P_{it-1}^A)}{PositionValue_{t-1}}$$

## 6.2 Calculating Monthly Portfolio Returns

To compute the monthly portfolio returns, it is necessary to calculate the monthly returns of each deal type first. Monthly returns are based on the daily deal return computed in the previous section. These daily returns are compounded geometrically into monthly returns in the following manner:

$$R_M = \prod_{t=1}^T (1 + R_{it}) - 1$$

The equation shows that the monthly return,  $R_M$ , equals the sum-product of all daily returns,  $R_{it}$ . The subscripts  $i$  and  $t$  refer to transaction of stock  $i$  on day  $t$ .  $T$  refers to the number of trading days in a month. Trading days are defined as all working days, i.e. from Monday to Friday. Holidays are not included in trading days. The purpose of the portfolio is to gauge the returns derived from positions where the bid-price is not completely reflected in the share price, i.e. the arbitrage spread. The returns should, however, not be affected by the takeover premium. Takeover premium can only be gained if the arbitrageur invested prior to the announcement date. A merger arbitrage strategy, as a passive strategy, involves only mergers and acquisitions deals after public announcements. It should therefore not take part in the takeover premium. However, in some cases the dataset provided by CRSP did register substantial increase in stock returns the day following the announcement date. The large returns are most probably a result of deals being announced after the markets are closed and thereby giving the entire takeover premium as the portfolio return the next day. To avoid the returns of the merger arbitrage investments being inadvertently biased upward, all investments start two days after the announcement dates.<sup>10</sup> The positions in a given transaction are held until the termination date, when the transaction is completed, withdrawn or revised. Revised transactions will first be terminated as withdrawn, then count as a new transaction according to new bid price. One target can then generate multiple transactions. This is similar to the study of Mitchell and Pulvino (2001).

<sup>10</sup>Both the studies by Jensen and Ruback (1983) and Baker and Savasoglu (2002) use a two-day lag after the announcement date as the start date for the merger arbitrage investment.

### 6.3 Calculating Merger Arbitrage Portfolio Returns

A merger arbitrage portfolio contains positions in multiple deals at the same time. Monthly portfolio returns consist of the weighted total monthly returns of all positions in active deals. Investments start two days after announcement dates, and terminate at the end of each month. Ongoing deals from previous month will continue new positions at the start of a new month. The portfolio starts off by rebalancing all active positions. Deals, in which the terms are revised before the deal consummation, are treated as multiple transactions. Deals with multiple bidders are also handled as multiple transactions.

Two strategies related to cash- and stock portfolio are constructed; Value weighted and equal weighted portfolios. A value weighted portfolio scales each position by the market value of target equity compared to the total market value of the portfolio at the end of the previous month. An equal weighted portfolio scales all positions equally, i.e. to a ratio of one to the total number of active deals. The formulas for the value weighted and equal weighted monthly return equals to (Carina et al. 1998):

$$\begin{aligned} \text{Value weighted:} \quad R_P &= \sum_{i=1}^{N_j} \frac{V_i \left( \prod_{t=m}^M (1 + R_{it}) - 1 \right)}{\sum_{i=1}^{N_j} V_j} \\ \text{Equal weighted:} \quad R_P &= \sum_{i=1}^{N_j} \frac{V_i \left( \prod_{t=m}^M (1 + R_{it}) - 1 \right)}{N} \end{aligned}$$

$V_i$  is the market value of target  $i$  on the announcement date.  $N_j$  is the total number of active deals in the portfolio during month  $j$ . The calculation of monthly portfolio returns are based on the assumption that the arbitrageurs have unlimited access to capital, and transaction costs are absent to investment. Both assumptions are clearly not realistic. However, the time series of returns generated from this approach provides a benchmark that is useful in analysing if merger arbitrage strategy is a superior investment strategy. For comparison it is more intuitive to present the portfolio returns in annual terms. The formula for geometric annual return is:

$$R_{Annual} = \prod_{t=1}^{12} (1 + R_{Monthly}) - 1$$

# Part V

## Results

### 7 Merger Arbitrage Return

This section determines the return characteristics of the data sample ranging from 2000 to 2012. Former academic theory suggests that merger arbitrage generates excess returns, for previous periods this has been established on a solid basis. This paper sets forth to analyse merger arbitrage returns in the U.S from 2000 until 2012, and with that become an updated and new look at merger arbitrage. The section is structured such that there is an overview of the major portfolio returns from merger arbitrage at first, both value weighted and equal weighted figures are included. A practical view on the merger arbitrage investment is then illustrated by an analysis of the cumulative returns of the merger arbitrage portfolios in opposed to the market portfolio. To evaluate the performance of the merger arbitrage portfolios, there is a discussion on the relationship between risk and reward related to these portfolios.

#### 7.1 Merger Arbitrage Portfolio Returns; 2000 - 2012

Measuring portfolio returns is a simple manner of accessing the characteristics of a strategy. But to get a relative understanding of portfolio performances, the portfolio returns must be compared to an appropriate benchmark. A benchmark is a proxy for the average investor. The benchmark is appropriate for relative comparison if it contains fundamental elements that match up with the portfolios, i.e. give access to all securities, capital, returns, transaction costs etc. which are offered by the portfolios (Bacon (2004)). The purpose for this paper is to evaluate the performances of the merger arbitrage portfolios relative to the market. To insure consistency with the portfolios and their purposes, the value weighted CRSP index is used as benchmark.<sup>11</sup>

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<sup>11</sup>The equal weighted CRSP index does not really reflect the average investors portfolio in the market, as this index is more heavily scaled to small caps than the common market index, which is represented by the value weighted CRSP index.

**Table 3: Merger Arbitrage Returns, 2000 to 2012**

The table display the sample data return result. Returns are denoted in percent (%). Returns are categorized in terms of weighting and the rightmost column show returns for the CRSP index.  $\Delta$  is the percentage difference between return from the merger arbitrage portfolio (to the left) and the CRSP index. The bottom row calculates the compound annual growth rate (CAGR) for each portfolio over the total period.

Year	Value Weighted Returns (%)				Equal Weighted Returns (%)				CRSP Index (%)
	Cash	$\Delta$	Stock	$\Delta$	Cash	$\Delta$	Stock	$\Delta$	
2000	4,34	16,37	30,93	42,96	-7,25	4,78	0,69	12,72	-12,03
2001	7,17	19,61	-44,12	-31,68	17,01	29,46	5,43	17,88	-12,44
2002	-5,22	16,89	9,03	31,14	11,76	33,87	21,86	43,97	-22,11
2003	19,45	-11,34	5,79	-24,99	20,77	-10,01	23,34	-7,45	30,79
2004	11,19	0,34	15,38	4,53	23,42	12,57	5,08	-5,76	10,85
2005	3,64	-1,75	9,87	4,48	2,51	-2,88	4,67	-0,72	5,39
2006	11,12	-2,92	18,95	4,91	11,22	-2,82	2,00	-12,04	14,04
2007	-14,78	-20,06	50,26	44,98	2,41	-2,86	27,53	22,26	5,27
2008	-19,48	20,17	69,67	109,32	-20,64	19,01	16,91	56,56	-39,65
2009	3,33	-24,76	2,15	-25,93	56,72	28,63	-35,03	-63,12	28,09
2010	2,29	-12,95	15,55	0,32	4,47	-10,77	15,97	0,74	15,24
2011	1,69	4,79	-14,74	-11,64	1,42	4,52	-3,45	-0,35	-3,10
2012	7,10	-5,82	26,06	13,14	4,91	-8,01	26,36	13,44	12,92
<b>CAGR</b>	<b>2,08</b>	<b>-0,11</b>	<b>12,51</b>	<b>12,43</b>	<b>9,34</b>	<b>7,35</b>	<b>7,77</b>	<b>6,01</b>	<b>0,59</b>

Table 3 depicts the annual returns from all four portfolios, both value weighted and equal weighted of cash and stock, and the returns from the value weighted CRSP index. Given a benchmark to compare with, the portfolio performances can be measured by the amount of return gained in excess to the benchmark, called *excess return*. Positive excess return means that the portfolio performed better than its benchmark. Negative excess return means poor performance as opposed to its benchmark. The excess return of each portfolios are depicted in the columns to the right of each portfolio.

The table shows that in most of the years the portfolios have higher annual returns than the market. In total, for all the portfolios, there is negative excess return in less than a third of the data. Even more interesting is the portfolios performances in depressed markets.<sup>12</sup> During this period the market had negative annual returns in five years. In four of these five years, the market had annual returns below -10%. Merger arbitrage portfolios, on the other hand, only performed below -10% in two years, at most, during that period. The bottom row of the table depicts calculations of the Compound Annual Growth Rate (CAGR) for all the portfolios. This is the geometric average return across all the years<sup>13</sup>, and takes into account the compounding effect of returns across time. During this period the market has shown a CAGR of 0.59% annually, which is quite low compared to the historical market

<sup>12</sup>Depressed market is in this paper defined as market with a negative annual return.

<sup>13</sup>See appendix for calculation

estimates.<sup>14</sup>

The reason for the low CAGR is due to this paper covering a time-period where the overall market has been through two severe downturns.<sup>15</sup> 2008 was an especially difficult year for the markets with a 40% decline in equity value for the entire market. The market collapse in 2008 was of grand proportions for the U.S. economy. When including an event as such in a study of relatively short time period, the event will have large impact on the derived results of the market performance. In fact, in hindsight the average investor would have been better off putting all the money in the bank instead of investing in the market. On average, all merger arbitrage portfolios outperformed the market. The value weighted portfolios of cash and stock had a CAGR of respectively 2.08% and 12.51%. The equal weighted portfolios of cash and stock had a CAGR of respectively 9.34% and 7.77%. The table of time-series returns from the period of 2000 to 2012 is very interesting in the context of comparing to previous studies. This analysis is very similar to the research done by Mitchell and Pulvino (2001), except that their study covered the period from 1963 to 1998. Using the exact same methodology, the CRSP market index had a CAGR of 6.22% over the 35 yrs in that study. Their merger arbitrage portfolio, consisting of both stock and cash mergers, had also a higher annual return of 16.05% , with only a single negative year over the whole period.

Clearly, *The Times They Are a-Changin'*.

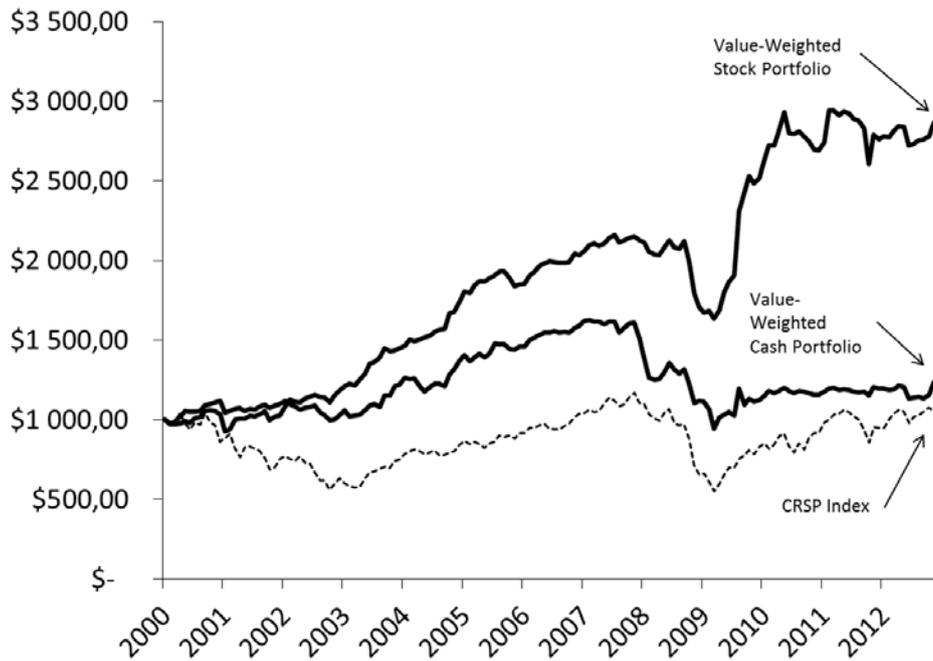
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<sup>14</sup>The CRSP index has over the period 1926 to 2012 given a CAGR of about 5.5%.

<sup>15</sup>The two severe market downturn are the burst of the Dotcom-bubble in 2001 and the burst of the financial crisis in 2008.

## 7.2 Cumulative portfolio returns

This part of the section displays the cumulative returns of the merger arbitrage portfolios, showing more practical results from the viewpoint of an investor. Figure 11 and 12 illustrates the cumulative wealth of investing \$1000 and holding that investment in twelve years, from the start date of January 1st, 2000 until December 31st, 2012. Figure 11 shows the cumulative wealth for the value weighted portfolios, and Figure 12 illustrates the equal weighted portfolios. Both portfolios are benchmarked to the value weighted CRSP index, which is a proxy of the market.



**Figure 11:** Cumulative Return: Value Weighted

Both value weighted merger arbitrage portfolios outperformed the market at every point during this period. The stock portfolio is the most profitable portfolio with an accumulated wealth of \$2 900 over the period. Comparatively the cash portfolio accumulates \$1 236. Not impressive return over twelve years, but still better than the average investor in the market who barely broke even at \$1 063 in 2012. Both equal weighted portfolios performed better than both value weighted portfolios of cash and stock, on average.

The equal weighted cash portfolio generated \$4 106 during the period, while the equal weighted stock portfolio gained a return of \$2 449.<sup>16</sup>

The merger arbitrage investments have proved to be a very profitable strategy during the time period from 2000 to 2012. The most successful portfolio, the equal weighted cash portfolio, generated a return almost four times to

<sup>16</sup>DeMiguel et al. (2007) has in fact shown that equal weighted portfolios (1/N strategy) might be superior to other portfolio choices. In the paper the researchers test an equal weighted portfolio extensively against mean-variance portfolios, value weighting, and a myriad of other advanced techniques from modern finance. However, not one of the sophisticated methods are able to beat the equal weighted method in any significant manner.

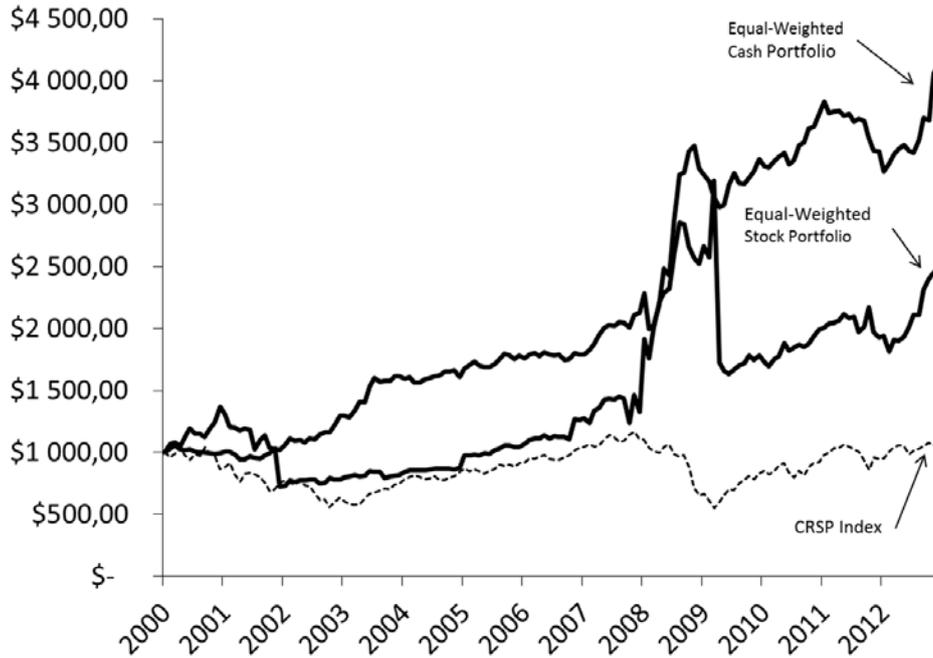


Figure 12: Cumulative Return: Equal Weighted

the market. While the market have suffered through two severe downturns, the merger arbitrage investments seems mostly sheltered from the market risk. It is worth noting that the estimation of cumulative returns do not include transaction costs related to the investments. By excluding transaction costs, the estimated returns will be higher than the actual returns. Nevertheless, transaction costs have declined during the last decades and are currently relatively low. Even though the actual returns may not be as great as the estimates, it is certain that merger arbitrage have been a lucrative investment strategy during this period.

### 7.3 Merger arbitrage return and volatility characteristics

In general, financial theory is built on the thought that returns can only be gained by bearing risks. Returns obtained in excess to the market are often explained by the investor taking a higher risk than the average investor. The logic behind this theory is that there is no “free lunch”. The investor will only get an extra premium if she is willing to bear the risks that the market despises. But, what exactly is risk? Risk is defined in many ways, and there are as many ways of measuring it. In this section risk is defined as the *variations in the returns* and measured by the standard deviation.<sup>17</sup> If the returns have a large variance and uncertainty of movement it is said that the returns have high risks. The correlation between return and risk is contradictory to the investors preferences. Investors find high returns attractive, but they despise risk. If a portfolio has high return but also a high level of risk, this will reduce

<sup>17</sup>For calculation; see appendix

the attractiveness to the portfolio.

In order to evaluate the quality and the performance of a portfolio, both factors of risk and return must be taken into consideration. A popular measurement often used to evaluate portfolio performances is the Sharpe Ratio (SR).<sup>18</sup> The SR measures the reward-to-risk relationship in the portfolio. A positive SR means that the portfolio gained returns in excess of the risk free rate. A high SR indicates that the portfolio gives high return for each unit of variability. If evaluating a portfolio with only the SR in isolation, investors would favour portfolios with the highest ratio. The SR enable the investors to easily rank the portfolios in order of preferences. However, the SR can sometimes be negative. In such cases this measurement does not make much sense. An alternative measurement which can be used is the  $M^2$ .<sup>19</sup> The  $M^2$  risk-adjusts the returns of the portfolio.<sup>20</sup> The idea behind this measurement is to imagine that a portfolio is mixed with a risk-free position so that the complete or adjusted portfolio matches the risk to the benchmark or the market. Hence, by using  $M^2$  one can judge the size of portfolio performances. This gives a better feel for the numerical value derived by this method.

**Table 4: Portfolio Performance Evaluation**

The table show the performance of the merger arbitrage portfolios and the CRSP index in terms of the standard performance indicators Sharpe Ratio and  $M^2$ .

	Value weighted		Equal weighted		CRSP Index
	Cash	Stock	Cash	Stock	
CAGR (%)	2,08	12,51	9,34	7,77	0,59
$\sigma$ Standard Deviation (%)	11,24	21,81	10,88	18,37	16,73
Sharpe Ratio	-0,02	0,47	0,65	0,30	-0,10
$M^2$ (%)	1,41	9,54	12,56	6,69	

Table 4 depicts the portfolio CAGR and annualized standard deviations based on the monthly returns, as well as calculations of the performance evaluation metrics of SR and  $M^2$ . The table shows that both cash portfolios have lower standard deviations than the market, while both stock portfolios have higher standard deviations. These findings are interesting. The difference in the standard deviations can be explained by different mechanisms involved with the merger arbitrage of stock and cash deals.

Cash deals only include taking one long position on the target stock. The outcomes of a cash deal is often limited to either the bid-price, if the deal succeed, and the pre-announcement price (in most cases), if the deal fails to go trough. With a bid-price functioning as a cap, and a pre-announcement price

<sup>18</sup>For calculation; see appendix

<sup>19</sup>The designation  $M^2$  does not include any element being squared.  $M^2$  is simply named after proposal by the partnership between Leah Modigliani (1997) and her grandfather Franco Modigliani (Bacon (2004)).

<sup>20</sup>For calculation; see appendix

functioning as a floor for the outcomes of a deal, the variance and standard deviation for a cash deal is reduced to a certain spread. The fluctuations in returns among the deals are then limited.

The increased volatility involved with stock deals is due to the complexity of the deal, which include two positions. One long position on the target stock, and one short position on the acquirer stock. By holding two positions in each deal, the returns for the outcomes can vary a lot more compared to cash deals. If the deal succeed, the return will be similar to the case of cash deals. However, if the deal does not complete or is withdrawn, the downturn can be much worse, as the negative returns will come from both positions of target and acquirer. The target stock will fall to its pre-announcement price, causing negative returns. The acquirer stock will theoretically increase to its initial price before the bid, which also will cause negative returns for the arbitrageur who hold a short position on the acquirer. This is why the stock portfolios have some of the worst performances in certain years when the market is depressed. This is illustrated by the performances of the value weighted stock portfolio in 2001 and the equal weighted stock portfolio in 2009 with respectively returns of -44% and -35%.

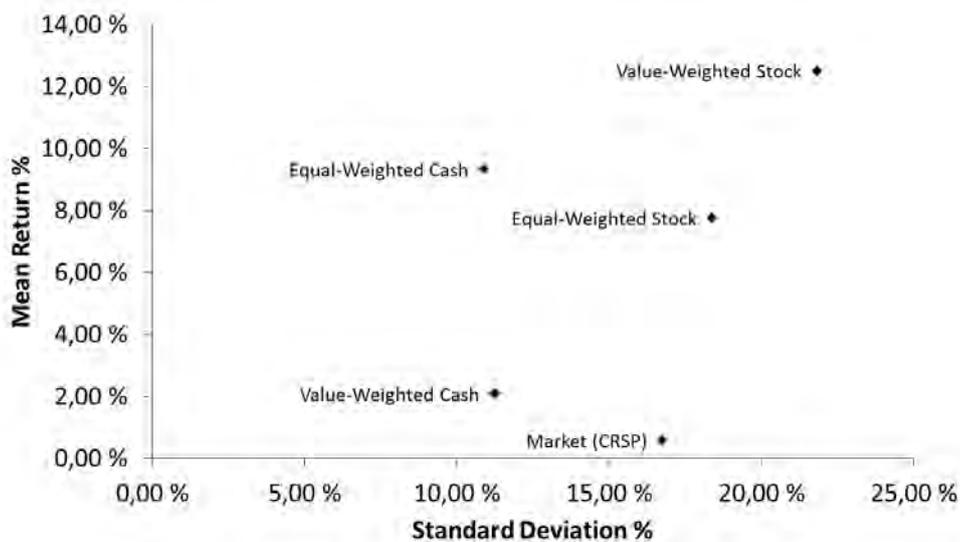


Figure 13: Risk & Return

All portfolios outperformed the market with SR higher than the benchmark of -0.1. The best portfolio in terms of risk-reward is the equal weighted cash portfolio of 0.47. The portfolio with the lowest SR is the value weighted cash portfolio of -0.02. Negative SR means that the portfolio gained an average annual return lower than what is given by the risk-free rate. Since the portfolio value weighted cash portfolio does contain risk, it might be confusing why the portfolio does not provide a higher return. As discussed in the previous section, the portfolio and market returns in the time-period covered in this paper is highly affected by two years of significant market downturns.

Both portfolio and market return is thus lower than what is usually expected from long term performances. In this case the  $M^2$  is a better measurement. The  $M^2$  provides only non-negative real numbers, given in units of percentage return, and is preferred when ranking portfolios relatively. The mechanics of the  $M^2$  measurement is to show the hypothetical return a portfolio would have if it matched the variance of the benchmark index. The  $M^2$  measurement enables direct comparison with the market index. In the case of the merger arbitrage portfolio the  $M^2$  for value weighted cash and stock are respectively 1.41% and 9.54%. For the equal weighted portfolios the  $M^2$  are respectively 12.56% and 6.69%. All of the merger arbitrage portfolios outperformed the market index at 0.59% over the period.

Summarizing this section on merger arbitrage returns, the data sample from the period between 2000 and 2012 indicate that the merger arbitrage portfolios outperformed the market, independent of which methodologies being used, i.e value weighted or equal weighted of cash or stock. Even when adjusting for risks, all portfolios still show superior returns. Both Sharpe Ratios and  $M^2$  are consistently higher than the market index. Hence, this section can conclude that the merger arbitrage strategy will still give a higher risk-reward ratio than the market.

## 8 Benchmarking Merger Arbitrage Returns against Linear Models

In the previous section, the total risk to the portfolios was measured by the standard deviation to the returns. In this section, other risk factors will be introduced. The Capital Asset Pricing Model (CAPM) and the three-factor model of Fama-French are used as benchmarks to evaluate the performances of the merger arbitrage portfolios. Using these benchmarks will help identify the inherent risk factors, and evaluate the excess return generated by merger arbitrage when other risk factors are taken into consideration. The first part of this section gives a short introduction to the CAPM and the Fama-French model. The second part covers the methodology in modelling both benchmarks. The last part will finish up by giving a short summary of the findings of the analyses, and a conclusion.

### 8.1 CAPM and Fama-French as Benchmark

The CAPM model was developed by Sharpe (1964), Lintner (1965) and Mossin (1966). The model is popular and widely used because of the insight it offers, and its accuracy is deemed acceptable for important applications (Bodie et al. (2011)). One of the purposes of the CAPM is to provide a benchmark rate of return for evaluating possible investments. Instead of using the total risk, which is composed of *systematic risk* and *unsystematic risk*, the CAPM argues that in a well-diversified portfolio the unsystematic risk will be diminished, leaving the portfolio with mostly systematic risk. The systematic risk is the risk that is attributable to market conditions, also called *market risk*. To figure the level of market risk in a portfolio, one can measure the fluctuations between the portfolio returns and the market returns. This correlation is given in beta. If the portfolio returns move in line with the market, the beta will equal to 1. A beta higher than 1 indicates that the portfolio returns fluctuates more heavily than the market, and vice versa. A negative beta indicates that the portfolio returns move in to opposite direction of the market. If the CAPM theory holds, the beta value of the merger arbitrage portfolios should be able to determine the expected returns of the portfolios. Returns obtained in excess of what is predicted by the CAPM, will indicate that the portfolio is superior to the market.

The Fama-French three-factor model is an extension of the CAPM model, designed by Eugene Fama and Kenneth French (Fama and French (1993)). In addition to the market risk in the CAPM model, Fama-French introduces two more factors: a size factor denoted with *SMB* and a value factor denoted with *HML*. *SMB* stands for Small Minus Big and represent returns of a portfolio of small stocks in excess of the returns to a portfolio of large stocks. *HML* stands for High Minus Low and represents the returns of a portfolio of stocks

with a high book-to-market ratio in excess of the returns to a portfolio of stocks with a low book-to-market ratio. Both size and value factors are valuable in the analysis of risk factors of merger arbitrage portfolios. These factors have on past evidence appeared to capture the risk premium well.  $\beta_{SMB}$  and  $\beta_{HML}$  stand for the levels of correlation to the value- and size-factors respectively.

## 8.2 Modeling Linear Asset Pricing Models

The models of CAPM and Fama-French are both linear asset pricing models, meaning that the models predict linear relationships between the merger arbitrage portfolio returns and the market returns. In order to measure a linear relationship, a regression analysis is performed for each merger arbitrage portfolio. The monthly returns of each portfolio subtracted by risk free returns are plotted in a scatter diagram against the market. The value weighted CRSP index is still used as proxy for the total market. Computed by OLS (Ordinary Least Squares) method, the diagram gives a best-fitted line through the plots. The equation for this straight line is given as following:

$$r_P - r_f = \alpha_P + \beta_P \times (r_M - r_f) + \epsilon_P$$

This equation is a revision of the CAPM formula. By subtracting the risk free rate from the portfolio return,  $r_P - r_f$ , the regression line will plot the size of the excess return,  $\alpha_P$  (alpha), in the intercept between the line and the vertical axis. Positive  $\alpha_P$  will indicate that the portfolio outperformed the market  $r_M - r_f$  during the time-period covered in this paper.  $\alpha_P$  equalling zero will indicate that high portfolio returns are obtained through portfolios bearing higher risks than the market. The slope of the line equals to the portfolio beta  $\beta_P$ . The error term  $\epsilon_P$  is the idiosyncratic risk which in the CAPM model is assumed to equal zero.

To insure that all risk factors are accounted when evaluating the merger arbitrage portfolios, there will also be performed a similar regression analysis as above, but this time benchmarked to the Fama-French model. The size and the value factors may then contribute in describing the high returns from the merger arbitrage portfolios. The monthly returns from *SMB* index and *HML* index used in the analysis are downloaded from the Kenneth R. French homepage.<sup>21</sup> The equation for this regression analysis is:

$$r_P - r_f = \alpha_P + \beta_P \times (r_M - r_f) + \beta_{SMB} \times SMB + \beta_{HML} \times HML + \epsilon_P$$

The excess return,  $\alpha_P$ , is interpreted analogous to the CAPM model. However, the different beta values in this equation cannot be depicted directly from the diagram. Nevertheless, all the beta values show the level of correlations between the portfolio returns and the indices of the market, the *SMB*

<sup>21</sup><http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/>

and the *HML*.

### 8.3 Benchmarking Merger Arbitrage portfolios to linear models

**Table 5: CAPM and Fama-French regression results**

The table provides an Ordinary Least Square (OLS) regression of the annual excess return from merger arbitrage against the CRSP index ( $R_m - R_f$ ), and the Fama-French factors *SMB* and *HML*. For all of the factors, the statistical significance of the result is denoted in the *P - value* columns.

	<i>N</i>	<i>R</i> <sup>2</sup>	Intercept		$R_m - R_f$		<i>SMB</i>		<i>HML</i>	
			$\alpha$ (%)	<i>P - value</i>	$\beta$	<i>P - value</i>	$\beta$	<i>P - value</i>	$\beta$	<i>P - value</i>
<b>Cash Offers</b>										
VALUE WEIGHTED										
CAPM	156	0,21	-0,10	0,66	0,24	0,00				
Fama-French	156	0,25	-0,27	0,26	0,24	0,00	0,03	0,72	0,20	0,01
EQUAL WEIGHTED										
CAPM	156	0,29	0,56	0,01	0,35	0,00				
Fama-French	156	0,36	0,38	0,08	0,33	0,00	0,18	0,00	0,24	0,00
<b>Stock Offers</b>										
VALUE WEIGHTED										
CAPM	156	0,00	0,96	0,06	-0,07	0,41				
Fama-French	156	0,02	0,79	0,13	-0,10	0,25	0,19	0,24	0,24	0,13
EQUAL WEIGHTED										
CAPM	156	0,01	0,57	0,18	-0,10	0,26				
Fama-French	156	0,03	0,77	0,08	-0,11	0,20	0,03	0,81	-0,24	0,07

Table 5 depicts an overview of the results from the regression analyses of the four merger arbitrage portfolios benchmarked to the CAPM and the Fama-French model.<sup>22</sup> The results give divisive explanations to the different portfolios. However, there are similarities in the portfolios of each category of cash and stock. The reason to this is due to distinctive characteristics related to the investments in cash deals and stock deals.

Comparing to the CAPM, all portfolios except from the value weighted cash portfolio generated positive  $\alpha$  during this period. Nevertheless, only equal weighted cash portfolio and value weighted stock portfolio give statistical significant results.<sup>23</sup> The annual excess returns are 0.56% and 0.96% to the equal weighted cash portfolio and value weighted stock portfolio respectively. The other two portfolios reveal more random alphas, as the p-values are relatively high, indicating insignificance. The beta values are quite low for all portfolios. The reason for this is due to the fact that merger arbitrage strategies implicate bets on deal completion. During a holding period between announcement date and completion date, the target stock price movement is mostly affected by the probability of deal outcomes. The risk related to market is thus of minor importance. The market beta should therefore be small. Both cash portfolios have significant low and positive beta values. Both stock

<sup>22</sup>Regression plots are depicted in the appendix.

<sup>23</sup>The equal weighted cash portfolio has significance at the 5% level, and value weighted stock portfolio has significance at the 10% level

portfolios, on the other hand, have slightly negative beta values. But these are insignificant implied by the p-values. The  $R^2$  values for all portfolios suggest that CAPM is not a reliable model in explaining the portfolios returns.  $R^2$  measures the proportion of variance in portfolio returns that is related to the variance of market returns. Low  $R^2$  values imply that the returns are scattered throughout the diagram, indicating that the best fitting straight line lead to unstable  $\alpha_P$  and  $\beta_P$  estimates (Bacon (2004)). However, cash portfolios have significantly higher  $R^2$  values than the stock portfolios, 0.21 and 0.36 versus values close to zero. Even though there are some portfolios that lack statistical significance, both the value weighted stock and the equal weighted cash portfolios generate significant  $\alpha_P$ .

Comparing to the Fama-French model, most of the results are quite similar to the case of CAPM benchmark. According to this model all portfolios still generate positive  $\alpha$ , except from the value weighted cash portfolio. However, only equal weighted portfolio of cash and stock are significant with p-values below 10%. The annualised excess returns to these portfolios are respectively 0.38% and 0.77%. The market beta values stay almost unaffected with the new benchmark. The betas for size and value factors are all small but significant, implying that both these factors may explain the portfolio returns to some extent. The relevance of the size factor in cash portfolios is due to the fact that cash is only feasible as payment for confined firm size.<sup>24</sup> Therefore cash portfolios mostly consist of smaller target firms, which increase the correlation to the *SMB* factor. The relevance of value factors is due to mergers and acquisitions being more likely to occur when the target is not overpriced in the market, meaning that target firms often have high book-to-market values. Cash portfolios that only consist of target firms should therefore correlate more to the *HML* factor. Including both size and value factors consistently lead to a small increase in the  $R^2$  values for all merger arbitrage portfolios. However, the  $R^2$  values are fairly low. The Fama-French model can probably not be considered as a good benchmark for evaluating merger arbitrage portfolios.

To summarize the results presented in table 5, regardless of benchmark method three of four portfolios gave positive  $\alpha$  during this period. Only value weighted cash portfolio fails to give positive alpha. The significance of the alpha values depends on the combination of portfolio and benchmark. However, the equal weighted cash portfolio came out as a portfolio with significant  $\alpha_P$  in both benchmarks. Low  $R^2$  values in all cases indicate that the linear asset pricing models of CAPM and Fama-French are not reliable in explaining the merger arbitrage portfolio returns during the time period between 2000 and 2012. This indication is also highlighted with quite low beta values for market

<sup>24</sup>As shown in figure 9, cash deals involve substantially smaller transactions.

and for both added risk factors. To obtain more statistical support in the models, an expansion of the event window including more monthly data may improve the results. Nevertheless, increasing  $N$  will compromise the purpose of this study, which is to analyse the development of merger arbitrage returns in the years after the millennium. To draw a conclusion, the merger arbitrage strategy still beats the market. But due to the short time-window of the research, only the equal weighted cash portfolio gives statistically significant alpha.

## 9 Benchmarking Merger arbitrage Returns against a Non-linear Model

It is questionable if merger arbitrage portfolio performances should be benchmarked against the CAPM and the Fama-French model. Both these linear models assume that the portfolio returns and risks are linearly related to the market. Measuring merger arbitrage portfolio returns against these models implicitly makes the assumptions that the returns and risks are symmetric.<sup>25</sup> This assumption could be rather problematic of two reasons. First, the pay-off structure of merger arbitrage investments is asymmetric. Second, previous studies claim that the merger arbitrage risks and returns are related to the market in a non-linear way. Mitchell and Pulvino (2001) suggests that a non-linear model is a better benchmark for merger arbitrage portfolios.

The first part of this section will start by presenting the arguments for the asymmetric pay-off structure of merger arbitrage portfolios. The next part will test for non-linear relationship to market, and present a piecewise linear model for benchmarking. The section will wrap up with a conclusion of whether the merger arbitrage portfolio still is a superior investment strategy when benchmarked to the piecewise linear model.

### 9.1 Asymmetric payoff

To fully understand the structure of merger arbitrage returns, it is useful to have a closer look at the returns obtained by cash deals. Cash deals are the simplest form for merger and acquisition transaction. It is therefore more informative to focus on analyzing cash deals in this section.

A cash deal involves the arbitrageur taking a long position in the target stock after an announcement. The opportunity for an upside return from this position is fixed to the arbitrage spread. Since the arbitrageur is supposed to hold the long position in the target stock until the completion date, the stock price would normally not raise above the bid price.<sup>26</sup> The bid price can thus be seen as a cap for the return. On the other hand, the downside for holding the position until completion date is uncertain and can be significantly larger than the upside. In most cases, the stock price will fall to its initial price prior to the announcement if the deal fails to complete. But in theory the stock price has no limit on the downside.

With a limited upside and an unlimited downside, the return distribution is asymmetric. This is a violation on the “random walk” assumption which is an essential assumption in the linear models. The violation is also the main argument for why linear models may not be able to capture the risk-reward

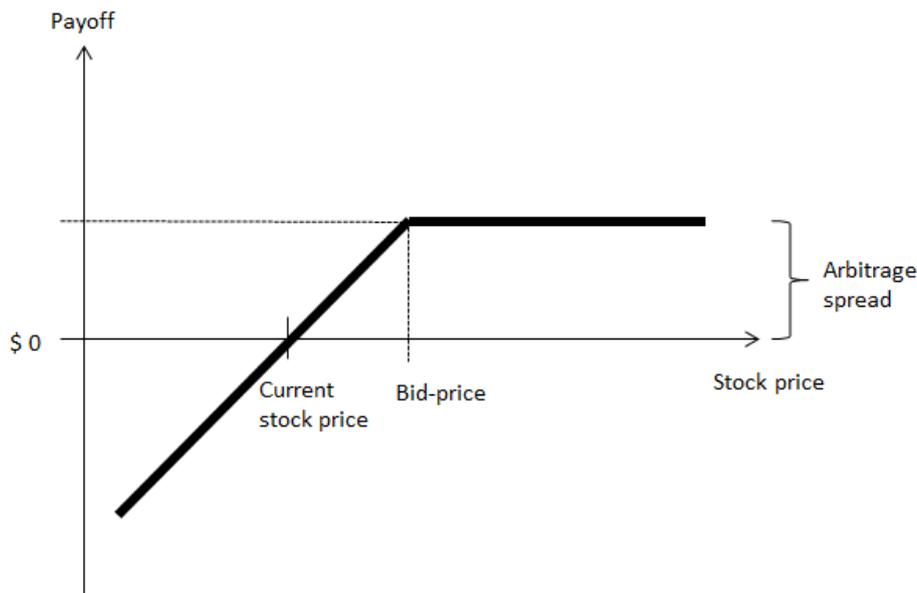
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<sup>25</sup>Symmetric return means that future stock price follows a random walk, i.e. the probability distribution of return is bell-shaped

<sup>26</sup>In some cases the stock price do raise above the bid price, if the market expect that the target firm will get higher bids in the near future.

relationship in merger arbitrage portfolios.

Some studies like Bhagat et al. (1987) suggest that option pricing models are a better suited for analysing merger arbitrage returns. Taking a long position in a target stock during a deal is quite similar to holding a short position in a European put option with the target stock as the underlying asset. This is illustrated in Figure 14. According to the study of Mitchell and Pulvino (2001) holding a merger arbitrage portfolio is akin to writing uncovered index put options. The European aspect of the option comes from the fact that the merger arbitrage bet includes holding a position until deal completion. The option can therefore only be exercised on the expiration date, which equals to the completion date. The *strike price* equals to the announced bid price, which make the cap on the pay-off structure. The intercept between the pay-off line and the horizontal axis illustrates the current stock price. The *current stock price* is lower than the strike price, meaning that the put option is in-the-money. The arbitrageur can however not yet earn the option premium by striking, due to the option being European.



**Figure 14:** Payoff Structure

The return from holding a merger arbitrage position is determined by the arbitrage spread. The idiosyncratic risk related to this position is coming from exogenous factors, which affect the process of the deal. Because of the asymmetric pay-off structure related to merger arbitrage portfolios, it is then questionable whether the performance of the overall stock market even is related to merger arbitrage returns at all. Mitchell and Pulvino (2001) claim that non-linear models are better benchmarks for evaluation of merger arbitrage portfolios. In the next part of this section, a non-linear model will be introduced.

## 9.2 Correlation in different market conditions

Mitchell and Pulvino (2001) claimed that in a flat and appreciating market there is no correlation between merger arbitrage portfolio returns and market returns. However, in a market downturn, market sentiments will have negative impacts on deal outcomes, suggesting positive correlation between merger arbitrage returns and market returns. Shleifer and Vishny (1997) argue that the effect of positive correlation in a market downturn can be explained by the investor risk-averse behaviours. Even though the arbitrageurs are familiar with the reward and risk related to the merger arbitrage investments, their investors may not be. Consequently, the investors may redeem their capital in a downturn market when the arbitrageur may need it the most. This may lead to negative returns in the merger arbitrage portfolio. In order to see if this argument for a varying correlation still holds for the time-period in this paper, there will be performed linear regression analyses in two different economic stages. Both cash portfolios will be benchmarked to the CAPM model.<sup>27</sup> The appreciating market is defined as a condition where the market excess return to the risk free rate is 2%, and the depreciating market has an market excess return to the risk free rate of -2%. The thresholds for different market conditions are set arbitrarily. The only purpose is to make a clear distinction between the two stages.

**Table 6:** Merger Arbitrage during different market conditions

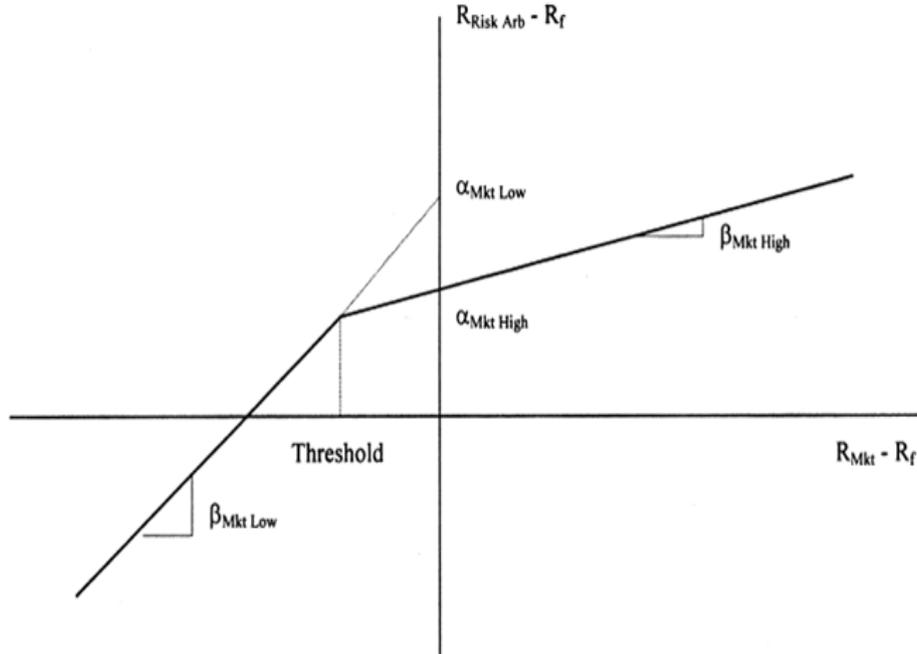
	<i>N</i>	<i>R</i> <sup>2</sup>	Intercept		<i>R<sub>m</sub> - R<sub>f</sub></i>	
			<i>α</i> (%)	<i>P - value</i>	<i>β</i>	<i>P - value</i>
<b>Value Weighted</b>						
Up Market ( <i>R<sub>m</sub> - R<sub>f</sub> &gt; 2%</i> )	63	0,02	0,7	0,39	0,13	0,24
Down Market ( <i>R<sub>m</sub> - R<sub>f</sub> &lt; -2%</i> )	47	0,17	0,5	0,56	0,34	0,00
<b>Equal Weighted</b>						
Up Market ( <i>R<sub>m</sub> - R<sub>f</sub> &gt; 2%</i> )	63	0,07	0,7	0,36	0,23	0,04
Down Market ( <i>R<sub>m</sub> - R<sub>f</sub> &lt; -2%</i> )	47	0,40	1,5	0,02	0,44	0,00

The results from table 6 indicates the correlation between the portfolio returns and the market returns varies in different market conditions.<sup>28</sup> In an appreciating market the correlation is limited. The beta  $\beta$  is close to zero. But in a depressed market, the correlation is slightly positive. The beta  $\beta$  for depressed markets are also highly significant with low p-values. These findings are consistent with the report of Mitchell and Pulvino (2001), suggesting that the relationship between risk arbitrage returns of cash portfolios and the market returns is non-linear.

<sup>27</sup>The stock portfolios will not be included in this analysis due to the complexity of the hedge position in stock deals.

<sup>28</sup>Regression plots are depicted in the appendix

### 9.3 Piecewise Linear Function



**Figure 15:** Piecewise Linear Model, Mitchell and Pulvino (2001)

This is an illustration of how a piecewise linear model might represent returns from merger arbitrage in a more accurate manner. In normal and flat markets  $\beta_{MktHigh}$  is relatively flat, while in falling markets the  $\beta_{MktHigh}$  increases. Note the threshold assumption connecting the two regression lines.

To assess the level of non-linearity, this paper addresses a method analogous to the Mitchell and Pulvino (2001), conducting a piecewise linear regression analysis for the cash portfolios. The piecewise linear model is an expansion of the CAPM model. Instead of testing for correlation with only one beta, two betas are created to capture correlation in different economic stages. This is illustrated in Figure 15. The first beta ( $\beta_{MktLow}$ ) represents the fluctuation in portfolio returns compared to a downturn market, the second beta ( $\beta_{MktHigh}$ ) represents the fluctuations in portfolio returns compared to a flat or appreciating market. The main difference between the piecewise linear model and the previous analysis, is that the piecewise model insures continuity in the model. Both linear pieces of the model should be connected. The formula for the piecewise linear model is presented as following:

$$R_p - R_f = (1 - \delta)[\alpha_{Down} + \beta_{Down}(R_M - R_f)] + \delta[\alpha_{Up} + \beta_{Up}(R_M - R_f)]$$

$\delta$  is a dummy variable which is equal to one if the market excess return is above a threshold level, and zero otherwise. The threshold is a given point in the piecewise model which distinguishes between a depressed market and a flat or appreciating market. This level is determined by computing for the excess market return which minimizes Sum of Squared Errors (SSE) of both

lines in the regression analysis. Minimizing the SSE will give the best fitted piecewise line to the given scatter plots. Similar to the methodology performed by Mitchell and Pulvino (2001), the following restriction is imposed on the piecewise linear model, making the linear pieces connect:

$$\alpha_{Down} + \beta_{Down}(Threshold) = \alpha_{Up} + \beta_{Up}(Threshold)$$

Table 7 reveals that the restrictions in the piecewise models resulted in thresholds of 0% and 1.4% for respectively value weighted and equal weighted cash portfolios.<sup>29</sup> While 0% seems to be an acceptable distinction point between two market conditions, a threshold of 1.4% seems to be a quite high limit for a depressed market. The table also shows that both alpha and beta for up- and down-market are quite similar. This applies for both cash portfolios. By creating a continuing piecewise line consisting of two best fitted line, the model erased the clear distinction between the beta of different market conditions which were found earlier. The p-values of the betas also suggests significant estimates. The findings indicates that the piecewise model for the time-period between 2000 and 2012 may not be much different to the original CAPM model.

**Table 7:** Piecewise Linear Regression

	Threshold (%)	R <sup>2</sup>	Intercept		R <sub>m</sub> - R <sub>f</sub>	
			α (%)	P - value	β	P - value
<b>Value Weighted</b>						
Up market	0,00	0,09	0,01	0,98	0,35	0,00
Down market	0,00	0,14	0,00	1,00	0,33	0,00
Piecewise Linear Model Total		0,23				
<b>Equal Weighted</b>						
Up market	1,40	0,10	-0,02	0,99	0,48	0,01
Down market	1,40	0,29	0,56	0,04	0,34	0,00
Piecewise Linear Model Total		0,39				

To check if there is evidence for a piecewise linear model, a t-test is conducted. The test aims to validate if the piecewise linear model is significantly different from a straight line:

$$\alpha_{Down} \neq \alpha_{Up}$$

$$\beta_{Down} \neq \beta_{Up}$$

In both portfolios the t-test fails to reject that there are significant differences between the parameters of appreciating and depreciating markets.<sup>30</sup> The data show no evidence supporting a piecewise linear model. This suggests that it is not different from the original CAPM model, and should therefore not

<sup>29</sup>Regression plots are depicted in the appendix

<sup>30</sup>See appendix for detailed t-test results.

be used as a benchmark for recent merger arbitrage portfolio performance. This is contradictory to the conclusions of Mitchell and Pulvino (2001). An explanation of the differing results is due to changing time period. The study of Mitchell and Pulvino included data in the time period of 1986 to 1997, while this paper contains more recent data from 2000 to 2012. A different time series combined with limited dataset can also be the reason for lack of significant results in the regression analysis.

To summarize this section, the paper addresses characteristics to the merger arbitrage portfolio returns which make it difficult to evaluate. With an asymmetric pay-off structure, the linear asset pricing models are not able to capture the risk-reward relationship in the portfolios. Previous studies have argued for using a piecewise linear model as benchmark model in such cases. However, the data from 2000 to 2012 cannot validate any difference between the suggested piecewise linear model and the original CAPM model. In addition to low explanation power,  $R^2$ , this paper concluded that the piecewise model is not applicable as benchmark. The estimated alpha values derived from this model can therefore not be used.

## Part VI

### 10 Conclusion

This paper reinforces that merger arbitrage still is a superior investment strategy providing excess returns. However, approving this fact does not necessarily compromise the fundamental theory of efficient financial markets. Merger arbitrage returns are obtained by the arbitrageur taking large risks, which the average investor does not want to carry. Much of the returns gained by the arbitrageurs can be explained by their role in mergers and acquisitions transactions.

In total four merger arbitrage portfolios are presented in this paper; value weighted and equal weighted portfolios of both cash and stock. By using time-series approach, the portfolio performances are measured during the time period from 2000 to 2012. The portfolio performances are benchmarked to the market returns. The results reveal that all portfolios outperformed the market on average in this period. The value weighted portfolios of cash and stock showed average annual returns of respectively 2.08% and 12.51%, and the equal weighted portfolios had annual returns of respectively 9.34% and 7.77%. It is worth noting however, that this study ignores transaction costs which might affect the magnitude of abnormal returns. The market, on the other hand, provided a annual return of barely 0.59%. The market returns from this period is very low compared to results presented in previous studies. Mitchell and Pulvino (2001) found returns in the magnitude of 6.22% over the period from 1963 to 1998. The substantial decrease in returns in this paper is probably due to the fact that the market has been through two severe recessions during this period. In hindsight the average investor would have been better off putting all the money in the bank rather than investing in the market.

All portfolios still outperformed the market when adjusting for market risk by using the performance indicators Sharpe ratio and  $M^2$ . To evaluate for other risk factors, the portfolios are benchmarked to linear models of CAPM and Fama-French. According to CAPM, all portfolios, except from the value weighted cash portfolio, generated positive excess return. The equal weighted cash portfolio displayed significant excess returns of 0.56% annually. Other portfolios still reveals excess returns, but is less supported by statistical significance. Similar results are presented when benchmarked to Fama-French, with an increased statistical explanation power.

Due to the asymmetric pay-off structure in merger arbitrage, Mitchell and Pulvino (2001) claimed that non-linear models are better benchmarks for the evaluation of merger arbitrage returns. This paper built a piecewise linear model to investigate this alternative approach to performance testing of

merger arbitrage. Nevertheless, the results could not confirm such a non-linear relationship. The t-test performed in this paper reject the existence of any significant differences between linear and non-linear models for recent data from 2000 to 2012.

## 11 Practical Implications of Merger Arbitrage

This paper as well as many others has tried to show that merger arbitrage is a profitable investment strategy, not only for the arbitrageurs who pick transactions carefully but also on average as a passive strategy. After reviewing the evidence of past academic work and conducting similar research on the topic it is possible to state with a certain degree of confidence that merger arbitrage has given excess return to investors. In a slight departure from the pure academics of this paper the following section provides a look at the possibilities for private investors to get a share of these profits.

Merger arbitrage was for a long time reserved a small group of elite professional investors on Wall Street. In his book *Risk Arbitrage* Guy P. Wyser-Pratte accounts for the community of risk arbitrageurs: *“The big money makers of Wall Street often mask their expertise in mystery, and among them the most mysterious is a cliquish band of specialists known as arbitrageurs. One member of the New York Stock Exchange says: “I think of them as vague shadows with European backgrounds. I dont even know who they are.””*

Wyser-Pratte (2009) states that almost up until the 1970s very few, even investment professionals, knew about the profits generated from merger arbitrage. This changed in the takeover rush of the 1980s when Ivan Boesky and other arbitrageurs made huge profits from the practice and started getting international recognition and Forbes magazine covers. Several investment firms opened their own merger arbitrage desks during this period, but most of them lacked the insight and skill to produce much profit from this. It was not until the 1990s with the establishment of a large hedge fund industry that this form of investing again became popular. However; hedge funds are notoriously secretive and investing in them requires a professional network and large amounts of capital and expertise.

The possibility for private investors to get in on merger arbitrage has until very recently been practically impossible. This has changed however; with the introduction of exchange traded funds (ETFs). ETFs are exchange traded shares of a highly diverse class of funds, it is basically an investment fund traded on the stock market. ETFs are set up to closely match the value of an index that it is tracking. It takes away the capital requirements of investing in large capital funds, hedge funds or virtually any other investment strategy imaginable. It is possible to simply buy shares in the indices that track these alternatives at very low transaction costs. There are several merger arbitrage indices on the market that constructs merger arbitrage portfolios. Table 8 has an overview of the most commonly known merger arbitrage indices.

They all follow quite similar methodologies; they track a given set of countries and when an acquisition of a specified size occurs they include the target stock, plus a short on acquirer stock in stock deals, in the index. E.g.

**Table 8:** Merger Arbitrage Indices

Index provider	Index	Ticker	Equity markets	Starting year
Standard & Poors (S&P)	Merger Arbitrage Index	SPLSAUP	All developed countries	2005
Credit Suisse	Merger Arbitrage Liquid Index	CSMEARL	North America & Europe	1998
IndexIQ	Merger Arbitrage Index	IQMNA	All developed countries	2007
Hennessee Group	Merger Arbitrage Index	HENMGAR	US	1993

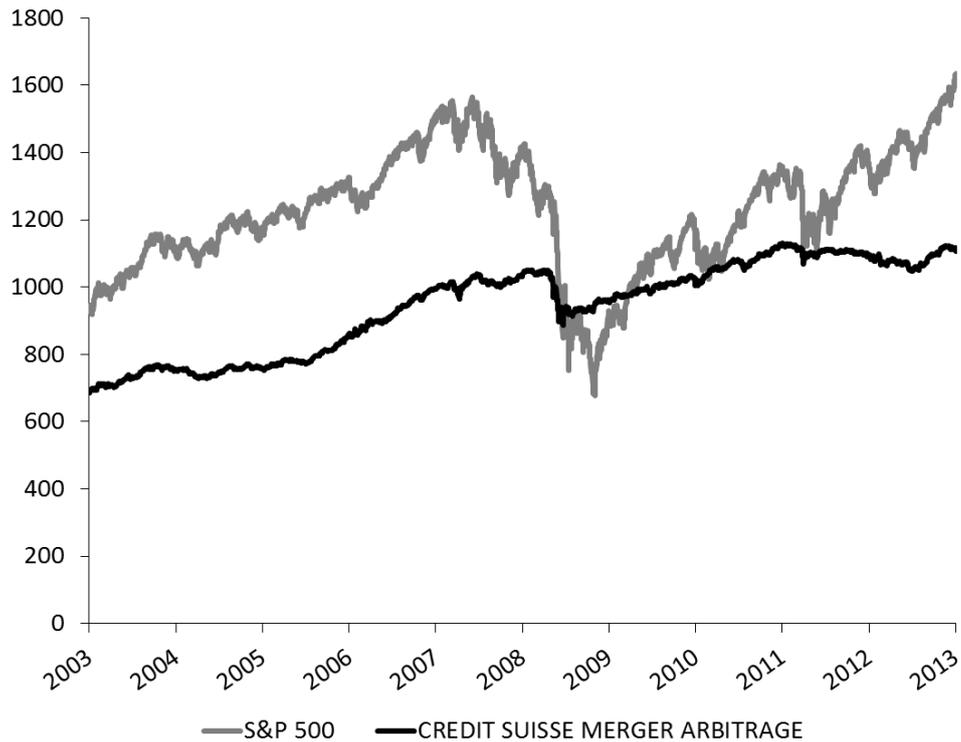
the S&P Merger Arbitrage Index has at any given time a maximum of 40 stocks currently in merger deals and it tracks both cash and stock deals. The deal size must be above \$500 million, there are liquidity possibility requirements and it must be possible to short the acquirer stock. The central properties of these indices are that they exhibit market neutral characteristics, low volatility and low correlation with the market index. These are shared properties of the merger portfolios in this paper.

For private investors it is then a matter of finding ETFs that track these indices to invest in merger arbitrage, in a way to become arbitrageurs themselves. Table 9 presents an overview of ETFs that track the merger arbitrage indices.

**Table 9:** Merger Arbitrage ETFs

ETF provider	ETF	Tracked index	Ticker
Credit Suisse	Merger Arbitrage Index Leveraged ETN	Credit Suisse Merger Arbitrage Liquid Index	CSMB
IndexIQ	IQ Merger Arbitrage ETF	IndexIQ Merger Arbitrage Index	MNA
ProShares	Merger ETF	S&P Merger Arbitrage Index	MRGR

If a private investor were to invest in a merger arbitrage ETF the expectation would be to earn excess returns when adjusting for risk. If one looks at the development of the Credit Suisse Merger Arbitrage Index compared to the S&P 500 composite index one can see how the ETF investment would typically perform. Figure 16 illustrates the difference between a typical merger arbitrage index and the average investor represented by the S& P 500.



**Figure 16:** S& P 500 and Credit Suisse Merger Arbitrage Index

The index has lower volatility and a much steadier development than the S& P 500, and would diversify any portfolio in terms of risk. These ETFs are easily available for investing through the normal trading platforms like Nordnet and Netfonds, making the once elusive “dark arts” of arbitrageurs available for average investors.

# Part VII

## Appendix

### A Calculations

#### Compound annual growth rate (CAGR)

The compound annual growth rate (CAGR) is the geometrical average return across all years. The formula to calculate CAGR is:

$$CAGR = (1 + R_{Month})^{12} - 1$$

#### Standard Deviation

Portfolio risk is defined as uncertainty in expected returns. This is measured with the historical variability in the portfolio returns which deviate from the mean. Standard deviation is used to calculate variability. A high standard deviation indicates high uncertainty. The formula for standard deviation is shown in the following equation:

$$\sigma_{Monthly} = \sqrt{\frac{\sum_{i=1}^{i=n} (r_i - r_{mean})^2}{N}}$$

Usually, the sample standard deviation formula contains n-1 in the denominator. However, the adjustment of -1 is negligible if the data sample is large. In this case, there are 144 months data-points, which should be sufficient for an approximately estimation. Since the portfolio returns are presented in annual terms, the monthly standard deviation is multiplied with the square root of 12, which is the number of monthly observations in a year:

$$\sigma_{Annual} = \sigma_{Monthly} \times \sqrt{12}$$

#### Sharpe Ratio (SR):

$$SR = \frac{R_{Portfolio} - R_f}{\sigma_{Portfolio}}$$

The risk free rate  $R_f$  is estimated using the U.S 3-month Treasury Bill downloaded from Kenneth R. French's homepage.

#### Modigliani's Performance Measure $M^2$

$$M^2 = (SR_{Portfolio} - SR_{Market}) \times \sigma_{Market}$$

## B Benchmarking Merger Arbitrage Portfolios to the CAPM

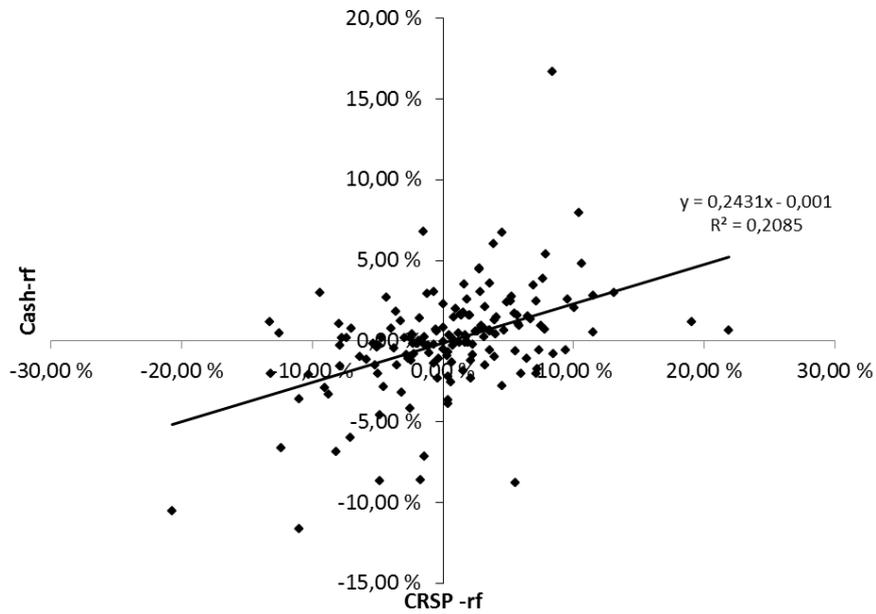


Figure A.1: Value weighted cash portfolio

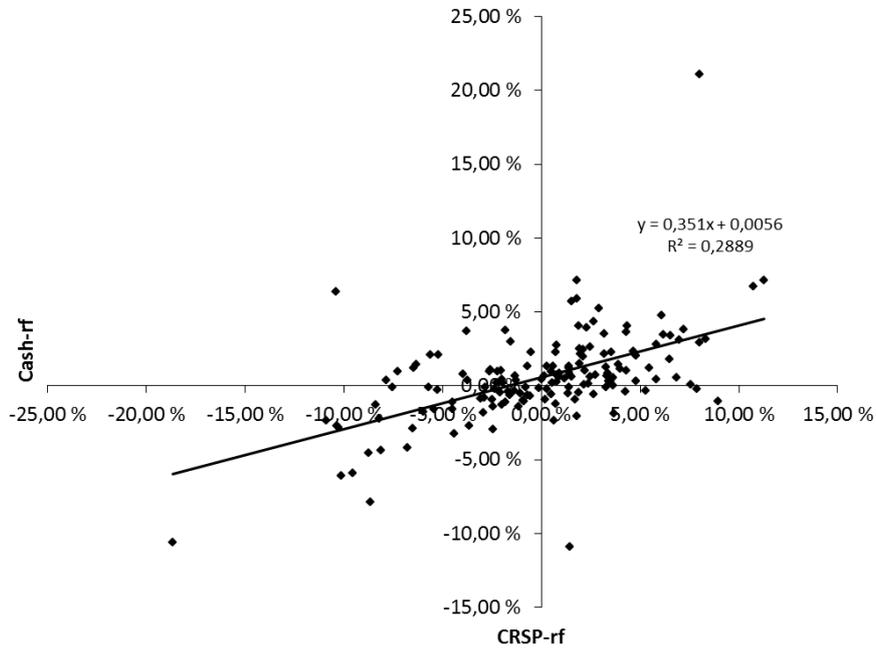


Figure A.2: Equal weighted cash portfolio

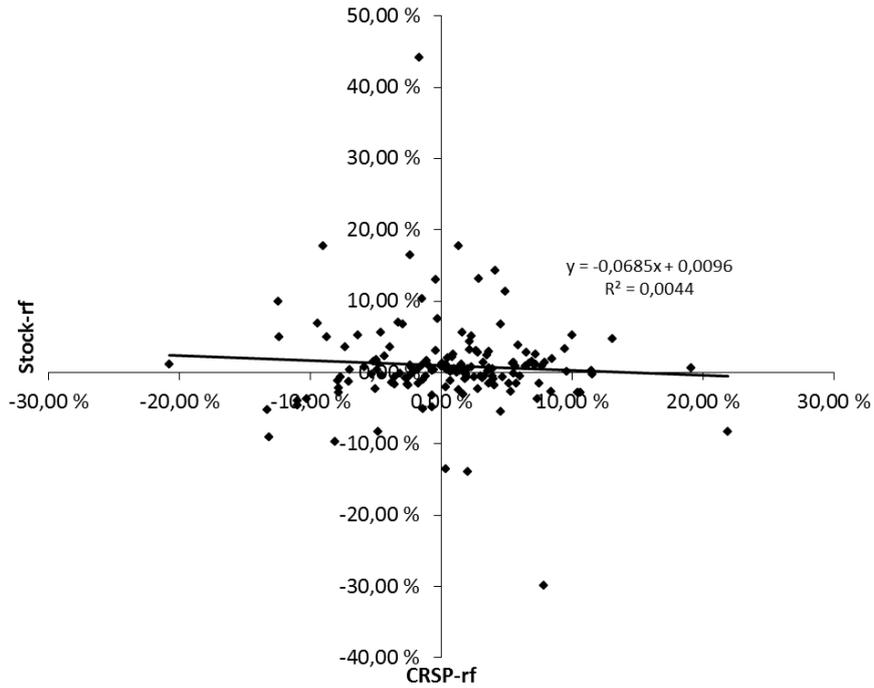


Figure A.3: Value weighted stock portfolio

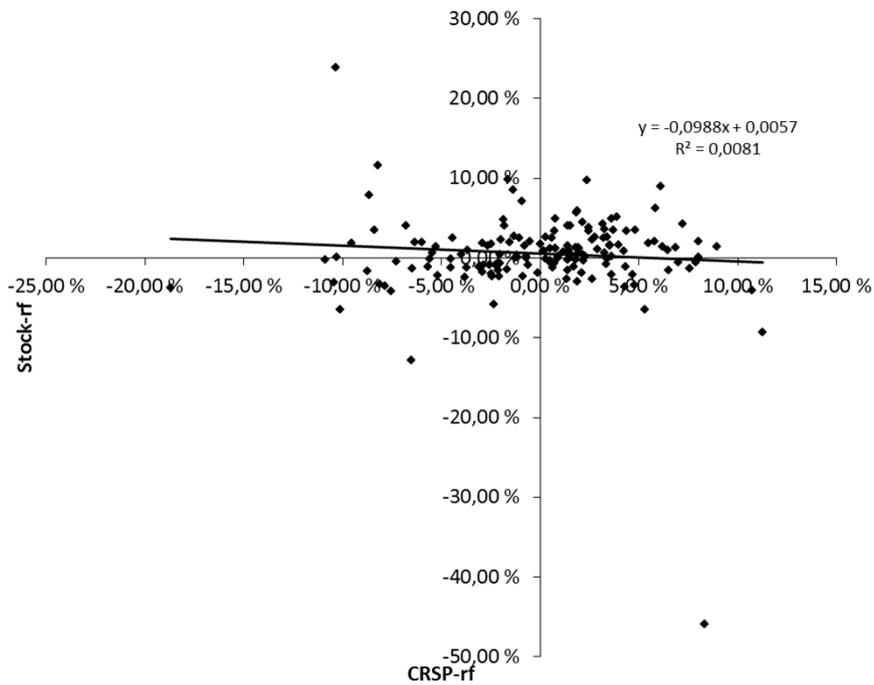


Figure A.4: Equal weighted stock portfolio

**Benchmarking all four merger arbitrage portfolios to the CAPM**

The figure shows clear differences between cash and stock portfolios. While both cash portfolios seem to have a positive correlation to the market, the stock portfolios are almost not correlated to the market at all. All portfolios generate positive alpha, except from the value weighted cash portfolio. The low explanation power,  $R^2$ , to all portfolios suggests that the CAPM is not a good benchmark model for explaining the portfolio returns.

## C CAPM over changing market cycles

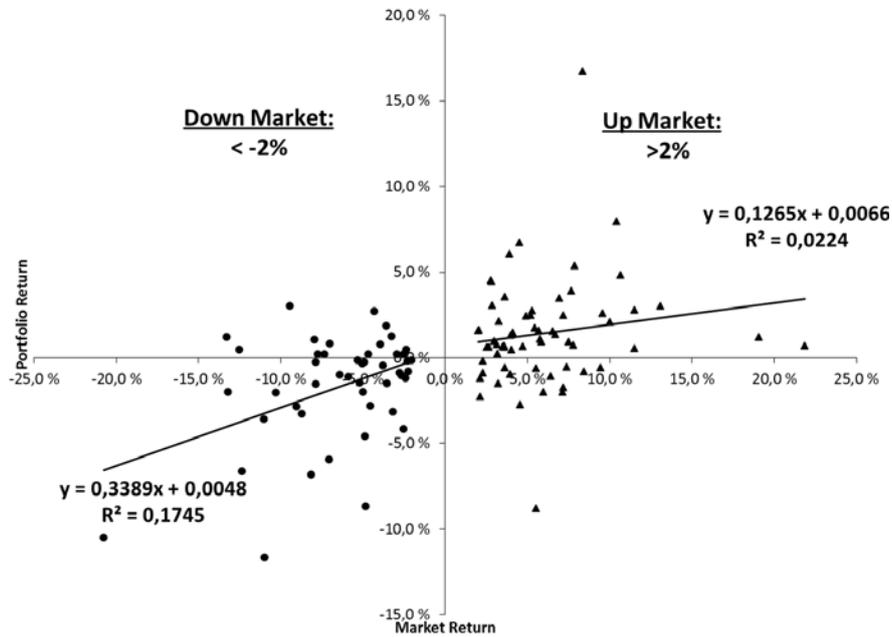


Figure A.5: Value weighted cash portfolio

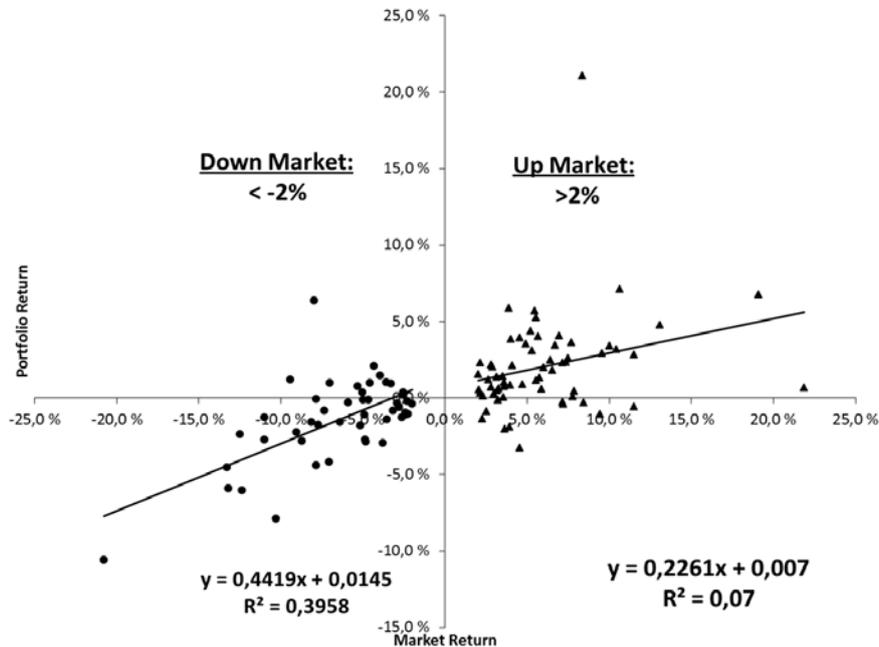


Figure A.6: Equal weighted cash portfolio

### CAPM - Up Market and Down Market:

These figures illustrates the performances of the cash portfolios benchmarked to the CAPM in an appreciating market and a depreciating market. A appreciating market is defined as a condition where the market excess return to the risk free rate is 2%, and a depreciating market has an excess return to the risk free rate of -2%.

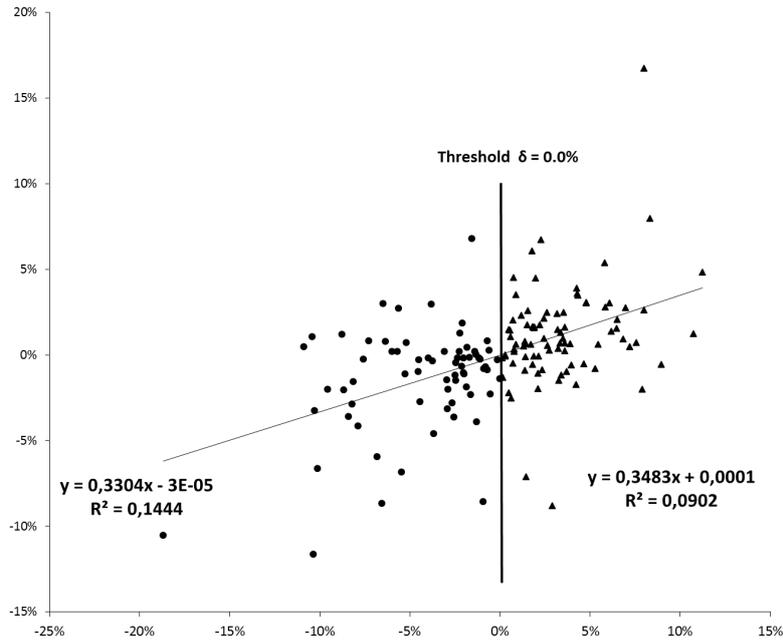
D **Piecewise Linear Model**

Figure A.7: Piecewise linear value weighted cash

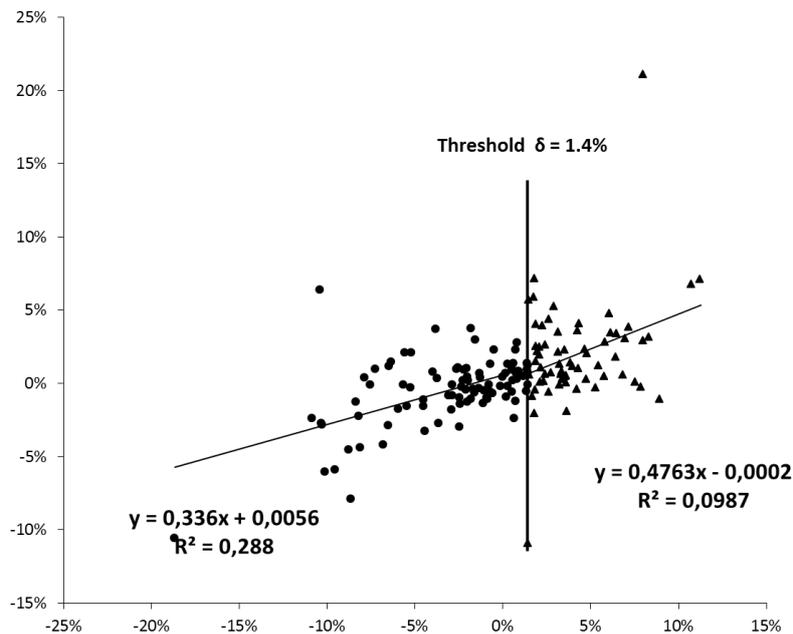


Figure A.8: Piecewise linear equal weighted cash

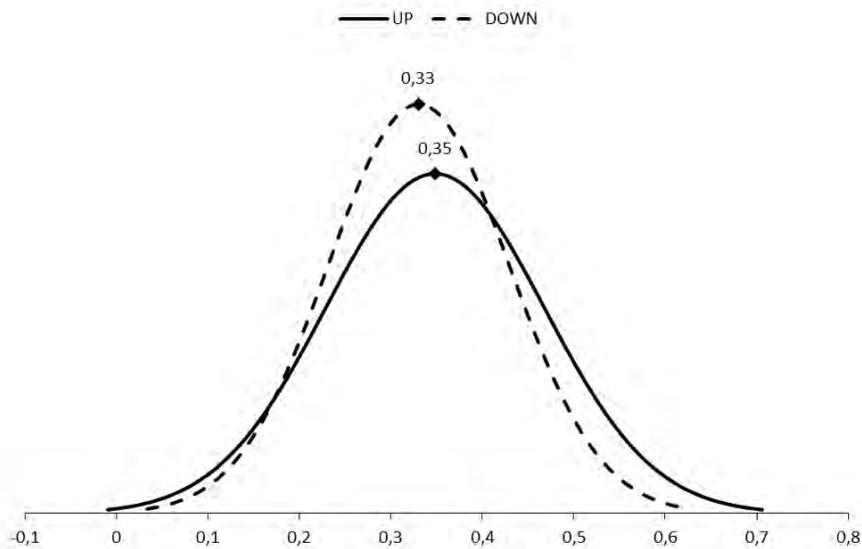
**Merger arbitrage portfolios benchmarked to the piecewise linear model:**

This figure plots the portfolios excess returns against the market excess returns. Both panels use the piecewise linear model as benchmark. Panel A and Panel B depict the performances of the respectively value weighted and equal weighted cash portfolio. The threshold which minimizes the SSE in Panel A is 0%, and 1.4% for Panel B.

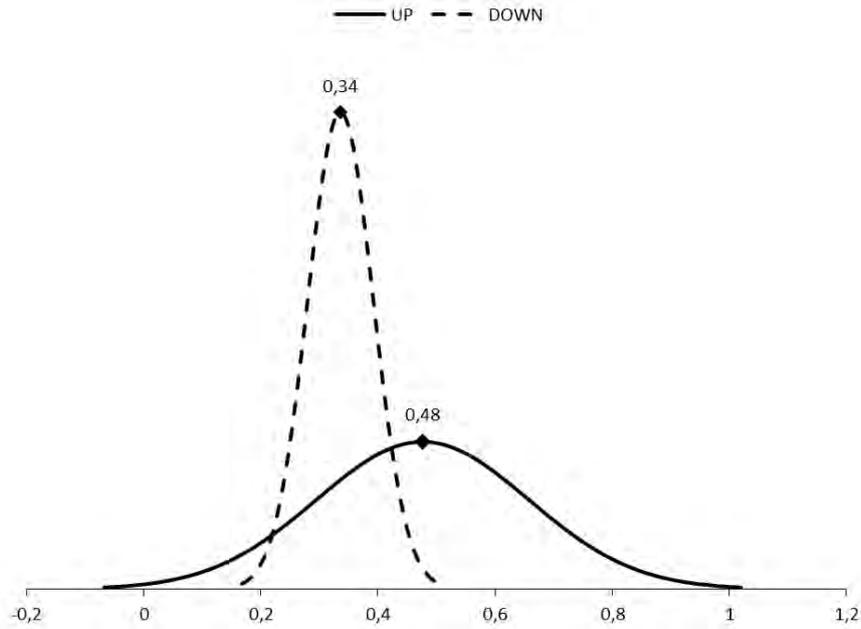
## E T-test: Validating if there is evidence for a piecewise relationship

**Table A.1:** T-test

	Coeffisient	P-value	Std.dev.	Lower 95%	Upper 95%
<b>Value Weighted</b>					
<i>UP</i>					
Alpha	0,01 %	0,9808	0,50 %	-0,98 %	1,00 %
Beta	0,3483	0,0045	0,1192	0,1112	0,5853
<i>DOWN</i>					
Alpha	0,00 %	0,9953	0,55 %	-1,11 %	1,10 %
Beta	0,3304	0,0014	0,0990	0,1327	0,5281
<b>Equal Weighted</b>					
<i>UP</i>					
Alpha	-0,02 %	0,9856	0,87 %	-1,76 %	1,73 %
Beta	0,4763	0,0108	0,1813	0,1140	0,8386
<i>DOWN</i>					
Alpha	0,56 %	0,0426	0,27 %	0,02 %	1,10 %
Beta	0,3360	0,0000	0,0560	0,2247	0,4473



**Figure A.9:** T-test: Value weighted



**Figure A.10:** T-test: equal weighted

A t-test is conducted to validate if there is evidence supporting the piecewise model:

$$\alpha_{Down} \neq \alpha_{Up}$$

$$\beta_{Down} \neq \beta_{Up}$$

The t-test reveals that both the estimated alpha values for the value weighted portfolio in up and down markets are insignificant, with p-values well above 95%. There is therefore not sufficient evidence supporting that the alpha values are different from zero. This alone does not provide any conclusive results for the piecewise model. The t-test indicate that the value weighted portfolio has significant beta values of respectively 0.35 and 0.33 for Up and Down market. However, the t-test shows that the betas are not significantly different from each other. Both beta values are set in between the 95% confidence interval of each other, indicating that the betas may have the same values. Summarized, there is no evidence supporting the piecewise linear model for the value weighted portfolio. With equal beta values and no validation on different alpha values, the result indicates that the piecewise model is similar to the CAPM model.

The results are almost the same for the equal weighted portfolio. The alpha for up market has p-values making it statistically insignificant. However, the alpha for down market is highly significant. The results make it difficult to validate whether both these values are equal or not. Both beta values at 0.47 and 0.33 for the equal weighted portfolio are significantly positive, but there is no evidence supporting that both these values are statistically different.

Figure A.10 show that the beta for the down market lies within the significant limits of the beta for the up market, therefore they are

statistically similar. The conclusion of this test is that the piecewise model can not be confirmed in this case either.

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