Convertible bond arbitrage

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Abstract

Convertible bond arbitrageurs attempt to exploit inefficiencies in the pricing of convertible bonds by purchasing the undervalued security and hedging market and credit risk using the underlying share and credit derivatives. Existing literature indicates that this strategy generates positive abnormal risk adjusted returns. Due to limitations in hedge fund reporting, performance measurement to date has been limited to studies of monthly returns. The use of monthly returns ignores important short run dynamics in price behaviour. This paper addresses this gap in the literature by replicating the core underlying strategy of a convertible bond arbitrageur to produce daily convertible bond arbitrage returns. The core strategy is replicated by constructing an equally weighted and a market capitalisation weighted portfolio of 503 hedged convertible bonds from 1990 to 2002, producing two daily time series of convertible bond arbitrage returns. For out of sample comparison the monthly risk/return characteristics of the portfolios are compared to the risk/return profile for two indices of convertible arbitrage hedge funds. The portfolio returns are then tested against the returns of a buy and hold equity portfolio indicating that the relationship between convertible bond arbitrage and traditional long only equity portfolios is non-linear. Results indicate that convertible bond arbitrage returns are positively correlated with equity markets in severe downturns and negatively correlated with equity markets in severe upturns.

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1. Introduction

Convertible bonds were first issued in the United States in the nineteenth century. A simple convertible bond is a relatively straightforward security. It is simply a regular corporate bond, paying a fixed coupon, with security, maturing at a certain date with an additional feature allowing it to be converted into a fixed number of the issuer's common stock. According to Calamos (2003) this convertible clause was first added to fixed income investments to increase the attractiveness of investing in rail roads of what was then the emerging economy of the United States.

Convertible bonds have grown in complexity and are now issued with features such as put options, call protection, ratchet clauses, step up coupons and floating coupons. Perhaps due to this complexity relatively few individual or institutional investors incorporate convertible into their portfolios. It has been estimated that hedge funds account for seventy percent of the demand for new convertible issues and eighty percent of convertible transactions (see Barkley (2001) and McGee (2003)).

While the overall market for convertible bonds has been growing to an estimated $351.9 billion by the end of December 2003 (BIS, 2004) the hedge fund industry has also been growing at a phenomenal rate. Initially investors were interested in large global/macro hedge funds and the majority of the funds went into these strategies. Fung and Hsieh (2000a) estimate that in 1997 twenty seven large hedge funds accounted for at least one third of the assets managed by the industry. However, since the bursting of the dotcom bubble, perhaps due to a reduction in appetite for risk, investors have been increasingly interested in lower volatility non-directional arbitrage strategies. According to Tremont Advisors, convertible arbitrage total market value grew from just $768m in 1994 to $25.6bn in 2002, an astonishing growth rate of 50% on average per annum.

The literature on securities arbitrage dates back more than seventy years. Weinstein (1931) has been credited as being the first to document securities arbitrage. He provides a discussion of how, shortly after the advent of rights, warrants and convertibles in the 1860's arbitrage was born. Although the hedges described by Weinstein lack mathematical precision they appear to have been reasonably successful. Thorp and Kassouf's (1967) seminal work, valuing convertible bonds by dividing them into fixed income and equity option components, was the first to provide a mathematical approach to appraising the relative under or over valuation of convertible securities. The strategies described by Thorp and Kassouf (1967) provide the foundation for the modern day convertible bond arbitrageur.

Academic literature on dynamic trading strategies has generally focused on modelling the relationship between the returns of hedge funds which follow such strategies and the asset markets and contingent claims on those assets in which hedge funds operate (see Fung and Hsieh (1997), Liang (1999), Schneeweis and Spurgin (1998), Capocci and Hübner (2004) and Agarwal and Naik (2004)). The difficulty with these studies it that the use of hedge fund returns to define the characteristics of a strategy introduces biases as discussed in Fung and Hsieh (2000b). Fung and Hsieh (2001) circumvent these biases by constructing portfolios of look back straddles on various assets which intuitively fit the return characteristics of a trend follower and document a strong correlation between the returns of their portfolios and the returns to trend following commodity trading advisors. Fung and Hsieh (2002) follow a similar methodology to provide evidence of convergence trading in several fixed income strategies. This paper follows Mitchell and Pulvino's (2001) influential study of merger arbitrage, in attempting to recreate an arbitrageur's portfolio.

Rather than using combinations of derivatives which you would expect to intuitively share the characteristics of a trading strategy's returns we create a convertible arbitrage portfolio by combining financial instruments in a manner akin to that ascribed to practitioners who operate that strategy. The portfolio is created by matching long positions in convertible bonds, with short positions in the issuer's equity to create a delta neutral hedged convertible bond position which captures income and volatility. We then combine the delta neutral hedged positions into two convertible bond arbitrage portfolios, one equally weighted, the other weighted by market capitalisation of the convertible issuers' equity. To confirm that our portfolios have the characteristics of a convertible bond arbitrageur we compare the returns of the convertible bond arbitrage portfolio and the returns from two indices of convertible arbitrage hedge funds in a variety of market conditions.

We also examine the relationship between convertible bond arbitrage and a traditional buy and hold equity portfolio, highlighting the non-linear relationship between daily convertible bond arbitrage returns and daily equity returns. In severe market downturns convertible arbitrage exhibits negative returns. We also find evidence that in severe market upturns the daily returns from our equally weighted convertible bond arbitrage portfolio are negatively related to equities. In effect the returns to convertible bond arbitrage are akin to writing naked out of the money put and call options. Although this is not the first study to document the put option like feature in convertible arbitrage returns[1] it is the first to document the negative correlation between daily

[1] Agarwal and Naik (2004) also document this feature of convertible arbitrage using monthly hedge fund asset values.

convertible bond arbitrage and equity market returns in extreme up markets. This negative correlation is explained by the long volatility nature of convertible bond arbitrage. In extreme up markets implied volatility generally decreases having a negative effect on portfolio returns. This is an important finding for any investor considering adding a convertible bond arbitrage fund to an existing buy and hold long only equity portfolio.

The remainder of the paper is organised as follows. In section 2, we identify some potential explanations for the high returns of convertible bond arbitrage. In section 3, we describe a typical convertible bond arbitrage position and provide a thorough description of how our portfolio is constructed. In section 4, we compare the returns of the convertible bond arbitrage portfolio with the returns of two convertible arbitrage hedge fund indices and some market factors. In section 5, we present the results from examining the relationship between convertible bond arbitrage and a traditional buy and hold equity portfolio. Section 6 concludes the paper.

2. Explaining the high returns of convertible bond arbitrage

Analysis of convertible bond arbitrage to date has highlighted the perceived abnormal positive risk adjusted returns that the strategy generates. Ineichen (2000) uses a linear one factor model to document the abnormal returns generated by convertible arbitrage hedge fund indices. Capocci and Hübner (2004), utilising one of the largest hedge fund databases ever used in a study of this nature, document convertible arbitrage funds exhibiting significant positive abnormal returns using both a single factor and multi factor model. Kazemi and Schneeweis (2003) use several alternative models to measure the performance of hedge fund indices and a sample of hedge fund managers. Regardless of the performance measure or sample employed the authors document significantly positive abnormal returns for convertible bond arbitrage.

Several studies have documented inefficiencies in the pricing of the convertible bond market. Amman, Kind and Wilde (2004) find evidence, over an eighteen month period, that twenty one French convertible bonds were underpriced by at least three percent relative to their theoretical values. This result is consistent with King (1986) who found on average that a sample of one hundred and three United States listed convertible bonds were undervalued by almost four percent. There is also evidence that convertible bonds are underpriced at issue. Kang and Lee (1996) identified an abnormal return of one percent from buying convertibles at the issue price and selling at the closing price on the first day of trading. Kang and Lee (1996) conclude that this may be due to the difficulty in estimating the value of the option component in unseasoned issues of convertible debt. However, it has also been suggested that in certain market conditions investment banks speak to hedge funds managers when pricing new issues of convertible debt to gauge hedge fund demand (Khan, 2002). This suggests that new issues may be priced attractively to ensure their success in a market dominated by non-traditional investors.[2]

Agarwal and Naik (2004) document that convertible bond arbitrage hedge funds exhibit written naked put option like returns. The authors identify a stronger correlation between the returns of convertible arbitrage hedge fund indices and equities in down markets. If the returns from convertible bond arbitrage have a non-linear relationship with equities then estimating a traditional one factor model across the entire sample may not capture all of the risk in the strategy. To test for this we subdivide the sample and estimate the basic CAPM developed by Sharpe (1964) and Linter (1965) in a variety of equity market conditions.

$$R_{CB} - R_f = \alpha + \beta_{Mkt}(R_{Mkt} - R_f) + \varepsilon_t \tag{1}$$

Estimating this model in different market conditions also allows us to identify what the effect would be of adding a convertible bond arbitrage portfolio to a traditional buy and hold equity portfolio (using a broad based equity index as a proxy for a buy and hold equity portfolio). Generally investors are interested in the diversification benefits hedge funds bring to a traditional long only equity portfolio. Of particular interest is the behavior of these strategies at market extremes.

3. Description of a convertible bond arbitrage position and portfolio construction

Fundamentally convertible bond arbitrage entails purchasing a convertible bond and selling short the underlying stock creating a delta neutral hedge long volatility position.[3] This is considered the core strategy underlying convertible bond arbitrage. The position is set up so that the arbitrageur can benefit from income and equity volatility.

The idea is to purchase a long convertible and short the underlying stock at the current delta. The hedge neutralizes equity risk but is exposed to interest rate and volatility risk. Income is captured from the convertible coupon and the interest on the short position in the underlying stock. This income is reduced by the cost of borrowing the underlying stock and any dividends payable to the lender of the underlying stock.

The non income return comes from the long volatility exposure. The hedge is rebalanced as the stock price and/or convertible price move. Rebalancing will result in adding or subtracting from

[2] In this study the effects of convertible bond under-pricing at issue is excluded. Positions are included in the portfolio at the closing price of the first day of trading. We acknowledge that this may introduce a negative bias to our portfolio returns relative to hedge fund returns.

[3] The arbitrageur may also hedge credit risk using credit derivatives, although these instruments are a relatively recent development. The short stock position partially hedges credit risk as generally if an issuer's credit quality declines this will also have a negative effect on the issuer's equity.

the short stock position. Transaction costs and the arbitrageur's attitude to risk will affect how quickly the hedge is rebalanced and this can have a large effect on returns.

In order for the volatility exposure to generate positive returns the actual volatility over the life of the position must be greater than the implied volatility of the convertible bond at the initial set up of the hedge. If the actual volatility is equal to the implied volatility you would expect little return to be earned from the long volatility exposure. If the actual volatility over the life of the position is less than the implied volatility at setup then you would expect the position to have negative non-income returns.[4]

Convertible bond arbitrageurs employ a myriad of other strategies. These include the delta neutral hedge, bull gamma hedge, bear gamma hedge, reverse hedge, call option hedges and convergence hedges.[5] However Calamos (2003) describes the delta neutral hedge as "the bread and butter" hedge of convertible bond arbitrage.

Convertible securities are of various different types including traditional convertible bonds, mandatory convertibles and convertible preferred. This study focuses exclusively on the traditional convertible bond as this allows us to use a universal hedging strategy across all instruments in the portfolio. We also focus exclusively on convertible bonds listed in the United States between 1990 and 2002. Convertible securities are listed on most international markets, predominately in the United States, Europe and Japan but also in smaller Asian countries such as Taiwan, Hong Kong and Korea. According to Khan (2002), until recently Japan represented the largest market share of the global convertibles market, yet due to the economic situation there has been a marked decrease in the primary issuance of convertible securities there. With low coupon rates income returns are at a minimum, other than volatility trades, there are few opportunities for convertible arbitrageurs. With the surge in issuance in the United States, due in part to the hostile equity issuance climate since the bursting of the dot com bubble, it can be assumed that a large proportion of convertible arbitrage activity is focused in the United States.

To enable the forecasting of volatility, issuers with equity listed for less than one year were excluded from the sample. Any non-standard convertible bonds and convertible bonds with missing or unreliable data were removed from the sample. The final sample consists of 503 convertible bonds, 380 of which were live at the end of 2002, with 123 dead. The terms of each

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[4] It should be noted that the profitability of a long volatility strategy is dependent on the path followed by the stock price and how it is hedged. It is possible to have positive returns from a position even if actual volatility over the life of the position is less than implied volatility at the set up of the position and vice versa.

[5] For a detailed description of the different strategies employed by convertible arbitrageurs see Calamos (2003).

convertible bond, daily closing prices and the closing prices and dividends of their underlying stocks were included.

Perhaps the most important parameter for calculating the theoretical value of a convertible bond and the corresponding hedge ratio is the estimate of volatility. As convertible bonds are generally of reasonable long maturity it is important to allow for volatility's mean reverting nature and the GARCH(1,1) model is employed. For each convertible bond one estimate of future volatility σ_{n+k}^2 is forecast following Hull (2001). Equation (2) sets out how future volatility was estimated from the inclusion date, day *n* to the redemption date, day *k*, using five years of historical closing prices of the underlying stock up to and including day *n-1*, the day before the bond is included in the portfolio.[6]

$$E(\sigma_{n+k}^2) = V_L + (\alpha + \beta)^k (\sigma_n^2 - V_L) \tag{2}$$

$$\sigma_n^2 = \gamma V_L + \alpha u_{n-1}^2 + \beta \sigma_{n-1}^2 \tag{3}$$

subject to

$$\gamma + \alpha + \beta = 1 \tag{4}$$

where σ_n^2 is the estimate of volatility on day *n*, V_L is the long run variance rate, u_{n-1}^2 is the squared percentage change in the market variable between the end of day *n – 2* and the end of day *n-1* and σ_{n-1}^2 is the estimate of volatility on day *n -1*. The parameters α and β are estimated to maximise the objective function (5).

$$\sum_{i=1}^{m} \left(-\ln(v_i) - \frac{u_i^2}{v_i} \right) \tag{5}$$

where v_i is the estimate of the variance rate σ_i^2, for day *i* made on day *i – 1*.

In order to initiate a delta neutral hedge for each convertible bond we need to estimate the delta for each convertible bond on the trading day it enters the portfolio. The delta estimate is then multiplied by the convertible bond's conversion ratio to calculate Δ_{it} the number of shares to be sold short in the underlying stock (the hedge ratio) to initiate the delta neutral hedge. On the following day the new hedge ratio, Δ_{it+1}, is calculated, and if $\Delta_{it+1} > \Delta_{it}$ then $\Delta_{it+1} - \Delta_{it}$ shares

[6] For some equities in the sample five years of historic data was unavailable. In this situation volatility was forecast using available data, restricted to a minimum of one year. Only equities with a minimum of one year of historical data were included in the original sample.

are sold, or if $\Delta_{it+1} < \Delta_{it}$, then $\Delta_{it} - \Delta_{it+1}$ shares are purchased maintaining the delta neutral hedge.[7]

Daily returns were calculated for each position on each trading day up to and including the day the position is closed out. A position is closed out on the day the convertible bond is delisted from the exchange. Convertible bonds may be delisted for several reasons. The company may be bankrupt, the convertible may have expired or the convertible may have been fully called by the issuer.

The returns for a position *i* on day *t* are calculated as follows.

$$R_{it} = \frac{P_{it}^{CB} - P_{it-1}^{CB} + C_{it} - \Delta_{it-1}(P_{it}^{U} - P_{it-1}^{U} + D_{it} - r_{t-1}P_{it-1}^{U})}{P_{it-1}^{CB} + \Delta_{it-1}P_{it-1}^{U}} \tag{6}$$

Where R_{it} is the return on position *i* at time *t*, P_{it}^{CB} is the convertible bond closing price at time *t*, P_{it}^{U} is the underlying equity closing price at time *t*, C_{it} is the coupon payable at time *t*, D_{it} is the dividend payable at time *t* and Δ_{it-1} is the delta neutral hedge ratio for position *i* at time *t – 1*. Daily returns are then compounded to produce a position value index for each hedged convertible bond over the entire sample period.

Table I presents a summary of the individual convertible bond arbitrage return series. 2001, 2002 and 1990 are the years when the majority of new positions were added. In 1990 sixty six new positions were added. Fifty five of these positions were convertible bonds which were listed prior to 1990, and eleven were new listings. The average position duration was 11.6 years, and the average position return was 70.1%, 4.7% per annum. The maximum return on an individual position was 460.7% and the minimum position return was -95.6%. In 2001 two hundred and thirty five new positions were added with average position duration of 1.6 years and average position return of 6% per annum. 1997, 1998 and 1999 are the years when the fewest new positions were added to the portfolio. In 1997 and 1998 one new position was added in each year, and in 1999 only four new positions were added. The worst returns were generated by positions added in 1999 and 2000, with average annual returns of -2.25% and -2% respectively. The closing out of positions is spread reasonably evenly over the sample period, with the exception of 2002 where the majority of positions were closed out when the portfolio is liquidated at 31st December 2002.

[7] As discussed earlier, due to transaction costs, an arbitrageur would not normally rebalance each hedge daily. However to avoid making ad hoc decisions on the timing of the hedge, we rebalance daily and exclude transaction costs from our study.

Next we combine the asset values of the individual positions into two convertible bond arbitrage portfolios[8]. The first portfolio is an equally weighted portfolio calculated assuming an equal initial investment in each hedged convertible bond position. In the second portfolio the individual positions are weighted by the market capitalization of the issuer's equity. This portfolio is then focused on the bigger issues. These bigger convertible bond issues should be more liquid and of a higher credit quality and intuitively one would expect fewer arbitrage opportunities.

The value of the two convertible bond arbitrage portfolios on a particular date is given by the formula.

$$V_t = \frac{\sum_{i=1}^{i=N_t} W_{it} PV_{it}}{F_t} \qquad (7)$$

Where V_t is the portfolio value on day *t*, W_{it} is the weighting of position *i* on day *t*, PV_{it} is the value of position *i* on day *t*, F_t is the divisor on day *t* and N_t is the total number of position on day *t*. For the equally weighted portfolio W_{it} is set equal to one for each live hedged position. For the market capitalization index the weighting for position *j* is calculated as follows.

$$W_{jt} = \frac{MC_{jt}}{\sum_{i=1}^{i=N_t} MC_{it}} \qquad (8)$$

Where W_{jt} is the weighting for position *j* at time *t*, N_t is the total number of position on day *t* and MC_{it} is the market capitalization of issuer *i* at time *t*. To avoid daily rebalancing of the market capitalization weighted portfolio the market capitalizations on the individual positions are updated at the end of each calendar month. However, if a new position is added or an old position is removed during a calendar month then the portfolio is rebalanced.

On the inception date of both portfolios, the value of the divisor is set so that the portfolio value is equal to 100. Subsequently the portfolio divisor is adjusted to account for changes in the constituents or weightings of the constituent positions in the portfolio. Following a portfolio change the divisor is adjusted such that equation (9) is satisfied.

[8] We employ a similar methodology to that utilized in the CSFB Tremont Hedge Fund Index calculation described in CSFB Tremont (2002).

$$\frac{\sum_{i=1}^{i=N_t} W_{ib} PV_i}{F_b} = \frac{\sum_{i=1}^{i=N_t} W_{ia} PV_i}{F_a} \tag{9}$$

Where PV_i is the value of position *i* on the day of the adjustment, W_{ib} is the weighting of position *i* before the adjustment, W_{ib} is the weighting of position *i* after the adjustment, F_b is the divisor before the adjustment and F_a is the divisor after the adjustment.

Thus the post adjustment index factor F_a is then calculated as follows.

$$F_a = \frac{F_b x \sum_{i=1}^{i=N_t} W_{ib} PV_i}{\sum_{i=1}^{i=N_t} W_{ia} PV_i} \tag{10}$$

As the margins on the strategy are small relative to the nominal value of the positions convertible bond arbitrageurs usually employ leverage. Calamos (2003) and Ineichen (2000) estimate that for an individual convertible arbitrage hedge fund this leverage may vary from two to ten times equity. However, the level of leverage in a well run portfolio is not static and varies depending on the opportunity set and risk climate. Khan (2002) estimates that in mid 2002 convertible arbitrage hedge funds were at an average leverage level of 2.5 to 3.5 times, whereas he estimates that in late 2001 average leverage levels were approximately 5 to 7 times.

From a strategy analysis perspective it is therefore difficult to ascribe a set level of leverage to our portfolio. Changing the leverage applied to the portfolio has obvious effects on returns and risk as measured by standard deviation. It should also be noted when estimating the capital asset pricing model that as leverage increases, the estimate of alpha will also increase. We decide to apply leverage of two times to both our portfolios as this produces portfolios with a similar average return to the HFRI Convertible Arbitrage Index and the CSFB Tremont Convertible Arbitrage Index.[9]

Table 2 presents annual return series for the equally weighted and market capitalization weighted convertible bond arbitrage portfolios, the CSFB Tremont Convertible Arbitrage Index, the HFRI Convertible Arbitrage Index, the Russell 3000 Index, the Merrill Lynch Convertible Securities Index and the risk-free rate. All annual returns are obtained by compounding monthly returns. Annual standard deviations are obtained by multiplying the standard deviation of monthly returns

[9] To ensure the level of leverage is not an important factor in our results we apply alternative levels of leverage to the portfolio from 1.5 to 5 times. Results were not materially different than for the 2 times leveraged portfolio and, to avoid repetition, are not reported.

by $\sqrt{12}$. The CSFB Tremont Convertible Arbitrage Index is an index of convertible arbitrage hedge funds weighted by assets under management. The HFRI Convertible Arbitrage Index is an equally weighted index of convertible arbitrage hedge funds. The Russell 3000 Index is a broad based index of United States equities and the Merrill Lynch Convertible Securities Index is a broad based index of convertible securities. The risk free rate of interest is represented by the yield on a three month treasury bill.

The two highest returning years for the convertible bond arbitrage portfolios, 1991 and 1995 correspond with the two highest returning years for the Russell 3000, the Merrill Lynch convertibles index and the HFRI hedge fund index. In 1991 the equally weighted index returned +17.2%, the market capitalization weighted index returned 17.43% and the HFRI index returned +16.2%. Although, obviously a good year for convertible arbitrage, the strategy was outperformed by a simple buy and hold equity (+26.4%) or convertible bond (+21.6%) strategy. 1995 produced strong returns with the equally weighted portfolio +23.2%, the market capitalization weighted portfolio +16.9%, the HFRI index +18.1% and the CSFB Tremont hedge fund index +15.3%. Again the strategy was outperformed by a simple buy and hold equity strategy (+29%) but outperformed the general convertible securities market.

The worst returning years for the equally weighted convertible bond arbitrage portfolio, 1990 and 1994[10], corresponds with negative returning years for the Russell 3000 and Merrill Lynch convertible securities index. The HFRI index had a below average return of 2.14% in 1990 and had its lowest return of -3.8% in 1994. The CSFB Tremont index does not date back to 1990 but in 1994 it had also had its lowest return of -8.4%. The two lowest returning years for the market capitalization weighted index were 1990 and 1992. In 1998 the CSFB Tremont index also had a negative return of -4.5%, however none of the other indices or portfolios had negative returns.

More recently in 2000, 2001 and 2002, after the bursting of the dotcom bubble, both of the convertible bond arbitrage portfolios (returning an average 7.3% for the equally weighted and 5.52% for the market capitalization weighted), the HFRI Convertible Arbitrage Index and the CSFB Tremont Convertible Arbitrage Hedge Fund Index have performed well. During this period the Russell 3000 and the Merrill Lynch Convertible Securities Index had an average annual return of -16.1% and -10.26%. This performance has demonstrated the obvious diversification benefits of the convertible bond arbitrage strategy but it should be noted that the sample period has been characterized by rapidly falling interest rates and an increase in convertible issuance. In the current hostile equity issuance environment there has been an

[10] Ineichen (2000) notes that 1994 was not a good year for convertible arbitrage characterised by rising US interest rates.

increase in issues of convertible bonds in the United States which provides more opportunities for the convertible bond arbitrageur. Intuitively, it would be expected that in such an environment convertible bond arbitrage returns would be positive.

Looking at the distribution of the monthly returns, both the equal weighted and the market capitalization weighted portfolios display negative skew of -1.23 and -0.77 respectively. The CSFB Tremont index and the HFRI index also display negative skew. This is consistent with other studies (see Agarwal and Naik (2004) and Kat and Lu (2002)). The monthly returns from the equal weighted and the market capitalization weighted portfolios also display positive kurtosis. The estimates of kurtosis appear to be high relative to the two hedge fund indices however Kat and Lu (2002) find that the returns of the average individual hedge fund exhibit excess kurtosis relative to portfolios or indices of hedge funds.

4. Out of sample comparison

In order to validate our two convertible arbitrage portfolios this section of the paper more formally explores their correlation with two hedge fund indices and market factors over a variety of market conditions. While demonstrating the robustness of our two portfolios this also allows us to observe the behavior of convertible bond arbitrage in different market conditions. As highlighted earlier investors have become interested in lower volatility non-directional arbitrage strategies because of the diversification benefits they bring to their portfolios in a low return equity environment. It is therefore important to see if this diversification benefit is constant or varies depending on market conditions.

Table 3 presents the correlation coefficients between the monthly returns on the equally weighted convertible bond arbitrage portfolio (Equal Portfolio), the market capitalization weighted portfolio (MC Portfolio), the CSFB Tremont Convertible Arbitrage Index (CSFB Tremont Convertible), the HFRI Convertible Arbitrage Index (HFRI Convertible), the Russell 3000, the Merrill Lynch Convertible Securities Index (ML Convertible Securities) and the VIX Index (VIX). The VIX index is an equity volatility index calculated by the Chicago Board Option Exchange. It is calculated by taking a weighted average of the implied volatilities of 8 30-day call and put options to provide an estimate of equity market volatility. As the CSFB Tremont data is unavailable prior to 1994 the correlation coefficients cover returns from January 1994 to December 2002[11].

[11] Correlation coefficients were estimated for the entire sample period 1990 to 2002 for all variables excluding the CSFB Tremont data. There was no change in the sign or significance of any of the coefficients.

The equal weighted portfolio, the market capitalization weighted portfolio, the CSFB Tremont index and the HFRI index are all positively correlated with the Merrill Lynch convertible index. With the exception of the CSFB Tremont index they are also all positively correlated with equities. The equal weighted portfolio is positively correlated with the market capitalization weighted portfolio, the CSFB Tremont index and the HFRI index over the entire sample period. Surprisingly, the market capitalization weighted portfolio is not correlated with the CSFB Tremont index, although it is positively correlated with the HFRI index. Monthly returns on the VIX are negatively correlated with both the equal weighted portfolio and the market capitalization weighted portfolio indicating that they are both negatively correlated with implied volatility. Neither of the hedge fund indices has any correlation with the VIX. This is surprising as convertible bond arbitrage is a long volatility strategy.

Next we ranked our sample of one hundred and eight monthly returns by equity market return and subdivided the sample into four sub-samples of twenty seven months. State 1, which is presented in panel A of table 4, covers the correlations between convertible bond arbitrage returns and market factors in the twenty seven lowest equity market returns (ranging from -16.8% to -2.6%). The equal weighted portfolio and the two hedge fund indices are positively correlated with the Merrill Lynch convertible securities index in this sub-sample. The equal weighted portfolio is positively correlated with the two hedge fund indices and the three are all negatively correlated with the VIX. In this sub-sample the market capitalization portfolio is not correlated with any of the other return series or market factors and the equal weighted portfolio appears to share more characteristics than the market capitalization weighted portfolio with the hedge fund indices.

Panel B of table 4 looks at the correlations between convertible bond arbitrage returns and market factors in the twenty seven next lowest equity market returns (ranging from -2.2% to +1.3%). None of our convertible arbitrage portfolios or indices has any correlation with equities in this sub-sample. Both the CSFB Tremont and HFRI indices are correlated with the Merrill Lynch convertible securities indices and the VIX index. The equal weighted portfolio is positively correlated with the market capitalization weighted portfolio and the two hedge fund indices are positively correlated.

Panel C of table 4 looks at the correlations between convertible arbitrage returns and market factors in the twenty seven next lowest equity market returns (ranging from +1.4% to +3.9%). The two hedge fund indices are positively correlated with the Merrill Lynch convertible securities index and each other. The market capitalization weighted portfolio is also correlated with the HFRI index.

The final sub-sample, looking at the correlations between convertible arbitrage returns and market factors in the twenty seven highest equity market returns (ranging from +4.0% to 7.6%) is presented in Panel D of table 4. The equal weighted portfolio is positively correlated with the market capitalization weighted portfolio and the HFRI index. Both the CSFB Tremont and HFRI indices are positively correlated with the VIX in this sample period which is negatively related to equity market returns. This indicates that in periods of high equity market returns, the change in volatility is negative and hedge fund returns are affected. Neither of these factors affects our two portfolios of convertible bond arbitrage returns.

Based on the evidence presented so far, the two hedge fund indices appear to share many of the characteristics of our convertible bond arbitrage portfolios. Over the entire sample period they are all positively correlated, and when the sample is subdivided they share similar characteristics. Perhaps the hedge fund indices share more characteristics with the equal weighted portfolio than the market capitalization weighted portfolio particularly in market downturns. This indicates that convertible arbitrageurs do not weight positions in their portfolio according to the size of the issuer perhaps due to greater arbitrage opportunities in the relatively smaller issues. It is also interesting to note that convertible arbitrage is positively correlated with the underlying convertible securities market in downturns and there are traces of a negative relationship, due to decreases in volatility, with equity market returns in market upturns.

5. Results of the CAPM regressions

Our analysis so far indicates that the relationship between convertible arbitrage and equity market returns is non-linear. As discussed previously we are not the first authors to come to this conclusion. However, studies to date have been restricted to analyzing relatively low frequency monthly returns data. In this section of the paper we report the results of estimating the basic CAPM using our two portfolios of daily convertible arbitrage returns. Estimating the CAPM using daily data allows us to examine the short run dynamics in the relationship between a buy and hold equity portfolio (using the Russell 3000 as a proxy) and convertible bond arbitrage. This is particularly important for an investor considering combining a convertible bond arbitrage strategy with a traditional buy and hold equity portfolio. We initially estimate the model using the entire sample period and then subdivide according to ranked equity market returns.

Table 5 reports the results from modeling the returns from the equal weighted convertible arbitrage portfolio. In table 5, R_{CB} is the daily return on the equal weighted convertible bond arbitrage portfolio R_{Mkt} is the daily return on the Russell 3000 stock index and R_f is the daily yield on a three month treasury bill. Table 6 reports the results from modeling the returns from the market capitalization weighted convertible arbitrage portfolio. The variables in table 6 are identical to table 5 with the exception of R_{CB}, which is the daily market capitalization weighted convertible bond arbitrage portfolio return.

Both tables are organized as follows. Panel A covers the entire sample, panel B reports the results when restricting the sample to those observations when the equity risk premium is within one standard deviation of the mean, panel C reports the results when the sample is restricted to those observations at least one standard deviation less than the mean, panel D reports the results when the sample is restricted to more than one standard deviation greater than the mean, panel E restricts the sample to at least two standard deviations less than the mean and panel F restricts the sample to more than two standard deviations greater than the mean.

Looking first at table 5, panel A we can see that over the entire sample period the CAPM indicates that convertible bond arbitrage has a positive equity market beta of 0.048 and a significant alpha of 0.000117, indicating a positive abnormal return, assuming the CAPM is correct, of approximately 3% per annum. Panel B of table 5 shows the relationship between convertible bond arbitrage and equity market returns when the equity risk premium is less than one standard deviation from the mean. Assuming the equity risk premium is normally distributed, this represents approximately 68.3% of trading days or 174 days per year[12]. Again beta is approximately 0.05 and alpha is a little lower at 0.000111.

Panel C of table 5 reports the relationship when equity risk premium is at least one standard deviation less than the mean, about 40 trading days per annum. The beta coefficient increases to 0.083 and the adjusted R^2 also increases, indicating that the relationship between convertible arbitrage and equity returns is stronger on these days. Panel D reports the results of the regression when equity risk premium is more than one standard deviation greater than the mean, again about 40 trading days per annum. In this sub-sample there is little relationship between convertible bond arbitrage and equities.

Panel E of the table reports the results from the CAPM when the sample is restricted to those days when the equity risk premium is at least two standard deviations less than the mean. This is relatively infrequent, about 2.3% of trading days. Like in panel C the regressions explanatory power has increased (adjusted R^2 of 9.2%) and the convertible arbitrage beta has increased to 0.125. Finally panel F reports the results from the regression when the sample is restricted to those days when the equity risk premium is more than two standard deviations greater than the

[12] Calculations here and elsewhere assume 255 trading days per year.

mean. Here we find evidence to support our observations in the previous section that convertible arbitrageurs appear to suffer in periods of extreme positive equity market performance. In these extremely positive days long volatility strategies such as convertible bond arbitrage typically suffer.

Table 6 reports the results from the market capitalization weighted portfolio. The findings are similar to those reported for the equal weighted portfolio with one exception. In extreme positive equity market performance the market capitalization weighted portfolio has no relationship with equities. It does not share the negative relationship documented in panel F of table 5. As this portfolio is weighted according to market capitalization of the issuer's equity the explanation for this difference may be that the effect of falling volatility has more of an affect on the convertible bonds of smaller issuers. However, as discussed in section 4, the equal weighted portfolio shares more characteristics with our two hedge fund indices and both these indices had a positive correlation with volatility in the top quartile of monthly equity returns.

To provide a closer examination of this effect we look in table 7 at the estimation of the CAPM using the equally weighted portfolio limiting the sample to those days when the equity risk premium is more than two and a half standard deviations form its mean. This represents a relatively infrequent seven trading days per year but from an investors perspective these may be the most important. Panel A looks at those days when the equity risk premium is at least two and a half standard deviations less than its mean. Like in panel C and E of tables 5 the explanatory power of the regression is higher than for the entire sample (adjusted R^2 of 13.7%) and the convertible bond arbitrage beta has again increased, to 0.137. Panel B of table 7 looks at those days when the equity risk premium is at least two and a half standard deviations greater than its mean and the results are striking. The explanatory power of the regression is high with an adjusted R^2 of 11.9%, and the beta is -0.267, providing further evidence of the negative relationship between convertible bond arbitrage and equity returns in extremely positive equity markets.

6. Conclusion

Our analysis of convertible bond arbitrage has provided some useful evidence on the characteristics of this dynamic trading strategy. We combined long positions in convertible bonds with short positions in the common stock of the issuer to create individual delta neutral hedged convertible bonds in a manner consistent with an arbitrageur capturing income. These individual positions were then dynamically hedged on a daily basis to capture volatility and maintain a delta neutral hedge. We then combined these positions into two convertible bond arbitrage portfolios and demonstrated that the monthly returns of our convertible bond arbitrage portfolio were positively correlated with two indices of convertible arbitrage hedge funds.

Across the entire sample period our two portfolios had market betas of between 0.048 and 0.061. Assuming the CAPM is correct our equal weighted portfolio appears to generate abnormal positive returns of 3% per annum. However, we also demonstrate that the relationship between daily convertible bond arbitrage returns and a traditional buy and hold equity portfolio is non-linear. In normal market conditions, when the equity risk premium is within one standard deviation of its mean our two portfolios have market betas of between 0.049 and 0.053. When we look at extreme negative equity market returns (at least two standard deviations below the mean) these betas increase to 0.125 and 0.126 for the equal weighted portfolio and the market capitalization weighted portfolio respectively. This indicates that on the average eight days per annum of extreme negative equity market returns convertible arbitrage will exhibit a large increase in market risk.

Perhaps most interesting is our finding that in extreme positive equity markets an equal weighted convertible bond arbitrage portfolio will exhibit a negative relationship with a traditional buy and hold portfolio. This is due to the drop in implied volatility associated with such market conditions and is an important factor for any investor considering the addition of a convertible bond arbitrage portfolio or fund to a traditional long only equity portfolio.

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Table 1
Sample summary

This table presents a summary of the individual convertible bond hedges constructed in this paper. Position duration is measured as the number of trading days from the addition of the hedged convertible position to the portfolio to the day the position is closed out. Max position return is the maximum cumulated return of a position from the date of inclusion to the date the position is closed out. Min position return is the minimum cumulated return earned by a position from the date of inclusion to the date the position is closed out. Average position return is the average cumulated return of a position from the date of inclusion to the date the position is closed out. Number of positions closed out is the number of positions which have been closed during a year.

Year	Number of New Positions	Average Position Duration (Yrs)	Max Position Return %	Min Position Return %	Average Position Return %	Number of Positions Closed out
1990	66	11.6	460.7	(95.6)	70.1	
1991	9	9.8	127.5	7.9	51.6	
1992	11	10.1	154.9	(59.5)	20.5	1
1993	10	9.7	88.1	1.26	39.6	2
1994	27	8.3	178	(99.1)	51.4	2
1995	33	6.8	453	(85.5)	46.7	2
1996	10	6.9	194.4	2.9	52.5	14
1997	1	5.4	22.2	22.2	22.2	12
1998	1	5	1	1	1	11
1999	4	3.5	24.1	(69.6)	(7.7)	8
2000	15	2.3	80.7	(85.5)	(4.6)	4
2001	235	1.6	344.3	(96.9)	9.81	16
2002	81	0.27	58.7	(29.6)	0.9	431
Complete Sample	503					503

Table 2
Annual convertible bond arbitrage return series

This table presents the annual return series for the equally weighted and market capitalization weighted convertible bond arbitrage portfolios, the CSFB Tremont Convertible Arbitrage index, the HFRI Convertible Arbitrage Index, the Russell 3000 Index, the Merrill Lynch Convertible Securities Index and the risk-free rate. All annual returns are obtained by compounding monthly returns. Annual standard deviations are obtained by multiplying the standard deviation of monthly returns by $\sqrt{12}$.

Year	Equally Weighted (%)	Mkt Cap Weighted (%)	CSFB Tremont Index (%)	HFRI CA Index (%)	Russell 3000 (%)	Merrill Lynch CB Index (%)	Risk Free Rate (%)
1990	-17.04	0.20		2.14	-9.13	-14.43	7.75
1991	17.19	17.43		16.21	26.36	21.63	5.54
1992	11.12	-4.09		15.14	6.38	14.70	3.51
1993	8.30	5.63		14.17	7.82	12.67	3.07
1994	1.89	0.70	-8.41	-3.80	-2.51	-12.33	4.37
1995	23.16	16.88	15.33	18.11	28.95	17.00	5.62
1996	12.60	5.35	16.44	13.59	17.55	8.63	5.15
1997	13.76	14.31	13.52	11.98	25.83	13.12	5.20
1998	3.76	10.95	-4.51	7.48	20.15	3.94	4.91
1999	4.37	0.57	14.88	13.47	17.75	33.17	4.78
2000	5.80	7.05	22.82	13.54	-8.90	-15.51	6.00
2001	7.03	6.02	13.61	12.55	-13.49	-7.13	3.48
2002	8.99	3.50	2.32	8.68	-25.89	-8.15	1.64
Mean	7.76 (9.04)	6.50 (7.26)	9.74	11.02 (10.62)	6.99 (6.61)	5.18 (3.64)	
Standard Deviation	5.89 (4.39)	7.14 (5.46)	4.88	3.37 (3.56)	15.41 (16.37)	12.51 (13.52)	
Skew	-1.23	-0.77	-1.69	-1.39	-0.73	-0.29	
Kurtosis	6.54	6.94	4.38	3.35	1.00	1.92	

*****To aid comparison with the CSFB Tremont Convertible Arbitrage Index figures in parenthesis are the average annual rate of return and annual standard deviation of returns from January 1994 to December 2002.

Table 3
Correlation between monthly convertible bond arbitrage returns and market factors

This table presents correlation coefficients for monthly returns on the equally weighted (Equal Portfolio) and market capitalization weighted (MC Portfolio) convertible bond arbitrage portfolios, the CSFB Tremont Convertible Arbitrage Index, the HFRI Convertible Arbitrage Index, and market factor returns. The Russell 3000 is a broad based index of US equities. The Merrill Lynch Convertible Securities Index is an index of US convertible securities and the VIX is an equity volatility index calculated by the Chicago Board Option Exchange. It is calculated by taking a weighted average of the implied volatilities of 8 30-day call and put options to provide an estimate of equity market volatility.

	Russell 3000	ML Convertible Securities	VIX	Equal Portfolio	CSFB Tremont Convertible	MC Portfolio	HFRI Convertible
Russell 3000	1.00						
ML Convertible Securities	0.73***	1.00					
VIX	-0.64***	-0.42***	1.00				
Equal Portfolio	0.45***	0.51***	-0.28**	1.00			
CSFB Tremont Convertible	0.17	0.29**	0.04	0.32***	1.00		
MC Portfolio	0.37***	0.34***	-0.25**	0.56***	0.17	1.00	
HFRI Convertible	0.37***	0.49***	-0.13	0.50***	0.80***	0.33***	1.00

*, **, *** indicate coefficient is significantly different from zero at the .05, .01 and .001 levels respectively.

Table 4
Correlation between monthly convertible bond arbitrage returns and market factors in different states of the economy

This table presents correlation coefficients for monthly returns on the equally weighted (Equal Portfolio) and market capitalization weighted (MC Portfolio) convertible bond arbitrage portfolios, the CSFB Tremont Convertible Arbitrage Index, the HFRI Convertible Arbitrage Index, and market factor returns in different states of the economy. The sample was ranked according to equity market returns and then divided into 4 equal sized groups with lowest returns in state 1, next lowest returns in state 2, highest returns in state 4 and next highest returns in state 3. Panels A to D represent correlations coefficients between CBA returns and market factors in each state, 1-4.

Panel A: State 1 returns

	Russell 3000	ML Convertible Securities	VIX	Equal Portfolio	CSFB Tremont Convertible	MC Portfolio	HFRI Convertible
Russell 3000	1.00						
ML Convertible Securities	0.56**	1.00					
VIX	-0.55**	-0.40*	1.00				
Equal Portfolio	0.16	0.51**	-0.39*	1.00			
CSFB Tremont Convertible	0.57**	0.44*	-0.73***	0.60***	1.00		
MC Portfolio	0.11	0.35	-0.26	0.37	0.08	1.00	
HFRI Convertible	0.40*	0.41*	-0.65***	0.63***	0.90***	0.14	1.00

*, **, *** indicate coefficient is significantly different from zero at the .05, .01 and .001 levels respectively

Table 4 (continued)

Panel B: State 2 returns

	Russell 3000	ML Convertible Securities	VIX	Equal Portfolio	CSFB Tremont Convertible	MC Portfolio	HFRI Convertible
Russell 3000	1.00						
ML Convertible Securities	0.54**	1.00					
VIX	-0.42*	-0.05	1.00				
Equal Portfolio	0.03	0.05	-0.14	1.00			
CSFB Tremont Convertible	0.03	0.40*	0.32	-0.01	1.00		
MC Portfolio	0.06	-0.07	0.14	0.53**	-0.26	1.00	
HFRI Convertible	-0.13	0.40*	0.45*	0.25	0.79***	-0.10	1.00

Panel C: State 3 returns

	Russell 3000	ML Convertible Securities	VIX	Equal Portfolio	CSFB Tremont Convertible	MC Portfolio	HFRI Convertible
Russell 3000	1.00						
ML Convertible Securities	0.44*	1.00					
VIX	-0.09	0.05	1.00				
Equal Portfolio	0.10	0.17	0.07	1.00			
CSFB Tremont Convertible	0.13	0.44*	0.26	0.24	1.00		
MC Portfolio	0.18	0.24	-0.31	0.26	0.37	1.00	
HFRI Convertible	0.31	0.57**	0.13	0.28	0.82***	0.47*	1.00

*, **, *** indicate coefficient is significantly different from zero at the .05, .01 and .001 levels respectively

Table 4 (continued)

Panel D: State 4 returns

	Russell 3000	ML Convertible Securities	VIX	Equal Portfolio	CSFB Tremont Convertible	MC Portfolio	HFRI Convertible
Russell 3000	1.00						
ML Convertible Securities	0.13	1.00					
VIX	-0.34	0.07	1.00				
Equal Portfolio	-0.16	0.17	0.10	1.00			
CSFB Tremont Convertible	-0.12	0.10	0.51**	0.34	1.00		
MC Portfolio	0.17	-0.00	0.19	0.66***	0.30	1.00	
HFRI Convertible	-0.13	0.22	0.47*	0.40*	0.80***	0.37	1.00

*, **, *** indicate coefficient is significantly different from zero at the .05, .01 and .001 levels respectively

Table 5
Regression of daily equally weighted convertible bond arbitrage returns

This table presents results from the following regression of convertible bond arbitrage returns.

$$R_{CB} - R_f = \alpha + \beta_{Mkt}(R_{Mkt} - R_f) + \varepsilon_t$$

where R_{CB} is the daily return on the equally weighted convertible bond arbitrage portfolio, R_{Mkt} is the daily return on the Russell 3000 stock index and R_f is the daily yield on a three month treasury bill. Panel A of the table presents results for the entire sample period. Panel B presents results after restricting the sample to those days with excess market returns within one standard deviation of their mean. Panel C presents results after restricting the sample to days with excess market returns at least one standard deviation less than the mean. Panel D presents results after restricting the sample to those days with excess market returns more than one standard deviation greater than the mean. Panel E presents results after restricting the sample to days with excess market returns at least two standard deviations less than the mean. Panel F presents results after restricting the sample to days with excess market returns more than two standard deviations greater than the mean. T-stats are in parenthesis.

Dependent Variable	α	β_{mkt}	Adj. R^2	Sample Size
Panel A: Entire Sample				
R_{CB} - R_f	0.000117	0.0484	0.019	3391
	(1.93)*	(8.08)***		
Panel B: Market Return - R_f (within 1 S.D. of the mean)				
R_{CB} - R_f	0.000111	0.0493	0.004	2581
	(1.57)*	(3.27)***		
Panel C: Market Return - R_f (1 S.D. less than the mean)				
R_{CB} - R_f	0.000737	0.0825	0.037	405
	(1.87)*	(4.05)***		
Panel D: Market Return - R_f (1 S.D. greater than the mean)				
R_{CB} - R_f	0.000798	0.009	0.0	402
	(1.88)*	(0.39)		
Panel E: Market Return - R_f (2 S.D. less than the mean)				
R_{CB} - R_f	0.00222	0.1253	0.092	109
	(2.15)**	(3.48)***		
Panel F: Market Return - R_f (2 S.D. greater than the mean)				
R_{CB} - R_f	0.00472	-0.113	0.029	91
	(2.76)***	(-1.93)*		

*, **, *** indicate coefficient is significantly different from zero at the .05, .01 and .001 levels respectively.

Table 6
Regression of daily market capitalization weighted convertible bond arbitrage returns

This table presents results from the following regression of convertible bond arbitrage returns.

$$R_{CB} - R_f = \alpha + \beta_{Mkt}(R_{Mkt} - R_f) + \varepsilon_t$$

Where R_{CB} is the daily return on the market capitalization weighted convertible bond arbitrage portfolio, R_{Mkt} is the daily return on the Russell 3000 stock index and R_f is the daily yield on a three month treasury bill. Panel A of the table presents results for the entire sample period. Panel B presents results after restricting the sample to those days with excess market returns within one standard deviation of their mean. Panel C presents results after restricting the sample to days with excess market returns at least one standard deviation less than the mean. Panel D presents results after restricting the sample to those days with excess market returns more than one standard deviation greater than the mean. Panel E presents results after restricting the sample to days with excess market returns at least two standard deviations less than the mean. Panel F presents results after restricting the sample to days with excess market returns more than two standard deviations greater than the mean. T-stats are in parenthesis.

Dependent Variable	α	β_{mkt}	Adj. R^2	Sample Size
Panel A: Entire Sample				
R_{CB} - R_f	0.000072	0.0607	0.017	3391
	(0.91)	(7.81)***		
Panel B: Market Return - R_f (within 1 S.D. of the mean)				
R_{CB} - R_f	0.000037	0.0537	0.003	2581
	(0.41)	(2.77)***		
Panel C: Market Return - R_f (1 S.D. less than the mean)				
R_{CB} - R_f	0.000942	0.1008	0.029	405
	(1.76)*	(3.64)***		
Panel D: Market Return - R_f (1 S.D. greater than the mean)				
R_{CB} - R_f	0.00009	0.0639	0.009	402
	(0.16)	(2.15)		
Panel E: Market Return - R_f (2 S.D. less than the mean)				
R_{CB} - R_f	0.00191	0.1266	0.051	109
	(1.38)	(2.62)***		
Panel F: Market Return - R_f (2 S.D. greater than the mean)				
R_{CB} - R_f	0.00104	0.0376	0.0	91
	(0.57)	(0.60)		

*, **, *** indicate coefficient is significantly different from zero at the .05, .01 and .001 levels respectively.

Table 7
Regression of daily equally weighted convertible bond arbitrage returns at market extremes

This table presents results from the following regression of convertible bond arbitrage returns.

$$R_{CB} - R_f = \alpha + \beta_{Mkt}(R_{Mkt} - R_f) + \varepsilon_t$$

Where R_{CB} is the daily return on the equal weighted convertible bond arbitrage portfolio, R_{Mkt} is the daily return on the Russell 3000 stock index and R_f is the daily yield on a three month treasury bill. Panel A of the table presents results after restricting the sample to those days with excess market returns at least two and a half standard deviations less than their mean. Panel B presents results after restricting the sample to those days with excess market returns at least two and a half standard deviations greater than their mean.

Dependent Variable	α	β_{mkt}	Adj. R^2	Sample Size
Panel A: Market Return - R_f (2.5 S.D. less than the mean)				
R_{CB} - R_f	0.00265	0.1365	0.137	46
	(1.59)	(2.88)***		
Panel B: Market Return - R_f (2.5 S.D. greater than the mean)				
R_{CB} - R_f	0.0107	-0.267	0.119	44
	(3.02)***	(-2.64)***		

*, **, *** indicate coefficient is significantly different from zero at the .05, .01 and .001 levels respectively.